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THE AGRICULTURAL EDUCATION IN THE REPUBLIC OF IRAQ

Abdulmuttaleb Abbas SALIH

University of Dhi-Qar, District Almustfawiyah, Nasiriyah, 64001, Iraq, Phone: +009647809249646, Email:, abd_mtlb@yahoo.com

Corresponding author: abd_mtlb@yahoo.com

Abstract

The study is situated in the field of agriculture and the main subject is education of agriculture in Iraq, within the context of creating a clear vision of the current status and the evolution of agricultural education in Iraq, by comparison with neighboring countries such as Iran, Jordan, Saudi Arabia, Turkey, and Syria. Given the fact that agricultural education is related to the field of education as well several factors will be taken into account, such as the education system in Iraq and neighboring countries, general education in the world, professional or vocational education and technical education also. The Iraqi educational system will represent one of the main cores, which is why a bigger section is dedicated to it. The results and conclusions section contain the main conclusions and the findings are discussed, and recommendations are concerning the findings.

Key words**:** *education, agriculture, statistics, Iraq*

INTRODUCTION

According to UNESCO, education is considered as an "organized and sustained instruction designed to communicate a combination of knowledge, skills and understanding valuable for all the activities of life".[15]

Agricultural Education represents the teaching of agriculture in order to prepare students for entry level jobs or to further education to prepare them for advanced agricultural jobs. Agricultural education can be taught at the elementary level, middle school level, secondary, post-secondary and adult levels. Elementary agriculture is taught in public schools and private schools as well. Vocational agriculture trains people for jobs in such areas as production, marketing, and conservation, whereas college agriculture involves training of people to teach, conduct research, or provide information to advance or extend the field of agriculture and food science or agricultural technologic. General education agriculture informs the public about food and agriculture.[12]

The sustainability of literacy greatly depends on evaluating adult education programs in order to assess their impact on learning acquisition. The Arab countries provide various modalities in adult education to address program quality, adequate teaching material, lack of incentive among learners, special population needs, community participation, and use of technology. Such concerns have been addressed in a multiplicity of innovations launched by various Arab countries[2].

Iraqi education is known to be very demanding throughout the Middle East, taught in both Arabic and English. Iraqi graduates have an advanced knowledge of complex subjects such as chemistry, math (algebra, calculus), biology and other scientific fields of study. The official educational cycle in Iraq extends to 11 years, including 6 years of mandatory primary education, which starts from the age of six years, followed by 3 years of intermediate school, then 3 years of secondary education, which is divided into general secondary of scientific and literary and secondary vocational industrial, agricultural or commercial. Students who finish high school and get the minimum qualifications for post-graduation study are able to enroll to universities or technical institutes.[16]

Vocational training is a branch of the secondary education system. The Iraqi students have the right to choose the vocational secondary education immediately after the intermediate stage instead of

continuing education in the academic year.
The vocational centers aim to provide students with professional and technical skills in order to prepare them to engage in various types of careers after graduation, the vocational training stage being extended to three years leading to public examinations. The top 10% with the best scores of the students can continue their studies in technical colleges[12][19]

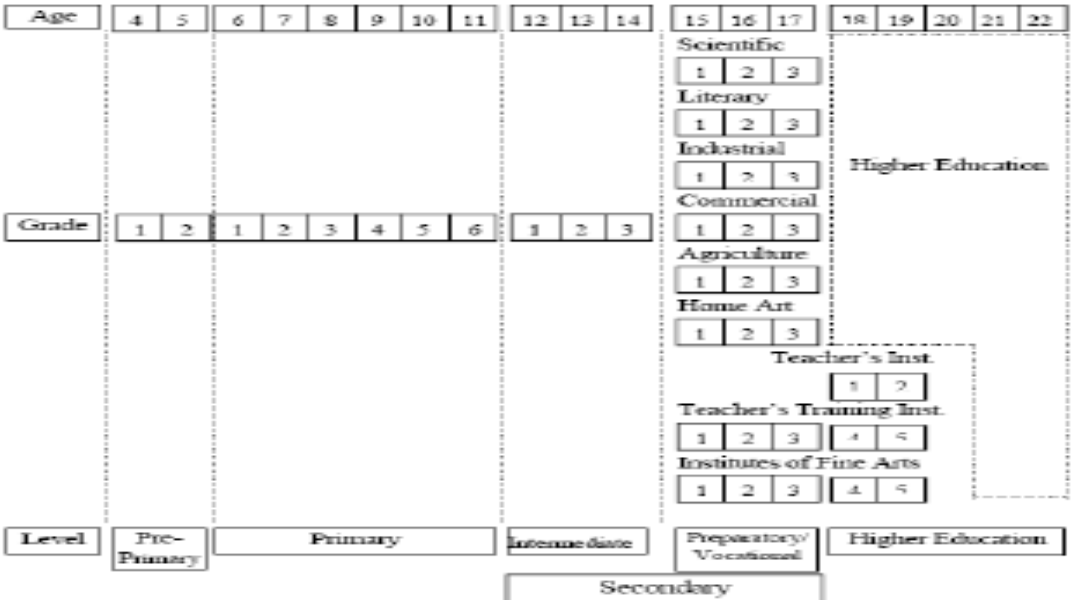

Fig 1. Structure of the education system of Iraq (World data on Education Donnees mondiales de l education, VII Ed. 2010/2011, pg. 5)

Intermediate School. After primary school, Iraqi students attend Intermediate grades 7-9, and upon completion of the 9th grade, students take the National Intermediate Baccalaureate Examination after which, if passing, students can then enter a secondary general or vocational school. Some schools in Iraq include only intermediate stage and therefore the students have to complete the preparatory education (secondary level II) at another school. Most schools, however, have intermediate and secondary stages. Because the local trainers have been isolated from international developments, they are in need for modernizing and some need training from foreign teachers.[11]
Intermediate school students take 34 classes per week including subjects of Islamic education, Arabic language, English, Science (Physics, Chemistry and Biology), history, geography, social studies, mathematics, fine art education, and military physical education. The female students take additional lessons in household education.
Secondary School. Students attend Secondary School from 10-12th grades in Iraq, choosing from two categories: General and Vocational. General schools offer education in the field of humanities or science. Vocational schools offer Agricultural, Industrial and Commercial education.[10]
In order to complete Secondary School and receive a certificate of completion, each student must take a Baccalaureate exam, after which, if a student does not pass this exam on attempt one, he/she is able to attend school for one more year and try to pass it again. If the student does not pass the exam a second time, he/she is not eligible to attend any other college or school. According to the Ministry of Education, secondary schooling in Iraq faces severe problems, such as a lack of infrastructure of schools and educational institutions, a lack of qualified teachers, the failure of the curricula to follow the developments of the global academic standards and a lack of textbooks and teaching aids. [9]
Technical and Vocational Training. Vocational training is a branch of the secondary education system. The Iraqi students have the right to choose the vocational secondary education immediately after the intermediate stage

instead of continuing education in the academic year. The vocational centers aim to provide students with professional and technical skills in order to prepare them to engage in various types of careers after graduation. The vocational training stage extends to three years leading to public examinations. The top 10% with the best scores of the students can continue their studies in technical colleges.[8]

Although the students have the freedom to choose among the main four branches of vocational education, this right does not exist always in practice, either because of lack of containment of all branches at the vocational school, the geographical distribution of schools, or availability in some places and non-existence of them in others.

Development of education. In northern Iraq, UNESCO has held a number of diverse in-service training courses for teachers in various stages of secondary education and most of the stages of higher education as part of its duties under the Oil for Food program. More than 1,000 teachers, inspectors and headmasters have benefited from these courses in a variety of subjects during 2001 and 2002.

After the invasion of Iraq, due to the lack of support for education, before 2003 it appeared that approximately, 80% of Iraqi schools (15,000 schools) needed reform and rehab for sanitary facilities. There were an estimated 240,000 pupils in Iraqi schools and universities before 2003.

The political changes from Iraq after 2003 and the transition to democracy have led to a reform of the educational system. The philosophy on which the new educational system was based has been established in 2008, and relies on the moral and religious values, perceived as foundations of the social, educational and scientific processes and on the humanistic values, which is respecting the human dignity of all individuals and the family as foundation of the society. The new Curriculum has been drafted with the technical support of the UNESCO International Bureau of Education, and includes the following principles:

- encouraging excellence and creativity in all the areas of intellectual life, scientific work and the arts;
- increasing the enrollment of learners in educational institutions;
- paying particular attention to the population of rural and remote areas;
- strengthening the role of education in consolidating tolerance and understanding among people based on the principles and practices of learning to live together peacefully at national, regional and international levels.

According to the National Development Plan 2010-2014, Iraq is seeking to be a peaceful and stable nation under the auspices of a federal democracy. In Iraq, the Ministry of Education has the function to elaborate the educational policy, plan and monitor implementation, develop the curriculum, manage schools, teachers and other educational personnel, develop standards for educational guidance and vocational counselling, develop standards for assessment and examinations. Education is under the supervision of the Ministry of Education, Kurdistan Region (According to the Constitution of 2005).

MATERIALS AND METHODS

This study involves the use of theory and statistical data. The theory may or may not be made explicit in the design of the research, although it will usually be made explicit in presentation of the findings and conclusions. In the paper the fallowing indicators have been used: arithmetic mean, coefficient of variation, average annual growth rate, ecologic indicators and statistical indicators.

The formulas used for to calculate these indicators, are:

$For\ the\ arithmetic\ mean = \bar{x} = \frac{\sum xi}{n}$, where $\bar{x}$ = the arithmetical mean, xi= the average production values for a number of years (i); n= number of years taken into account.

Annual growth rate= $= n\sqrt{\prod (p1/p0) - 1}$; where: ∏p1/po = the chain indicators product during the analyzed period.

The research method followed the following steps, beginning with scientific databases research of the relevant articles concerning education and agricultural education in Iraq,

neighboring countries and the world, then the development of Iraqi agricultural education, followed by an analysis and selection of the relevant data and the last step was extraction and summarization of the results based on interpretation and evaluation of data.

The 2000-2004 data on literacy is derived from the March 2004 UNESCO Institute for Statistics (UIS) Literacy Assessment which uses directly reported national figures taken between 1995 and 2004, or when not available are based on UIS estimates for 2002, or EFA Global Monitoring Report 2005.

RESULTS AND DISCUSSIONS

In 1980 the Arab States were able to attain 51.3% literacy rate, an increase of 11% from the previous decade (40.8%)[17]. For the age group

Table 1 Evolution adult literacy rate, population 15+ years, both sexes (%) in Iraq and adjacent countries.

Country		MU	1991	2002	2004	2009	2011	2015	Mean	sddev	C%	Annual growth rate
Iran	both sexes	%	65.53	77	82.44	82.96	83.63	87.17	79.79	7.71	9.67	5.87
	vs. 1991	%	*100*	*117.5*	*125.8*	*126.6*	*127.61*	*133.02*	x	x	x	x
Iraq	both sexes	%						79.72				
Jordan	both sexes	%		89.89	91.13	92.55	95.9	98.01	93.50	3.38	3.61	2.18
	vs. 2002	%		*100*	*101.38*	*102.96*	*106.69*	*109.04*	x	x	x	x
Syria	both sexes	%		82.89	80.84			86.3	83.34	2.76	3.31	2.03
	vs. 2002	%		*100*	*97.53*			*104.12*	x	x	x	x
Turkey	both sexes	%	79.23		87.37	90.82	94.11	95.69	89.44	6.54	7.32	3.07
	vs. 2004	%	*100*		*110.26*	*114.62*	*118.77*	*120.77*	x	x	x	x

Data processed by: World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators[20]

15-24, the achievements were greater, eleven countries attained a literacy rate of 90% and over well above the world average of 87.6% (Jordan, UAE, Bahrain, Syria, Qatar, Kuwait, Algeria, Libya, Saudi Arabia, Oman, Tunisia), with Jordan scoring the highest (99.4%)[19].

Such "literacy abundant" countries are contrasted to another "literacy deprived" group of five states with the largest Arab population all-scoring below the developing countries average of 85.2% (Sudan, Egypt, Morocco, Mauritania, and Yemen)[3].

During 1999 -2014, the duration of compulsory education has been of 8 years in Iran (except for 1999, when it was 5 years), 6 in Iraq, and 10 in Jordan. In Syria and Turkey, the evolution appears to be more obvious. During 1999-2007, the duration of compulsory education was of 8 years in Turkey, and since 2012 of 12 years. In Syria, the duration of compulsory education was 6 years and since 2005 it became of 9 years.[19]

In Iran, during 1991-2015, the adult literacy rate has a mean of 79 %, in Iraq a mean of 79.72 % (in 2015), in Jordan a mean of 93%, and in Syria a mean of 83 %. The more constant literacy rate is registered in Turkey for both sexes, 89.4%.

During 2000-2014, employment in agriculture has represented 17.9% of total employment in Iran, 1.8% in Jordan and the highest rates appear to be in Turkey.

Table 2. Evolution of employment in agriculture (% of total employment), în Iraq and neighboring countries during 2000-2014

Country	MU	2000	2006	2008	2011	2014
Iran	%		23.2	21.2		17.9
	vs. 2006			91.4		77.2
Iraq	%		29.7	23.4		
	vs. 2006			78.8		
Jordan	%	4.9	3.1	2.6	1.7	1.8
	vs. 2000		63.3	53.1	34.7	36.7
Syria	%	32.9	19.6	14.5	13.2	
	vs. 2000		59.6	44.1	40.1	
Turkey	%	36.0	22.6	22.1	22.8	19.7
	vs. 2006		62.8	61.4	63.3	54.7

Source: Data processed by: World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators

As is the case for all social sectors, in Iraq the government plays a major role in education. The Ministry of Education is responsible for pre-school, primary and secondary education; higher education falls under the Ministry of Higher Education and Scientific Research. A large number of other ministries is also responsible for specialized education institutes.

The Ministry of Higher Education and Scientific Research in Iraq consists of six departments, defines the higher education policy and supervises the administration and organization of the higher education system: universities, colleges and technical institutes. Both the private and the public universities are autonomous in Iraq regarding the financial, administrative and technical matters. In Iraq, the Ministry of Agriculture and Irrigation, just like other ministries, can administer vocational training centers in order to produce skilled workers.[9]

In June, 31, 2015, 144 students were enrolled in formal education (grades 1 – 12); 15,508 in camp settings, and 15,636 in non-camp settings. Of the 29,338 children enrolled in basic education (grades 1 – 9), 69% were boys and 71% girls. 3,810 students were benefitting from

non-formal education activities. There are currently a total of 115,000 students enrolled in the 13 public universities and 11 private universities of the Kurdistan Region. The vast majority of these students attend public universities, which tend to be much larger than private universities and do not charge tuition.[9]

Most of the universities in the Region are very new: with the exception of Salahaddin University, nearly all of the local universities are less than two decades old. However, because of the Region's stability, Kurdistan's universities are drawing higher-level professors and students from historically more prestigious universities in Baghdad, Basra, and Mosul. While this process is providing the universities a boost in competitiveness, it also places further stress on the capacity of the Region's higher education system.[14]

General secondary education in Iraq

- 4,042 general secondary schools (51% Intermediate level, grades 7-9; 38% 'Secondary' (grades 7-12), 11% Preparatory (grades 10-12)
- 49% boys schools, 33% girls schools, 18% co-educational
- 48% single shift, 50% double shift, 2% triple shift
- 1,443,436 students (boys 62%, girls 38%)
- Gross Enrolment Ratio: 40% (boys 49%, girls 31%)
- Teachers: 76,216 (41% male, 59% female) [14]

Table 3. Enrollments in Secondary education during 1970/2003 and 2012/2013

Specification	MU	Male Students	Female Students	Total	
Mean 1970/2003	no	896,776	546,660	1,443,436	100.0
	%	62.12	37.87	100,00	X
2012/2013	no	x	x	810939	56.18

Data processed by: Statistical Appendix, Worldbank [22]; Investment Map of Iraq, 2014, Republic of Iraq Presidency of Council of Ministers National Investment Commission, Project on 16/4/2014,pag 148[21]

Higher education in Iraq:

- 20 universities, 37 technical institutes, 9 technical colleges
- 201 university colleges
- 251,175 university students (42% female) and 65,908 students in technical institutes/colleges
- 19,112 staff (43% female) in universities and 2,837 in technical education
- 28 university research centres
- 5 universities in Baghdad enroll 47% of all students.[14]

In general, the number of the students in the universities and institutions is very low, only 10% of the population in the age range of (18-23), while in the developed countries it reaches (40%) of the population, and this decline in the university education is due to the decline of the income because of the wars, embargo, and brutality, pushed the youths to go directly to work rather than higher education.[16].

UNESCO assisted the Ministry of Education and the Ministry of Higher Education to complete the school year 2002/2003, thereby reassuring parents and students that they could look forward to a return to normalcy and peace. During this critical phase, support was provided for end-of-year examinations and for preparing the new school year.

Transport, materials and revised textbooks in the fields of mathematics and science were provided and the education for girls was

emphasized by the completion of a secondary school model for girls in a densely populated area of Baghdad, adapted to the local environment and climatic conditions. The establishment of a database on secondary education and the provision of technical equipment to process and manage this data further assisted the Ministry of Education. At the level of higher education, international donor support was mobilized through the creation of the International Fund for Higher Education in Iraq, with the initial contribution of $ 15 million from Qatar. [16]

During this period, Iraqi officials from the Ministry of Education and the Ministry of Higher Education visited UNESCO Headquarters to convey directly their immediate concerns. Given the education system's wide range of needs and competing priorities, UNESCO undertook a needs assessment immediately after the conflict, with the generous financial support of the Japanese Government.[16]

Evolution of Iraqi Educational Agriculture.

Agricultural production occupies about 9.5 million of Iraq's 43.7 million ha and represents the second largest contributor to the national gross domestic products.[4] For Iraq, educational agriculture has therefore always been an important factor. The first agricultural vocational school established was in 1926, at Al-Rustemieyh[15] as a post-intermediate three-year college, which closed after three years of operation.

Other primarily vocational schools were opened by the Ministry of Education, which after operating as secondary and sometimes intermediate level, had finally materialized in 1965 as full boarding agricultural secondary schools, offering a two-year post-intermediate course, and later a three-year post-intermediate course. The total enrollment at these schools during 1968-1969 was of 3,574 students and an average of 1200 graduates per year. The main criteria for admission was age of over 18 and the order of merit in the intermediate and secondary examination.[5]

The second level of agricultural education was the High Agricultural Institute which was established in 1965 on the campus of the Faculty of Agriculture, at Abu-Ghraib, under the sponsorship of Baghdad University. The program consisted of a two-year calendar course and the main focus was agricultural sciences, followed up by a specialization in agronomy and horticulture, food technology, plant protection and others [15]. Number of students of the secondary education schools are estimated by (810,939) for the school year 2012-2013[21].

The vocational schools in Iraq are divided into 4 sections, agricultural, industrial, commercial and fine arts and the number of these schools in Iraq is (597) for the school year 2012-2013, (67%) of which are industrial, (29%) commercial, (2%) agricultural and (2%) are for fine arts[21]. Surveys results have shown that the number of students admitted to Iraqi universities, private colleges and technical educational institutions reached (554,587) students for the year 2012-2013 while their number for the year 2010-2011 was (476,377) students[21].

At the moment, educational agriculture can be pursued at universities (the most common are Mosul and Baghdad Universities), continued in research centers and by continuous training for farmers through the programs and workshops offered for the purpose of extending agriculture. The SBAR is the largest national agricultural research (NARS) institution: it represents 26% of the potential research years of the NARS. Its main mandate is agricultural research which mobilizes about 75% of the time of its professional staff. Other activities cover community services (soil analysis, seed production, etc.), extension and training.[18]

In the field of Iraqi agricultural extension, the Iraqi educational system is an important factor. Below, in table 5, the main agricultural educational topics identified as a critical need in 2013 are listed. The information was taken from the Journal of International Agricultural Extension Education, Volume 20 Number 1, 2013.

The Iraq Agricultural Extension Revitalization (IAER) Project, was a partnership between United States Department of Agriculture/Foreign Agriculture Service (USDA/FAS) and United States Department of Agriculture/National Institute for Food and

Agriculture (USDA/NIFA). [1]
The SBAR consists of six main agricultural divisions: agronomy, horticulture and forestry, date palms and tissue culture, soils, animal resources, and plant protection. Research activities include both crop and animal production.
Within crop production, priority is given to cereals (wheat, rice, barley, corn) as they represent the main crops for human consumption. Attention is also given to industrial crops (cotton, sunflower) and horticultural crops. Research is also conducted on forestry, fisheries, agricultural economics, agricultural machinery, etc. SBAR cooperates with CWSR - the Centre for water and soil research- through joint teams whenever necessary.
The IAER is a program that has encouraged change throughout the Iraqi agricultural system, it has encouraged cooperation between the agricultural colleges of Iraq, the agricultural extension agencies, farming associations, and rural communities.
The process has created a platform for follow-on projects to address macro issues of Iraq's agricultural system such as government funding, ministerial resources, and rural credit resources. The educational topics identified by trainees during the IAER program tended to target specific issues, as seen in Fig.2.

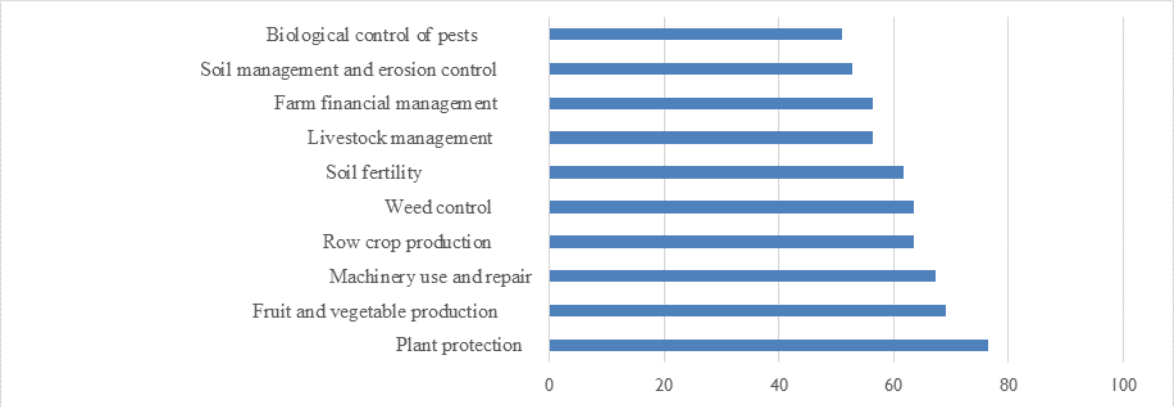

Fig. 2. Agricultural Educational Topics Identified by Iraqi Extension Personnel as a Critical Need for their Respective/ Regions(%). (Data processed by: Journal of International Agricultural Extension Education, pp.14)

In the same journal, a survey was taken the results of which showed the preferred formats through which Iraqi farmers prefer to receive agricultural information. The survey showed that approximately 46% of the mixed-gender session indicated that farmers had no formal agricultural education. According to Sawada et al, further education of Iraq extension personnel is needed and can be achieved using specialists from more developed countries [13].

Table 4. Preferred Formats through which Iraqi farmers prefer to receive agricultural information

Specification	Farmer preference	Extension agent preference	Extension agent preference vs./Farmer preference
	(%)	(%)	(%)
Personal face-to-face	64.2	74.9	10.7
Written brochures and bulletins	20.7	11.7	-9
Internet	9.5	3.8	-5.7
Video media	3.8	9.6	5.8
Written books	1.8	0	-1.8

Source: Data processed by: Journal of International Agricultural Extension Education [1]

Another agriculture extension and education program in Iraq is The ACIAR project, which has been funded by the AusAID (now DFAT) budget. ACIAR's current project in Iraq focuses on the enhancement of barley, wheat and grain–legume production under dryland

conditions in northern Iraq through the introduction and evaluation of appropriate modern varieties; and on the adaptation of improved management practices including tillage, fertilizer and weed-control techniques. This agronomic advance is being underpinned by stimulating innovation among small manufacturers of machinery in the region.[7]

The Iraq Salinity Project is an initiative of Government or Iraq, Ministries of Agriculture, Water Resources, Higher Education, Environment, and Science and Technology, and an international research team led by ICARDA- the International Centre for Agricultural Research in the Dry Areas. In partnership with the University of Western Australia, the Commonwealth Scientific and Industrial Research organization (CSIRO) of Australia, the International Water Management Institute (IWMI), Sri Lanka, and the International Centre for Bio saline Agriculture (ICBA) , Dubai, United Arab Emirates.

CONCLUSIONS

The system of education in Iraq is well established:

-Education has been free at all levels from primary to university education, indicating a high level of access to education.

-In 1980 the Arab States were able to attain 51.3% literacy rate, an increase of 11% from the previous decade (40.8%).

-The average student-teacher ratio in Iraq is relatively favorable. Moreover, nearly all secondary school teachers hold a university degree.

-In general, the number of the students in the universities and institutions is very low, only 10% of the population in the age range of (18-23), while in the developed countries it reaches (40%) of the population

-Both the private and the public universities are autonomous in Iraq regarding the financial, administrative and technical matters.

-Now, educational agriculture can be pursued at universities continued in research centers and by continuous training for farmers through the programs and workshops offered for the purpose of extending agriculture.

In the field of agricultural education, besides Universities, there are many research programs and workshops offered to farmers by International Programs, developed for the extension of agriculture.

According to recent research, approximately 46% of the farmers have no formal agricultural education and researchers agree that further education of Iraq extension personnel is needed and can be achieved using specialists from more developed countries. To this extent, now there are programs like IAER, which have encouraged change throughout the Iraqi agricultural system and cooperation between the agricultural colleges of Iraq, the agricultural extension agencies, farming associations, and rural communities. To conclude, I think developing such programs would be of great help to the development of educational agriculture, since they also promote the use of new technologies in agriculture and help the extension of agriculture.

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THE TECHNOLOGY OF THE MAIN AGRICULTURAL PRODUCTS ORGANICALLY GROWN IN THE REPUBLIC OF IRAQ

Hussein Ali Hussein AL QAESI

University of Dhi-Qar, District Almustfawiyah, Nasiriyah, 64001, Iraq, Phone: +009647809249646, Email: hussein_782003@yahoo.com

Corresponding author: hussein_782003@yahoo.com

Abstract

Agriculture in Iraq represents a vital component of the country's economy. Prior to the development of the petroleum industry, agriculture was the primary economic activity in Iraq. Nowadays, there is a strong debate about which direction should Iraqi agriculture take, for its revival and for contributing to national wellbeing, taking also into account the growing competition for water and the challenges due to climate change. This study will be divided into four main sections, which is an introduction in which the literature will also be reviewed, the second main section will be dedicated to technology of agriculture in the present context, the third to organic agriculture the main products grown in Iraq. The last two important sections will be dedicated to the results, which will contain tables of statistical data followed by a discussion in which data will be interpreted, and it will end with the conclusions and recommendations.

Key words**:** *technology of agriculture, organic agriculture in Iraq, main agricultural products*

INTRODUCTION

The present research is situated in the field of agriculture, focusing on evaluating the technology of the main agricultural products grown organically in Iraq

1. What is the availability of technology of agriculture in Iraq?
2. What are the prospects of organic agriculture in Iraq?
4. What are the main agricultural products grown organically in Iraq?

Most analysts agree that Iraq has the potential for substantial agricultural growth, though currently the area of cultivatable land in Iraq is estimated to be around 12 million hectares, and currently, only about 50% of the total is actually cultivated.

In 1995, a national strategy for agricultural research and technology transfer was adopted, and researchers from the different institutions started participating in research planning and evaluation, holding joint field days, seminars, and writing joint publications. Working relationships with farmers, the extension services, and developmental agencies were highly improved. Adaptive research, in farmers' fields, is being conducted not only by extension agents, but also by faculty members. Iraq can be competitive in modern production technology, with the development of temperature controlled supply chains.

MATERIALS AND METHODS

This study involves the use of theory and statistical data. The theory may or may not be made explicit in the design of the research, although it will usually be made explicit in presentation of the findings and conclusions. In the paper the fallowing indicators have been used: arithmetic mean, coefficient of variation, average annual growth rate, ecologic indicators and statistical indicators.

The formulas used for to calculate these indicators, are:

$For\ the\ arithmetic\ mean = \bar{x} = \frac{\sum xi}{n}$,

where $\bar{x}$ = the arithmetical mean, xi= the average production values for a number of years (i); n= number of years taken into account

The average annual rate of growth [1] = r1990-1999 (and respectively r2000 – 20014)= $\sqrt{\prod\left(\frac{p1}{p0}\right) - 1;}$ where r1990-1999, and respectively r2000 – 20014= average

annual growth rate; $\prod\left(\frac{p1}{p0}\right)$ = entagled growth indicators

The research method followed the following steps, beginning with scientific databases research of the relevant articles concerning organic agriculture in Iraq and technology of the main agricultural products grown organically in Iraq, followed by an analysis and selection of the relevant data and the last step was extraction and summarization of the results based on interpretation and evaluation of data.

Data sources used are the USDA-PSD database, the FAO FAOSTAT database, and data provided from the ministry of Agriculture, Iraq.

RESULTS AND DISCUSSIONS

The main agricultural products in Iraq.

In Table 1, during 2000-2012, it appears that the arable land has decreased, and has an average of 9.9 %. The mean for forest area was 1.9 % of land, while the territory of permanent farmland was of 0.5 percent, showing an increase from 2000 to 2012. The territory of arable land showed a mean of 4,313.6 ha during this period.

Table 1. Evolution of how land use in Iraq during 2000-2012

Indicator	MU	2000	2006	2007	2011	2012	Average (2000-2012)	Stdev	C%	Growth annual
Arable land	Th. ha	4,100	4,800	4,950	4,000	3,427	4,313.6	514.6	11.93	-1.48
Arable land	%	9.4	11.0	11.3	9.2	7.9	9.9	1.2	11.70	-1.43
Territory permanent farmland	%	0.46	0.43	0.43	0.48	0.53	0.5	0.0	6.55	1.23
Forest area	Th. ha	818	825	825	825	825	823.4	2.5	0.30	0.07
	%vs2000		100.9	100.9	100.9	100.9	x	x	x	x
Forest area (% of land)	%	1.87	1.89	1.89	1.90	1.90	1.9	0.0	0.54	0.13
Average rainfall per year	mm	…	…	216	…	216	x	x	x	x

Data processed by:FAOSTAT Database 2000-2012

In Table 2, during 2000-2012, the arable land per person shows a decrease from 0.172 ha in 2000 to 0.105 in 2012, with a mean of 0.156 for this period. The annual growth was a negative one, -4.03. The land used for grain production, shows also a decrease from 2,490.4 in 2000 to 2,015.8 in 2012, with a mean of 2,594.9 for this period, while the cereal production, measured I kg/ha, shows an increase from 363.2 in 2000 to 1,742.9 in 2012, with an average mean of 1,286.3.

Table 2. Evolution of agricultural potential in Iraq during 2000-2012

Indicator	Mu	2000	2004	2007	2011	2012	Average (2000-2012)	St.dev	C%	Growth annual
Arable land per person	ha	0.172	0.169	0.172	0.126	0.105	0.156	0.028	17.95	-4.03
Land used for grain production	000 ha	2,490.4	2,783.6	2,966.8	2,374.3	2,015.8	2,594.9	646.5	24.91	-1.75
Cereal production	kg/ha	363.2	1,191.6	1,264.8	1,798.5	1,742.9	1,286.3	430.9	33.50	13.96
Value added in agriculture until 2005. constant worker	$ US	4,968.3	5,356.1	5,653.0	6,487.9	6,734.5	5,867.2	959.4	16.35	2.57
	%vs2000		107.8	113.8	130.6	135.5	x	x	x	x

Data processed by: FAOSTAT Database 2000-2012

According to Table 3, regarding the evolution of agricultural potential in Iraq, during 2000-2012, the annual growth of rural population decreased from 2.86% in 2000 to 2.32 % in 2012, with an average of 2.32 in 2012. The average was 2.5%. Improved water source access of rural population increased from 28.9 in 2000 to 68.5 in 2012, with a mean of 58.7 and a positive annual growth of 2.85. The poverty gap in the rural poverty line was 9.5, in 2007, that being the highest peak.

Table 3. Evolution of the main indicators of rural areas in Iraq for the period 2000-2012

Indicator	MU	2000	2004	2007	2008	2012	Average (2000-2012)	Stdev	C%	Growth annual
Rural population	Th. Pers.	7,498.3	8,345.6	8,946.1	9,144.7	10,042.2	8,754.5	815.3	9.3	2.46
	% vs 2000		111.2	119.3	121.9	133.9	x	x	x	x
Rural population growth annual	%	2.86	2.57	2.23	2.22	2.32	2.5	0.2	9.0	-1.72
Rural Population of total population	%	31.50	31.29	31.13	31.07	30.83	31.2	0.2	0.7	-0.18
	% vs 2000		99.31	98.80	98.63	97.84	x	x	x	x
Improved water source. rural of rural population with access	%	48.9	55.5	60.3	62	68.5	58.7	6.3	10.8	2.85
	% vs 2000		113.50	123.31	126.79	140.08	x	x	x	x
The poverty gap in rural poverty line	%			9.5		7.6	x	x	x	x
Report of the poor under the national poverty line of rural population	%			39		30.6	x	x	x	x
Employment in agriculture of total employment	%		17	15.1	23.4		x	x	x	x

Data processed by: FAOSTAT Database 2000-2012

In Table 4, regarding the evolution of the main indicators of rural areas in Iraq for the period 2000-2012, the annual growth of rural population showed an average of 2.5%. Employment in agriculture of total employment had the highest peak in 2007, 17%.

During 2000-2012 the Crop production index shows a mean of 102.8, with an increase from 2000, from 91.6 to 111.6 in 2012. It also shows an increase of food production index, from 100.8 in 2000, to 114.7 in 2012. The livestock production shows a mean of 110.7, with an increase as well from 123.1 to 110.7.

The main agriculture products grown in Iraq are wheat, barley, rice, vegetables, dates, cotton and cattle (FAOSTAT database).

Tables 4 and 5 below summarize the main crop areas, cropping systems and average yields in the country.

Table 4. Evolution of the main agricultural products in Iraq during 2000-2012

Indicator	MU	2000	2004	2007	2011	2012	Average (2000-2012)	Stdev	C%	Growth annual
Crop production index (2004-2006 = 100)	%	91.6	91.6	102.6	113.9	111.6	102.8	10.84	10.5	0.05
Food production index (2004-2006 = 100)	%	100.8	91.2	103.0	115.3	114.7	105.0	11.1	10.5	1.66
Livestock production index (2004-2006 = 100)	%	123.1	92.6	101.8	121.9	126.0	110.7	15.3	13.8	1.08

Data processed by: FAOSTAT Database 2000-2012

In 2010 and for the first time in Iraq, 37 farmers (Grapes growers) were organically certified and work is ongoing to increase the land organically cultivated and certified farmers.

Table 5. Access to basic agricultural inputs compared to 10 years ago

Region of respondent	More		Similar		Less		Total	
	no	%	no	%	no	%	no	%
South Iraq (n=7)	5	15.6	0	0.0	2	15.4	7	13.7
Central Iraq(n=7)	7	21.9	2	33.3	8	61.5	17	33.3
Kurdistan (n=28)	20	62.5	4	66.7	3	23.1	27	52.9
Total	32	100.0	6	100.0	13	100.0	51	100.0

Data processed by: Journal of International Agricultural Extension Education

Figure 1 shows the harvested wheat areas for different regions within Iraq. The large increase of wheat grown area after 1991 is likely due to a national policy to increase food production in Iraq, possibly induced by international economic sanctions. The average productivity of wheat is shown to rise steadily.

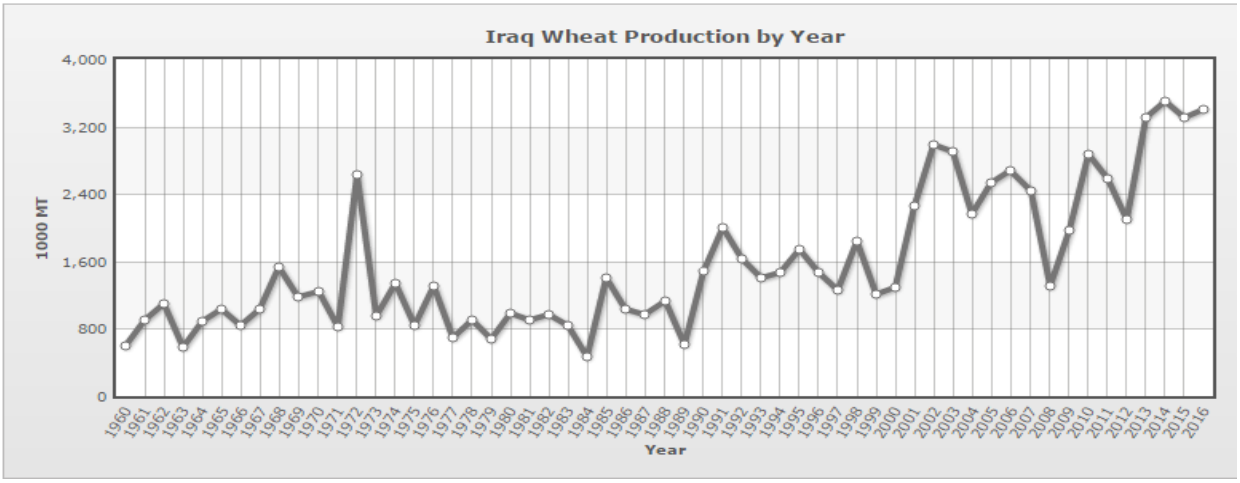

Fig 1. Iraq wheat production by year. (Data processed by:Ministry of Agriculture – GoI and FAOSTAT)

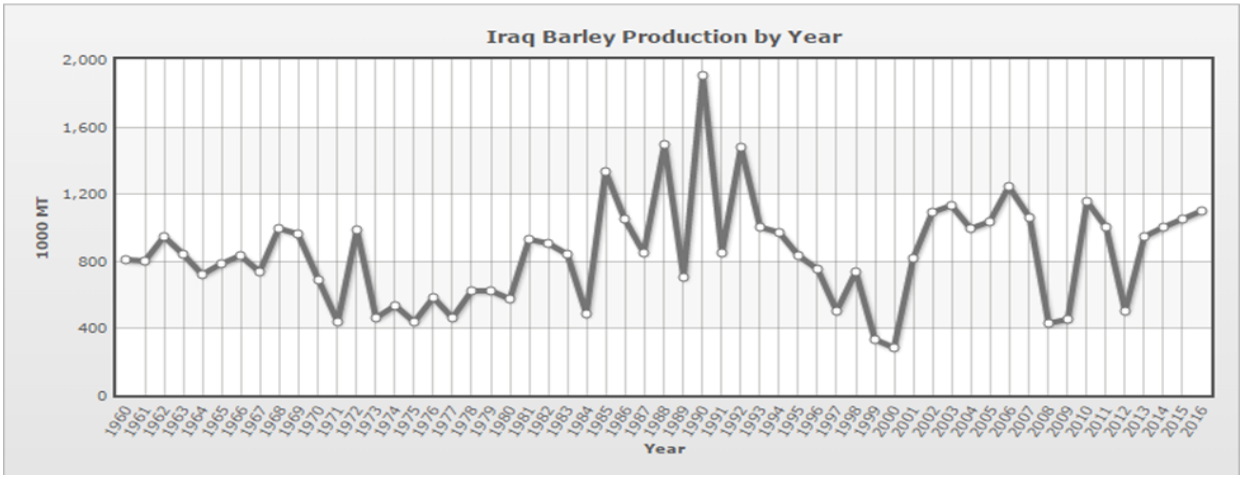

Fig 2. Iraq Barely production by year. (Data processed by:FAOSTAT Database 2000-2012)

The production of barley can be separated into three regions; Northern, Central and Southern Iraq.

According to figure 3, cotton is mentioned as an important crop in Iraq. The FAOSTAT database shows vegetables like cucumber and watermelon, and crops like sunflower in the same magnitude as cotton.

Haj (2010)[6] describes how cotton production was introduced and encouraged during the British Mandate period (1914-1932) as it was considered it would become a main export product, however, it did not become one. The table shows a decrease in production.

In Figure 4, the production of dates shows a large increase between 1994 and 2003, with a large decrease (more than 50%) after 2003. The production data for 2008 according to Williams (2009)[11] are lower than the reported values in FAOSTAT.

According to Figure 5, the production of rice in Iraq is mainly grown in four provinces in central and south Iraq, with a large concentration around Najaf. Rice varieties are long-grain aromatic types, considered in high demand in Iraq. The growing season of rice starts in July and ends in October-November. The productivity for rice during 1993-1999 appears lower than in other years, and corresponds to a period of high production of rice.

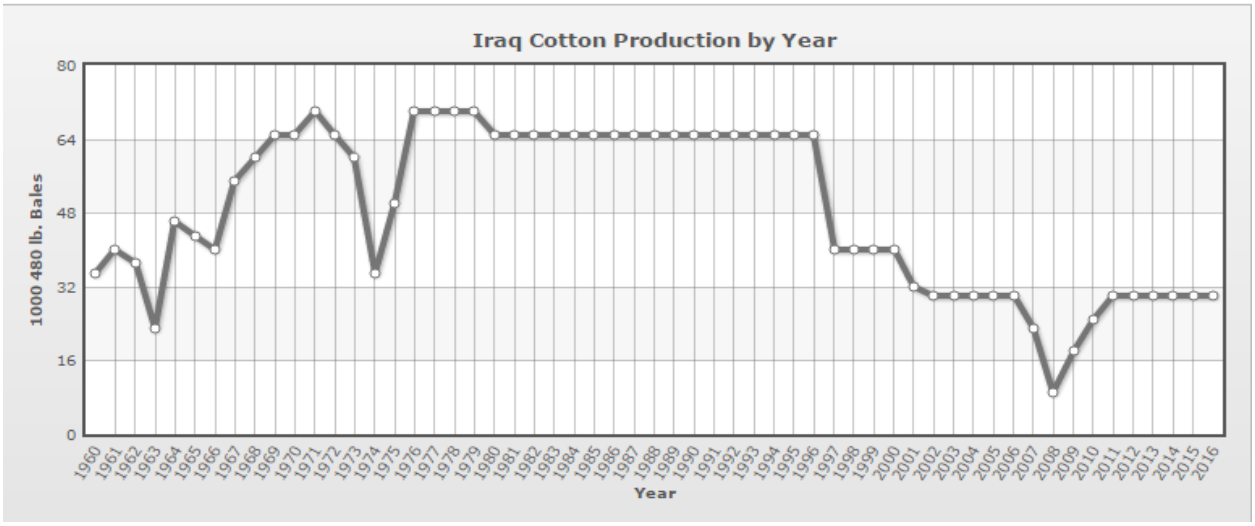

Fig 3. Iraq cotton production by year (Data processed by:FAOSTAT Database 2000-2012)

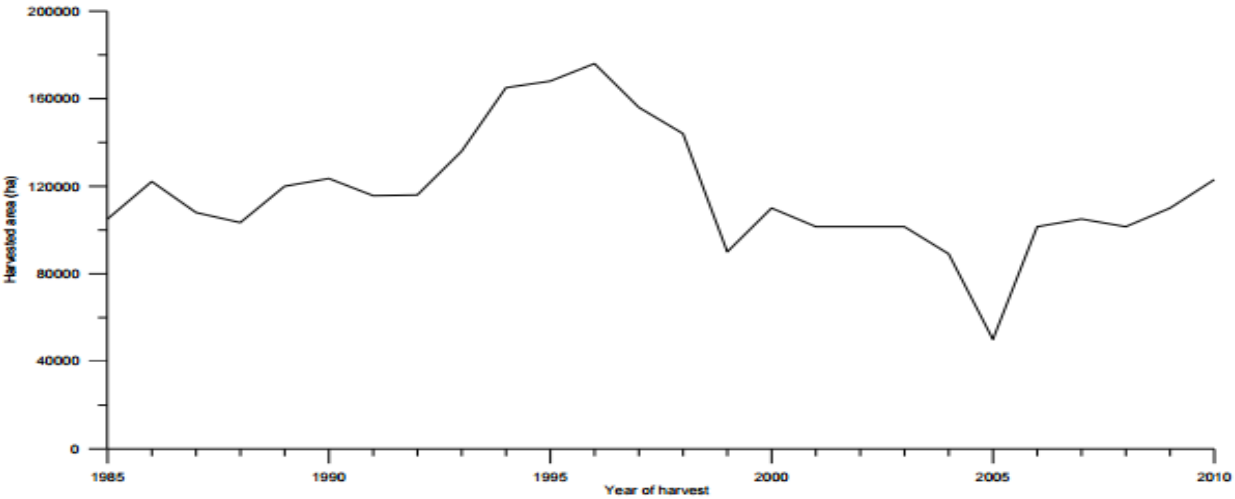

Fig 4. Cultivated area of dates in Iraq. (Data processed by: FAOSTAT Database 2000-2012)

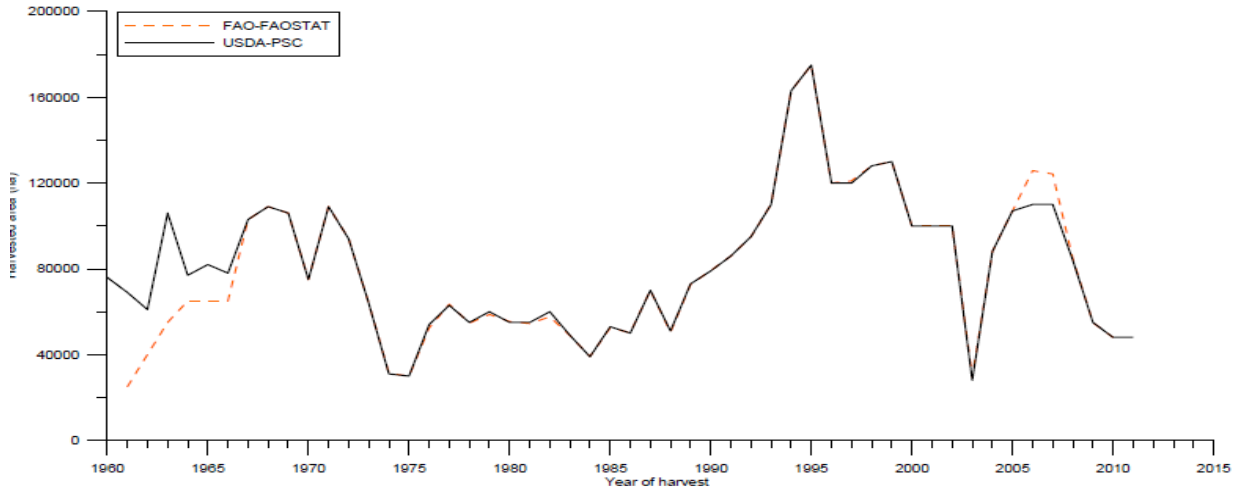

Fig 5. Cultivated area of rice in Iraq.(Data processed by:FAOSTAT Database 2000-2012)

Technology of agriculture. Agricultural technology is among the most revolutionary and impactful areas of modern technology and has a very important role in developing the agricultural industry (Hurst, 1991)[7].

Agricultural technology refers mainly to

machines which are designed for specific stages of the agricultural process, including machines for tilling the soil, planting seeds, irrigating the land, cultivating crops, protection from pests and weeds, harvesting, livestock feeding, and sorting and packaging the products. The most known agricultural technology tools are pumps and other specialized gears used to provide water quickly and in high volumes to large areas of land, fertilizers and pesticides. Some of the farm equipment generally includes: tractors, cultivators, plows, subsoiler, power tiller, harrows. These mostly are used for soil cultivation, but there are machines also used for planting: seed drill, air seeder, precision drill, rice transplanter etc. For harvesting the most used equipment is corn harvester, cotton picker, sickle, swather. Another tool is biotechnology, but biotechnology raises many questions. Fertilizing and pest control also benefit from technological tools, such as fertilizer spreader, manure spreader and sprayer (USAID, 2006)[10].

Technology has many advantages in agriculture, including expediting crop production rate and crop quantity, reducing the costs of production for farmers and food costs for consumers. It can help making crops more nutritious. Also, despite providing so many benefits, biotechnology raises environmental concerns due to the fact that genetic modification can lower the levels of biological diversity. It also raises safety concerns due to the use of chemicals and it can prove to be an expensive tool (Yeoshua,2005).

According to a survey made by Rita Abi-Ghanem et al[1], published in *Journal of International Agricultural Extension Education* results show thatthe flow and availability of agriculturalsupplies and products has become lessrestricted compared to the previous decade.Sixty-three percent of theparticipants indicated greater access toagricultural inputs, such as seed andfertilizer, in 2008 than in 1998. Despite perceiving noticeable improvement overall, 83.6% of the program attendees responded that access to new agricultural technologies and inputs was currently insufficient to successfully promote productive agricultural practices.

According to table 4, most farms in southern Iraq increasingly have timely access to improved equipment. The extensive strife from 2003 to 2008 exacerbated problems in the dispersal of agricultural supplies in the central Iraq region. Agriculture was promoted and well supported with new technologies from both the KRG government (which received autonomy in 1991–1992) and international organizations from 1997 to 2003. However, foreign entities abandoned their programs in 2003, preceding the war.

Southern Iraq, especially in the areas surrounding Basra, possessed advanced vegetable and crop production practices prior to sanctions, which declined after. Earlier reports noted a shortage of equipment in southern Iraq (FAO, 2003)[5] and more than half of the tractors are allegedly at least 15 years old (Ghanem et al, 2013)[1].

Table 6. Access to new agricultural technologies compared to 10 years ago

Region of respondent	More		Similar		Less		Total	
	no	%	no	%	no	%	no	%
South Iraq (n=7)	4	22.2	0	0	3	16.7	7	14.9
Central Iraq(n=7)	7	38.9	7	63.6	5	27.8	19	40.4
Kurdistan (n=28)	7	38.9	4	36.4	10	55.6	21	44.7
Total	18	100	11	100	18	100	47	100

Data processed by: Journal of International Agricultural Extension Education

Table 5 and 6. Changes in Access to Basic Agricultural Inputs and New Technologies in Iraq Based on Region Between 1998 and 2008 (n = number of respondents)

In Table 5, Kurdish responses generally suggested a feeling of increased access to agricultural inputs over the last decade (74, 15, and 11% of the Kurdish participants denoted more, similar, and less resource access, respectively). Kurdish representatives more frequently designated that new technologies were exceedingly limited during the period in question. The influx of international aid after KRG autonomy and their subsequent departure could offer an explanation for this disparity (Schnepf, 2003)[9]. While 58% of those at the predominately male session indicated greater availability of new technology, 57% of the all-women's session denoted access has decreased. In central Iraq, conditions remained unstable at the time that the survey was conducted. It was considered unsafe for extension personnel, particularly women, to visit farmers and distribute information in certain locations (Ghanem et al, 2013)[1].

Fertilizers

In Table 7, during 2004-2012, the fertilizer consumption showed an average of 140.9, with an increase from 111.4 to 154.4, from 2004 to 2012 and the fertilizer consumption per hectare of arable land showed an increase as well from 24.4 to 56.6, showing an average of 46.6.

Table 7. Evolution of Iraq using chemical fertilizers in the period 2004-2012

Indicator	MU	2004	2005	2006	2011	2012	Average (2004-2012)	Stdev	C%	Growth annual
Fertilizer consumption of fertilizer production	%	111.4	132.4	132.5	130.5	154.4	140.9	21.05	14.94	4.17
Fertilizer consumption per hectare of arable	kg/ha	24.4	41.6	46.3	46.1	56.6	46.6	13.96	29.96	11.10
	%vs2004		170.8	189.8	189.0	232.1	x	x	x	x

Data processed by:FAOSTAT Database 2000-2012

Pesticides

Pesticides are used to control organisms that are considered to be harmful, but their use raises a number of environmental concerns. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including non-target species, air, water and soil (Miller, 2004)[8]. In order to protect the public from pesticide misuse, pesticides safety education and pesticide applicator regulation are designed. The most people using pesticides in Iraq, especially the laborers who are in the most contact with pesticides, have likely received minimal or no training in protection of environment.

Below there is a graph that shows the use of pesticides in Iraq during 2000-2007.

According to figure 6, there appears to be an increase in the use of pesticides in Iraq starting especially from 2000.

Prospects of organic agriculture in Iraq

There are many definitions for organic agriculture but all spin around the idea that it is a system that relies on ecosystem management rather than external agricultural inputs: "Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system." (FAO, 1999) [4].

In 1997, the organic agriculture activities started in Iraq through the dissemination of organic agriculture techniques, awareness raising on environment and pesticide hazards, rural extension and training courses for farmers, rural women, agriculture department staff and students.

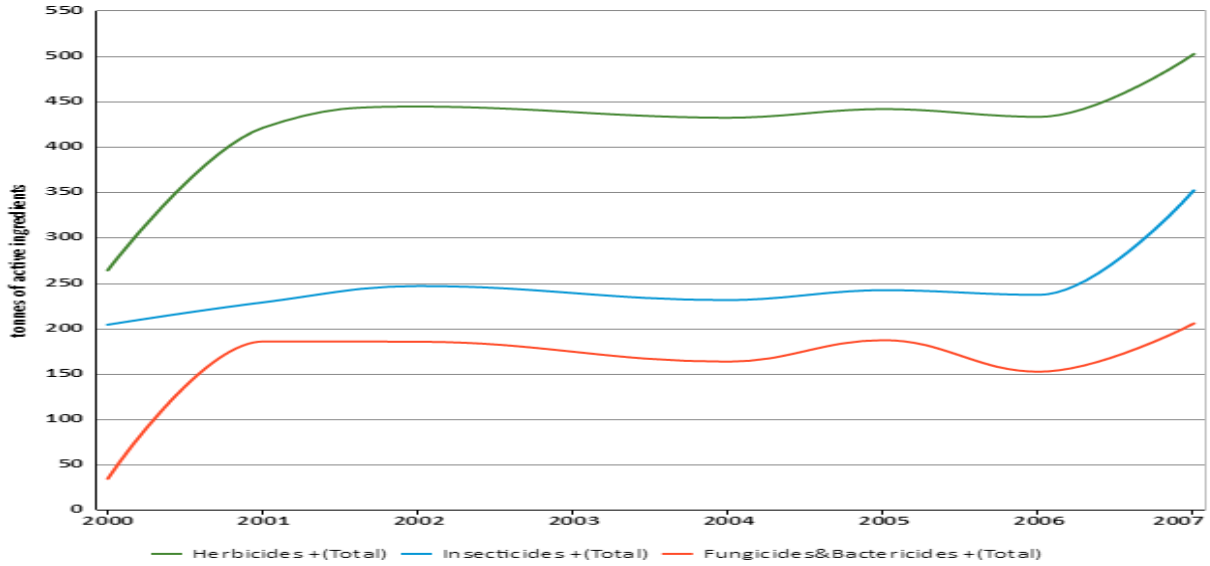

Fig 6. . Use of pesticides in Iraq during 2000-2007(Data processed by: FAOSTAT Database 2000-2012)

At that period, the main goal of the government was to produce food without taking any consideration to the value, health and environmental issues. Also there were problems with the FAO policy in Iraq, as the FAO due to the UN resolution 986 (Oil for Food) was regularly importing a lot of agriculture chemicals and distribute to or oblige farmers to receive these chemical inputs as a condition to receive other equipment (FAO).[5]

In 2009, in the Ministry of agriculture in Iraq the Organic agriculture department was founded which expected to play an important role in dissemination of organic agriculture among farmers, and the following years many conferences and meetings were arranged by universities and Iraqi academics recommended to adopt organic agriculture as a mean to reduce the deterioration in the environment. At the time, extension of agriculture is an important matter of discussion in Iraq and its neighboring countries, since it has a major economic and sociologic impact. According to experts there is a growing awareness about the pollution problems caused by the misuse of chemicals, while the cost of many imported inputs makes them unaffordable for most small farmers (Bashur, 2008)[2]. Organic agriculture is an important option when considering the extension of agriculture so its reality and future prospects require theoretical and applied research, a good administration that would reflect in society's involvement, trough targeted investments, agricultural education, and appropriate legislation.

The role of organic farming is to eliminate the use of fertilizers, pesticides, animal drugs and food additives, I order to improve soil, water and environmental quality. The excess use of nitrogen fertilizers in agriculture can lead to nitrate accumulation into plants which constitute a problem when eaten.

CONCLUSIONS

Today, organic agriculture is studied in colleges of agriculture in the Kurdistan region and Iraq especially by graduate students. The technology of agriculture used for crops is basic but it seems that the agricultural sector is beginning to expand:

-The flow and availability of agricultural supplies and products has become less restricted compared to the previous decade.

-Results show greater access to agricultural inputs, such as seed and fertilizer, and to new technologies

-Most analysts agree that Iraq has the potential for substantial agricultural growth,

-In 1995, a national strategy for agricultural research and technology transfer was adopted, and researchers from the different institutions started participating in research planning and evaluation,

Although these are important achievements that need to be underlined, however there are still many challenges the organic farmers have to face in Iraq:

-Drought and desertification problems

-Lack of law and legislation in Iraq to provide a legal framework for organic production;

-Lack of organic marketing of farmers' products.

There appears to be an increase in the use of pesticides in Iraq starting especially from 2000. In 2009, in the Ministry of agriculture in Iraq the Organic agriculture department was founded which expected to play an important role in dissemination of organic agriculture among farmers, and the following years many conferences and meetings were arranged by universities and Iraqi academics recommended to adopt organic agriculture as a mean to reduce the deterioration in the environment. Technology makes it possible to share and learn.

Organic agriculture is an important option when considering the extension of agriculture so its reality and future prospects require theoretical and applied research, a good administration that would reflect in society's involvement, trough targeted investments, agricultural education, and appropriate legislation.

These challenges can be overcome by procedures and the government's mismanagement of soil and agricultural land, as well as marketing and certification of organic products.

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GENDER ANALYSIS OF PROBLEMS AND PROSPECTS OF RURAL HOUSEHOLD-BASED ENTERPRISES IN OSUN STATE, NIGERIA

Docas Lola ALABI[1], Michael FAMAKINWA[1], [2] Sunday Idowu OGUNJIMI[2]

[1]Obafemi Awolowo University, Department of Agricultural Extension and Rural Development, Ife, Nigeria, Emails: alabidorcas@yahoo.com, famakinwamichael@yahoo.com
[2]Federal University Oye-Ekiti, Department of Agriculture Economics and Extension, Nigeria, Phone+2348033817014, +2348035996430, Email: Sunday.ogunjimi@fuoye.edu.ng

Corresponding author: Sunday.ogunjimi@fuoye.edu.ng; jimisunday@yahoo.co.uk

Abstract

The study investigated the basic problems confronting the growth of non-farm household-based enterprises among male and female rural entrepreneurs in Osun state, Nigeria and examined the potential prospects of these enterprises to the development of rural economy. Snow ball sampling procedure was employed to select 100 male and 100 female entrepreneurs for the study from four LGAs of the state. Data were described with frequency counts, percentages, means and standard deviation while ANOVA was used for inferential purpose. The results show that 55% and 59% of male and female respectively engaged in processing of agricultural produce. The mean ages for male and female entrepreneurs were 44.47 and 45.92 years respectively; the mean household sizes were 6 and 5 persons while the mean monthly net income was ₦16, 878 and ₦17,638 for male and female respectively. Identified constraints included shortage of capital (mean=2.36; 2.53), inadequate managerial skill (mean=1.67; 1.83), increasing demand for imported goods (mean=1.62; 1.50) while potential prospects include; serving as income source during agricultural off seasons (mean=4.67; 4.78), employment generation (mean=4.67; 4.78) and poverty alleviation (mean=4.40; 4.34) for male and female respectively. ANOVA showed that there was no significant difference in the constraints faced by male and female entrepreneurs and no significant difference in the prospects of the enterprises among male and female respondents. Based on the findings, the study concluded that despite the fact that these enterprises were faced with multiple challenges, they hold great prospects for economic transformation of both male and female entrepreneurs. Opportunities for the growth of these enterprises exist in employing strategies like strong linkage of the entrepreneurs to financial institutions, low interest rate, public re-orientation for indigenous products, provision of adequate infrastructural facilities and entrepreneurial education for skill acquisition. It therefore recommended a holistic intervention of all relevant institutions including finance, education and the government to assist these small business owners to scale up their operation from the subsistence level, thereby enhancing rural entrepreneurship development.

Key words**:** *entrepreneurs, gender, non-farm enterprises, problems, prospects, rural*

INTRODUCTION

Agriculture has been the most important sector in the Nigerian economy next to petroleum. It employs about 70% of the workforce and accounts for about 40% of Gross Domestic Product, [5]; [14]. Unfortunately, the job-generating capacity of the sector has been hampered by a number of factors including small size of landholdings, inadequate labour, limited agricultural innovation dissemination, inadequate rural infrastructural facilities and climate change. The sector therefore could no longer create adequate employment opportunities for the rural population and as a result, small holder farmers now look for alternative opportunities in order to increase and stabilize their incomes [6]. Gradually, the rural economy is transforming from being solely agricultural based to a diversify array of activities and enterprises [6]; [3]. Recent findings revealed that farming alone is unable to generate sufficient income to cater for the entire needs of rural households [7];[8]. [10] estimated that rural non-farm work provides 20-45 per cent of full time employment in rural areas and 30-50 per cent of rural household income. Diversification of income sources is becoming an important means of improving rural household income and cushioning the effects of the risk associated with environmental and climatic changes. It equally helps to ease the adverse effects caused by changes in

government policies and market related problems such as price instability, input prices increase among others. Diversification into non-farm activities has recorded a tremendous increase in importance in many developing countries including Nigeria in the past two decades with the share in the total household income ranging from 30% and 50% [2]. [4];[11] observed that farming households in Northern Nigeria often pursue more than one, sometimes several, different non-agricultural activities simultaneously or at different times throughout the year. [2] found that 94.4% of the households in South-western Nigeria derived their income sources from diversified range of livelihood activities with non-farm activities accounting for 67.1% of the total income.

[12] defined household enterprise as the first unit of micro-entrepreneurship, the family firm or the non-farm business that could potentially grow into a small or medium enterprise. These enterprises have the potentials to reverse rural-urban migration, promote indigenous entrepreneurship, enhance household food security and poverty alleviation as well as serving as a hub for rural industrial transformation.

Previous studies have shown that both gender participate in non-farm rural household based enterprises and that these enterprises are faced with several constraints. However, it is evident from literature that gender disaggregation of these problems and the potential prospects of these enterprises have not been adequately investigated in the study area. This study was conceived to identify specific problems facing each gender involving in rural household-based enterprises as well as to isolate the potential prospects of these enterprises with a view to recommend appropriate policy that will proffer adequate intervention that will enhance the growth of these enterprises and consequently, the rural economy.

Objectives of the study

The main objective of the study is to analyze the differences in the problems and prospects of non-farm rural household enterprises managed by male and female genders. The specific objectives are:

(i)to describe the demographic characteristics of male and female operators of non-farm rural household based enterprises in the study area;

(ii) to identify the types of enterprise they engage in; and

(iii) to identify the problems facing male and female entrepreneurs as well as the prospects of these enterprises.

Hypotheses of the study

(i) There is no significant difference in the constraints faced by male and female entrepreneurs in their business venture.

(ii) There is no significant difference in the prospects of enterprises operated by male and female entrepreneurs.

MATERIALS AND METHODS

The study was conducted in Osun State. A multistage sampling procedure was used to select the respondents. Four out of the six administrative zones in the State were randomly selected at the first stage while one Local Government Area (LGA) was randomly selected from each of the selected zones at the second stage. 12 communities were proportionately sampled from the four selected LGAs at the third stage and a total of 100 male and 100 female respondents were selected at the final stage using snowball technique. Structured interview schedule was employed to elicit data from respondents on their demographic characteristics, types of enterprise they engaged in, their perceived expected roles of government, problems faced by male and female entrepreneurs and their perceived prospects of rural household enterprises. Constraints were measured using 4 points Likert-like scale: very severe (3), severe (2), less severe (1) and not severe (0). The Maximum score was 60 while minimum was 0. Prospect was also measured using 4 points Likert-like scale. High potential (3), moderate potential (2), low potential (1) and no potential (0).The Maximum score was 39 while minimum was zero.

Data collected were analyzed using descriptive statistical technique like frequency counts, percentages, means and standard deviation while Analysis of variance was used

to test the hypotheses.

RESULTS AND DISCUSSIONS

Demographic characteristics of the respondents.

Table 1 shows that majority (83% and 80%) of male and female respondents respectively were within the age bracket of 31-60 years while the mean ages were 44.47 years and 45.92 years respectively.

This could imply that the younger generations were less disposed to establishing small enterprises that may not offer quick return on investment; rather, they may prefer migrating to the urban centres in search of white collar jobs that are not readily available.

Table 1. Distribution of respondents by their demographic characteristics (n = 100 male, 100 female)Source: Field survey, 2016

Variables	Male			Female		
	%	Mean	Std. Deviation	%	Mean	Std. Deviation
Age (years)						
≥ 30	9	44.47	10.46	7	45.92	10.23
31-60	83			80		
≤ 60	8			13		
Marital status						
Single						
Married	85			77		
Divorced	3			4		
Separated	3			3		
Widowed	4					
Level of education						
Not beyond primary school	59			76		
Above primary school	41			24		
Household size						
1-5	16			24		
6-10	77	6.16	2.42	76	5.46	1.12
Above 10	7					
Monthly Income (₦)						
≤ 20,000	70			74		
21,000- 40,000	21	17,638.95	12,702.79	19	16,879.00	15,822.84
≥40,0000	9			7		
Experience (years)						
≤ 20	42			52		
21- 40	38	6.30	5.18	26	4.71	4.39
≥ 40	20			22		
Types of enterprise						
Artisans in bricklaying, carpentry, tailoring & timber work	29			20		
Trading	12			14		
School services	4			7		
Processing of cassava, oil palm, maize, locust beans & soybean	55			59		

The finding agrees with [1] that 60.53% of entrepreneurs in Oyo State were between age 46 and 60 years. Majority (85% and 77%) of male and female respectively were married. Generally, married people have more responsibilities which often necessitate diversification of economic activities. Also, 59 and 76 percent of male and female did not go beyond primary education. The disparity between male and female level of education might be an indication of prejudice against female education. However, the level of

education for majority of both genders was very low which could limit their enlightenment on better handling of their enterprises. The average household size was 6 and 5 persons for male and female respectively. Household size could determine involvement in rural non-farm enterprises. The finding is in line with [9], which reported that larger households in rural areas have greater involvement in non-farm activities to cater for their household responsibilities especially during the agricultural off seasons.

For male and female respondents, the mean monthly income was ₦ 17,638.95 and ₦ 16,879.00 respectively while the mean years of experience was 6.30 years and 4.71years respectively. The mean income for both genders was below the minimum wage of ₦ 18,100.00 per month for the least paid Nigerian worker; implying the need for scaling up the income potentials of these enterprises to make them more attractive to the unemployed rural populace particularly the youth, thereby minimize rural-urban migration.

Results in Table 1 shows further that above average (55% and 59%) of male and female respondents respectively, engaged in processing of agricultural produce like cassava, oil palm, maize, locust beans and soybean processing; followed by artisanship such as bricklaying, timber work, carpentry and tailoring (29%; 20%).The finding agrees with [13], who observed that for Africa as a whole, processing activities form the second largest rural industry next to agriculture. It implies that processing enterprises should be the main focus of any concerned government, non- governmental organizations, donor agencies or planners of rural agro industrial transformation in the study area.

Problems facing rural entrepreneurs

Respondents were asked to indicate as many constraints as they perceived that hindered the growth of rural entrepreneurship in the study area. The mean score in descending order of severity were used to identify constraints.

Table 2. Distribution of respondents by types of constraints facing rural entrepreneurship, n=100 male, 100 female

Constrains	**Male**		**Female**	
	Mean	Ranked	Mean	Ranked
Shortage of working capital	2.36	1st	2.53	1st
Community obligations such as contributing time and money to community service	1.67	2nd	1.83	2nd
Role conflict between family and business	1.62	3rd	1.50	9th
Inadequate managerial skill	1.60	4th	1.41	12th
Lack of access to training on the job	1.59	5th	1.59	7th
Excessive interest charged on borrowed money	1.58	6th	1.70	4th
Demolition of stalls by govt. officials	1.52	7th	1.64	5th
Increasing demand for manufactured goods among people in the locality	1.51	8th	1.54	8th
Harassment by law enforcement agencies	1.51	8th	1.63	6th
Poor infrastructural facilities	1.49	10th	1.76	3rd
Inadequate availability of raw materials	1.45	11th	1.29	14th
Debt losses	1.42	12th	1.42	11th
Limited access to extension services	1.41	13th	1.37	13th
Competition from government industries	1.39	14th	1.44	10th
Inadequate sales	1.21	15th	1.07	15th
Limited access to land	1.20	16th	1.02	17th
Inadequate record keeping culture	1.11	17th	1.01	18th
High cost of labour saving equipment	0.94	18th	0.85	19th
Poor business location	0.80	19th	1.03	16th
Limited access to quality labour	0.60	20th	0.43	20th
Grand mean score	1.39		1.40	

Source: Field survey, 2016

Results in Table 2 shows that when the grand mean scores of 1.39 and 1.40 for male and female respondents respectively are compared with individual mean scores, challenges such as shortage of working capital (mean= 2.36; 2.53) has the highest level of severity, This

was followed by community obligations such as contributing time and money to community service (mean= 1.67; 1.83).Others include role conflict between family and the business (mean= 1.62; 1.50), inadequate managerial skill (mean= 1.60; 1.41), lack of access to training on the job (mean= 1.59; 1.59), excessive interest charged on borrowed money (mean= 1.58; 1.70), demolition of stalls by government officials (mean= 1.52; 1.64), increasing demand for imported goods among people in the locality (mean= 1.51; 1.54), harassment by law enforcement agencies (mean= 1.51; 1.63) and poor infrastructural facilities (mean=1.49;176) were considered to be the most severe problems facing the growth of these enterprises.

The finding implies that major problems facing the growth of rural non-farm enterprises were mostly institutional and community-related. For instance, shortage of working capital and excessive interest charged on borrowed money could be traced to financial institution; poor infrastructural facilities and harassment by law enforcement agencies were government-related while community obligations such as contributing time and money to community service and increasing demand for imported goods among people in the locality were community-related. It therefore shows that the commitment of these institutions is paramount to overcoming the identified inadequacies and consequently enhancing rural entrepreneurship development in the area.

Prospects of non- farm household-based enterprises

Respondents were asked to indicate as many prospects as they perceived that non-farm household-based enterprises could bring to rural households if well developed. The mean score in descending order of potential were used to identify prospect.

Table 3 shows that with the grand mean scores of 3.92 and 4.01 for male and female respondents respectively. Prospects of non-farm household enterprises as mostly perceived by both male and female respondents include income potentials during agricultural off seasons (mean=4.67; 4.78), employment generation (mean= 4.67; 4.78), poverty alleviation (mean=4.40; 4.38), promoting indigenous entrepreneurship (mean=4.39; 4.75), preventing rural urban migration (mean=4.39; 4.65), serving as farm-based households source of savings (mean=4.35; 4.29), assisting farm households to spread risks (mean=4.09; 4.24) and a means of survival when farming fails (mean=3.94; 4.20). The finding implies that development of both primary agriculture and other non-farm rural enterprises should go on simultaneously to enhance overall growth of rural economy.

Table 3. Distribution of respondents by their perceived prospects of rural household enterprises, n=100 male; 100 female

Perceived prospect	**Male**		**Female**	
	Mean	Ranked	Mean	Ranked
Income potentials during agricultural off seasons	4.67	1st	4.78	1st
Employment generation	4.67	1st	4.78	1st
Poverty alleviation	4.40	3rd	4.38	5th
Promote indigenous entrepreneurship	4.39	4th	4.75	2nd
Prevent rural urban migration	4.39	4th	4.65	3rd
Serve as farm-based households source of savings	4.35	6th	4.29	5th
Assist farm households to spread risks	4.09	7th	4.24	6th
A means of survival when farming fails	3.94	8th	4.20	7th
Opportunity of combining work with family welfare	3.83	9th	3.97	9th
Utilize valuable but scattered pockets of rural resources	3.83	9th	3.87	11th
Introduce vital skills into rural areas	3.74	11th	3.93	10th
Promote apprenticeship	3.62	12th	3.65	12th
Promote locally produced goods	3.45	13th	3.44	14th
Social transformation of the rural areas	3.51	14th	3.57	13th
Grand mean score	3.92		4.01	

Source: Field survey, 2016

Hypotheses testing

Data in Tables 4 and 5 show that there was no significant difference in the constraints faced by male and female entrepreneurs as well as in prospects of their enterprises. This implies that rural entrepreneurs irrespective of gender are faced with similar challenges and that rural household enterprises have potential prospects for the rural dwellers economic transformation if adequately focused.

Table 4. Distribution of respondents by analysis of variance of the constraint of male and female n= 100male; 100 female

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.620	1	1.620	.016	0.900
Within Groups	20397.880	198	103.020		
Total	20399.500	199			

Source: Field survey, 2016

Table 5. Distribution of respondents by analysis of variance of the prospects of male and female n= 100male; 100 female

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	6.611	1	6.611	.062	.503
Within Groups	21403.310	198	106.484		
Total	21409.921	199			

Source: Field survey, 2016

CONCLUSIONS

The study concluded that non-farm enterprises hold great prospects for transforming the economic life of both male and female rural dwellers and that opportunities for their growth exist in employing strategies including strong linkage between the entrepreneurs and financial institutions, low interest rate, public re-orientation for indigenous products, provision of adequate infrastructural facilities and entrepreneurial education for skill acquisition of rural entrepreneurs of both genders. The study recommends that since both genders engaging in household-based enterprises are faced with similar constraints and the roles of financial, education and government institutions are germane to the elimination of these constraints, these institutions should work as a team to formulate policies that will assist household-based entrepreneurs overcoming these prevailing problems and thereby fostering the potentials of rural entrepreneurship. Such policies should focus rural entrepreneurship education, simplifying loan criteria for rural small business owners and improving rural market facilities among others

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EVALUATION OF NATURAL AND ANTHROPIC TOURISM POTENTIAL IN BISTRITA-NASAUD COUNTY, ROMÂNIA

Ovidiu Toma ALBU, Manea DRAGHICI

University of Agronomic Sciences and Veterinary Medicin, Bucharest, 59 Mărăşti Blvd., District 1, 011464, Bucharest, Romania, Phones: +40 0724 783 007, +40 0745 100 937, E-mails: ovidiutomaa@yahoo.com, dmprofesor@hotmail.com

Corresponding author: ovidiutomaa@yahoo.com

Abstract

The study aimed to analyze the complex relations between the anthropic factor and natural potential of Bistrita-Nasaud County, with relevance for the turistic phenomenon. Therefore, we proceed to an inventory of potential, based on visits and bibliographic source of information. Also,the study tries a description of adminitrative units, based on their potential, natural and anthropic, and also to identify typologies of villages, based on their turistic potential. The analize relives that the county has an abundance of natural and anthropic resources, such as: national parks, protected areas, spectacular lakes, unique caves in Europe, thermal water, traditions preserved thousands years, special culinary dishes. Therefore, a plenty of tourism activities are suitable in this region, including also special tourism such as hunting, equestrian, cultural tourism, rural tourism and agrotourism.

Key words: *potential, anthropic, natural, tourism*

INTRODUCTION

Starting from the fact that "tourist attraction is the fundamental reason of the public reception by a destination for fun, curiosity or education", a region or territory shows interest as long as it has attraction elements whose planning can determined a tourism activity. [1]
The most important and frequently used classification in the field split the tourist attractions, by their contain, in two main categories: natural tourist attraction and anthropic attractions (man made). [2, 10]
Based on this classification, we will identify and describe the attractions of natural and anthropic within Bistrita-Nasaud County. Also, depending of identifed potential, we will determine the types of tourist villages from the county.

MATERIALS AND METHODS

The methodological approach includes the identification of the tourism capital from the Bistrita-Nasaud County in general and in particular, from rural settlements.
The research methods used are the inventory type analysis of the natural and anthropic potential. The analysis of the tourism potential of Bistrita-Nasaud's County and rural area is based on data and information obtained by bibliographic documentation and potential scoring in admitrative units function on natural and anthropic resources and infrastructe.

RESULTS AND DISCUSSIONS

The Bistrita-Nasaud County develops its relief as a vast amphitheater, indestructible linked to the Carpathian arc, like a kaleidoscope of wonderful natural landscapes [3].

Photo 1. Bistrita-Nasaud county

The county consists of a varied landscape, bordered by a several mountain peaks (Tibles, Rodna, Suhard and Calimani), whose extensions summarize 1/3 of its lands, remaining 2/3 that belong to hilly relief. [4]

The County is drained by a system of rivers which is focused on the main river – Somesul Mare, the total length of the rivers network totalizing about 3030 km.

From the climatic poin of view, Bistrita-Nasaud County falls in the categorie moderate continental [5]

Most of the natural touristic resources are located in the Mountain area.

In Bistrita-Nasaud County we can identify the following categories of natural tourism resources:

-national parks: Rodna and Calimani

-protected areas; within those areas are scientific nature reserves

-spectacular natural lakes

-karst caves

-monuments of nature.

We will describe below some of the most beautiful natural attractions offered by Bistrita – Nasaud County.

(1)The National Park – Rodnei Mountains. Rodnei Mountains National Park has been designated natural reservesion in 1990 and is one of the most valuable reserves because such geological structures, but also of interest to fauna, flora and caving in the area. It features including several endemic species of plants. [6]

"Rodnei Mountains" National Park is internationally appointed by UNESCO Committee as a Biosphere Reserve, within the "Man and Biosphere" program. [7]

(2)Lala Mare" Lake.

Lala Mare Lake is located in the absolutely superb area of Rodnei Mountains and is part of the Mixed Reserve "Ineu-Lala". It is the largest glacial lake from Romania and is located at 1,815 m altitude.

It is an ideal tourist destination for summer coolness, blending the spectacular view with the fishig. Also here you can admire the mountain peonies.

(3),,Izvorul Tausoarelor" cave

The cave was discovered in 1955 and is the longest cave in Romania and uneven. Due to the difficulty degree, this cave is destinated only for cave explorers.

Due to the fact the county is located in a area with mainly a hilly-mountain relief, the vegetation is in stairs, very mixed, depending by alltitude, soil, temperature, etc. We can find here almost all floristic range until the allpine range.

From the point of view of vegetation treasures, the Bistrita-Nasaud County is the one of the most interesting and pretious part of Romania.

The chandelier spruce, populare named „The king of the firs", was the border guard between Transilvania and Moldavia.

We will continue our introspection in Bistrita-Nasaud County and we will present in the following paragraphs the main „man made" attractions within the County.

Throughout its history Bistrita-Năsăud enjoyed the presence of different cultures, so that the charm of this area is given by the cultural footprint of each nation that pops in this region from the hungarians, saxons, szeklers to Armenian or Hebrew.

The anthropic tourism potential is a major category for Bistrita and gradually gaining in the touristic area of interrest, as well as the modern man inclination for knowing himself through the most significant achievements of communities at various stages of their history.

In the county of Bistrita-Nasaud can find a multitude of anthropic attraction, from the vestiges of Roman constructions - Roman camp from Orheiul Bistrita until the medieval artifacts – ruins of Ciceului and Rodnei citadels, Evangelical Churches from Herina and Dumitra and places of pilgrimage for believers - Piatra Fantanele, Parva or Nuseni Monasteries. But those who gain most tourists are from far are the resorts and here, we are mention the Sangeorz - Bai resort but also to the artificial lake from Colibita, around which was developed the resort. Besides those are other significant anthropic tourist attractions such as Baile Figa, Piatra Fantanele, Blaznei Valley or Vinului Valley.[8]

About the air is said that is the most ozonate from Europe.

A valuble heritage who is not exploated is the grandious mansions of nobility. In present,

most of them are deteriorated. Only in Uriu village are three mansions.

Another important aspect which we will analize forward is the scoring from the point of view of tourism potential granted to the each administrative unit from the county. This points are calculated taking into consideration the existance of naturale and anthropic turistic objectives, as well as the existance of infrastructe. Next will be presented and analyzed in detail (Table 1) the scores giving to the administrative unit from the county, according to the tourism potential.

As shown in Table 1 the data resulting from scoring application in tourism following the criteria set for the financing of a project submitted under Measure 313, conducted by RDP, Annex 10, the maximum score achieved by the villges in Bistrita-Nasaud County, was 8 out of 10 .

The 8 points were obtained by only 2 villages, in 4 were recorded 7 points, 10 villages received 6 points. We can concluded that 27.59 % from the villages are in the first grid of scoring, with points between 8 and 6.

Table 1. The list of Bistrita-Nasaud villages with points awarded based on the tourism potential

No.	Village	Score	Total	
			Number	%
1	Lechinta, Rodna	8	2	3.45
2	Maieru, Prundu Bargaului, Sant, Tarlisua	7	4	6.90
3	Budacu de Jos, Caianu Mic, Lesu, Nuseni, Rebrisoara, Sieu, Silvasu de Campie, Telciu, Urmenis, Zagra	6	10	17.24
4	Cetate, Cosbuc, Dumitra, Ilva Mare, Nimigea, Salva, Sieu-Magherus, Sintereag	5	9	15.52
5	Branistea, Chiochis, Ciceu-Mihaesti, Galatii Bistritei, Lunca Ilvei, Matei, Milas, Monor, Parva, Romuli, Runcu Salviei, Sânmihaiu de Câmpie, Sieu-Odorhei, Spermezeu, Teaca, Tiha Bargaului, Uriu	4	17	29.31
6	Dumitrita, Feldru, Ilva Mica, Josenii Bârgaului, Magura Ilvei, Mariselu, Petru Rares, Rebra	3	8	13.79
7	Budesi, Chiuza, Ciceu-Giurgesti, Livezile, Micestii de Campie, Sieut	2	6	10.34
8	Negrilesti, Poiana Ilvei	1	2	3.45
	Total villages		**58**	**100**

Own calculation based on:
http://fondurieuropene.newschannel.ro/downloadform/pndr-masura-313-anexa-10-lista-comunelo...

We will review in the following paragraphs the main villages considered to have the greatest potential.

Lechinta village

In Lechinta Village we identify beautiful old churches: the Evangelical Church from century XV, the Orthodox church „Sfantul Mare Mucenic Gheorghe", the wood church "Sfinţii Arhangheli Mihail şi Gavriil" build in 1711, the wood church „Sfânta Cuvioasă Paraschiva", etc.

Rodna village

The tourist routes to National Park „Rodna Mountains" start from here. Also, from here you can visit the sheepfold from Rodna Mountains and also can be made hore riding.

Maieru village

Here we can find a spectacular relief, peaks with splendit panoramic view. Also in Maieru area you can see the edelweiss.

Here is the museum „Cuibul Visurilor" were are presented ethnographic objects (agricultural tools, costumes), historical (Dacian vessels, sketches, maps, documents) and documents that belonged to the writer Liviu Rebreanu, who grew up in the area Maieru. In this museum is one of the great village collection from Romania.

Another aspect, also important as the one describe above, closely linked to the valorification of tourism attractions is the identification and presentation of the number of establishments with tourism functions from the county.

Analyzing the data in the table below, we see that the number of total turistic establishments from the county records in the early 90's a numer of 27 establishments. The number remains slightly constant for aproximativaly 10 years, followed by a constant increasing in the period 2011 – 2013. Starting with 2014 we can observed a decreasing trend.

We meet the same decreasing trend in the last years also for the rural turistic establisments.

A brief analysis of these numbers indicates a major establishments deficit.

Regarding the accommodation places, the trend is descending, compared with the early 90's. So, if in year 1991 we had 838,000 accomodation places per year, in 2015 the number decreased at 745,400 places.

Regarding the agroturistic establishments, the accommodation places increased with 160 % in 2015 comparative with 2010, when we have the first record. Unfortunaly, we

observed that after a constant increasing in period 2010 – 2014, in 2015 the number of accommodation places start to decrease.

Table 2. Establishments of touristic reception with functions of tourists accommodation by type of establishmen in Bistrita-Nasaud county

Type of establishment	UM	1990	1995	2000	2010	2011	2012	2013	2014	2015
Total	no	27	28	23	27	38	49	49	45	44
	vs 1990(%)	*100.0*	*103.7*	*85.2*	*100.0*	*140.7*	*181.5*	*181.5*	*166.7*	*163.0*
Hotels	nr	9	14	11	13	15	18	18	16	16
	vs 1990(%)	*100.0*	*155.6*	*122.2*	*144.4*	*166.7*	*200.0*	*200.0*	*177.8*	*177.8*
Hostels	no	:	:	:	:	1	1	1	1	1
Motels	no	:	1	1	3	4	4	4	3	3
Touristic villas	no	8	3	1	:	3	4	4	:	1
Touristic chalets	no	2	1	1	1	1	1	1	8	7
Campings	no	1	1	:	:	:	:	:	:	:
Scool nad pre-school camps	no	6	5	5	4	2	2	2	1	1
	vs 1990(%)	*100.0*	*83.3*	*83.3*	*66.7*	*33.3*	*33.3*	*33.3*	*16.7*	*16.7*
Touristic boarding houses	no	:	:	4	2	5	9	9	8	8
	vs 2000(%)			*100.0*	*50.0*	*125.0*	*225.0*	*225.0*	*200.0*	*200.0*
Agroturistic boarding	no	:	:	:	4	7	10	10	8	7
	vs 2010(%)				*100.0*	*175.0*	*250.0*	*250.0*	*200.0*	*175.0*

Source: INS, Tempo_tur101D,2017 [9]

Table 3. Touristic accommodation capacity in function by type of establishment in Bistrita-Nasaud county

Type of establishment	UM	1991	1995	2000	2010	2011	2012	2013	2014	2015
Total	thousands places /days	838.0	818.8	677.2	718.7	757.1	831.0	801.6	791.6	745.4
	vs 1991(%)	*100.0*	*97.7*	*80.8*	*85.8*	*90.3*	*99.2*	*95.7*	*94.5*	*88.9*
Hotels	thousands places /days	764.5	746.0	626.9	634.0	615.3	641.2	614.4	571.9	532.0
	vs 1991(%)	*100.0*	*97.6*	*82.0*	*82.9*	*80.5*	*83.9*	*80.4*	*74.8*	*69.6*
Hostels	thousands places /days					6.5		6.5	4.0	2.4
Motels	thousands places /days	7.9	2.2	2.5	26.2	42.0	51.6	47.0	47.9	44.2
	vs 1991(%)	*100.0*	*27.8*	*32.0*	*333.1*	*534.0*	*655.7*	*597.2*	*608.9*	*561.3*
Touristic villas	thousands places /days	7.6	15.0			3.3	1.9	1.6	0.4	
Touristic chalets	thousands places /days	12.4	10.4	1.7		2.1	3.5	4.9	32.8	44.0
	vs 1991(%)	*100.0*	*83.6*	*14.1*		*17.2*	*28.0*	*39.3*	*264.2*	*354.9*
Campings	thousands places /days	1.8	0.5							
Scool nad pre-school camps	thousands places /days	46.7	40.6	24.9	22.1	22.1	11.0	9.2	12.2	5.5
	vs 1991(%)	*100.0*	*86.9*	*53.3*	*47.3*	*47.3*	*23.6*	*19.8*	*26.2*	*11.8*
Touristic boarding houses	thousands places /days			21.1	19.2	36.7	72.3	68.4	69.3	72.5
	vs 2000(%)			*100.0*	*91.0*	*173.9*	*342.8*	*324.3*	*328.9*	*343.7*
Agroturistic boarding houses	thousands places /days				17.2	29.0	49.5	49.6	53.0	44.7
	vs 2010(%)				*100.0*	*168.7*	*287.7*	*288.1*	*308.3*	*260.0*

Source: INS, Tempo_tur103B, 2017 [9]

Regarding the accommodation places, the trend is descending, compared with the early 90's. So, if in year 1991 we had 838,000 accomodation places per year, in 2015 the number decreased at 745,400 places.

Regarding the agroturistic establishments, the accommodation places increased with 160 % in 2015 comparative with 2010, when we have the first record. Unfortunaly, we observed that after a constant increasing in period 2010 – 2014, in 2015 the number of accommodation places start to decrease.

CONCLUSIONS

The Bistrita-Nasaud County it is extremly tenderer county, with a larger density of tourism objectives, responding to a varius demands in this respects. Unfortunately, this potential is not vey well known and also, is not put into light.

There is no studies by zones and subzones regarding the attractiveness and negative aspects, but some good sense appreciations based on direct observation cand be made and can be contestated hardly: village aspect, the aspect of natural and cultural objectives, services quality, etc.

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THE GENOTYPES' FEED-BACK TO THE ENVIRONMENTAL FACTORS

Eugeniu ALEXANDROV

Institute of Genetics, Physiology and Plant Protection of the Academy of Sciences of Moldova, 20 Padurii, street, MD-2002, Chisinau, Republic of Moldova, Phone\Fax: +(373)22550740, Mobile: +(373)79450998, Email: e_alexandrov@mail.ru

Corresponding author: e_alexandrov@mail.ru

Abstract

Expected results in improving grapevine can be obtained only when using the technique of directed interspecific hybridization based on crossing genotypes from different eco-geographical areas, thus creating native varieties of grapevine. In this case, the genotype combines the desired properties and characteristics of the parent forms. As a result, the formation of genotypic characteristics necessary for adaptation occurs. The adaptation of the created varieties to extreme environmental conditions is possible only if they have been received as a result of crossbreeding of various species (taxa) of grapevine. Besides possessing high resistance to diseases and pests, these genotypes are characterized by high adaptability to the soil and climatic conditions. The use of the biological potential of interspecific genotypes will help obtain high quality products, in terms of organic agriculture, which requires reducing the use of synthetic and natural chemicals in pest and disease control.

Keywords: *genotypes, environmental factors, interspecific hybrides, reaction.*

INTRODUCTION

Development of human society imposes pay specific attention issues related to environmental protection. It is indisputable that the capabilities necessary get to know the genetic potential of the genotypes in relation to climatic conditions, which have a significant impact on the quantity and quality of programming of the products.

It is well recognized that the is not inherited directly to the character, but just the genetic code responsible for a certain reaction of the organism, which allows determination of the limits of changes. Thus, the phenotype of which is formed based on a certain genotype under the influence of climatic conditions.

Creating new capacities as a reaction genotype of response of the against different of the environment factors is conditioned by genotypic modifications [13, 14].

MATERIALS AND METHODS

As an object of study have served of vineyard the genotypes in compared with areas spreading, taking into consideration the biotic and abiotic factors of the environment. [4, 5, 7, 8, 11, 13].

RESULTS AND DISCUSSIONS

For each specific genotype is its response a given reaction, which is determined by preventive genetic point of view. The plant varieties possess a certain amount of response to environmental factors.

The capacity of coexistence of living organisms in relation to some factors of the habitat is assured of the heritability and genotypic modifications. Due to the changes genotypic those organisms adapts to environmental factors that are most representative of a particular habitat. But the formation of new capacity ensures normal of genotype coexistence in the conditions of new format, where the initial variety could not be coexist [16, 17].

At the end of the Paleozoic era there was only one gigantic continent - *Pangaea*, which consists of two parts: northern - *Laurasia* and south - *Gondvana*.

In the cainozoi, with about 70 million years agoshall be initiated rapid development of magnoliofitelor. The current were growing throughout Europe: chestnut, oak, palm trees, vines etc.

Fig. 1. Gigantic continent - *Pangaea*.

It takes place finalizing the different continents on this planet started at about 200 mln. years ago [13].

The genotypes of vines until the continental drift, develop into uniform pedoclimatic conditions and geographical and after the separation of the continents evolution of species has passed through in conditions of geographical isolation. Although the spontaneous species from different geographic regions (European, Asian and American) differ in morphological, however, share many common characteristics, which indicate that they are the related and have a common origin [15].

Pending the completion of the process of formation continents, the climatic conditions were similar throughout the area of spreading vine genotypes, which contributed to their widespread.

As a result of the intensification of cloak convection action torrent of the earth had occurred hobs tectonic movements, fact that led to the change of the Earth's topography and soil and climate conditions. Finally, many genotypes changed their area of spreading, and some genotypes generally disappeared.

Natural areas of spread for: *Phyloxera vastatrix* Planch., *Plasmopara viticola* Berl. & De Toni, *Uncinula necator* (Schwein) Burrill. etc. is the South-eastern North America (Fig. 2.) [12, 13, 20, 21].

The genotypes of vines as: *M.rotundifolia* Michx., *V.labrusca* L., *V.lincecumi, V.riparia, V.aesrivalis* etc. has the same area of distribution - South-eastern North America and during the evolution of the genetic code of the genotypes of these species of vines has been modified in the sense of creating immunity against this pest (Fig.2.) [12, 13, 20, 21].

The varieties of *V.vinifera* L. that are spread in the Euro-Asian and not have the same natural habitat of spread the phylloxera of the vine as a result of the lack of influence during developments was not necessary the formation of genotypes grapevine living resistance to this pest.

Although *V.vinifera* L. has great potential genetic the genotypes of origin intraspecific does not ensure overcoming the genetic barrier on a nonresistant against the unfavorable conditions of the environment in the area of cultivation.

The mechanism for resistance genotypes to pathogens consists of groups of genes that are responsible for adapting against the exogenous factors and resistance to pathogens. A major role in this relationship is represented by integration and impact of genes on the relationship as "genotype - environment" and "host - parasite".

In such cases the only solution to the problem would be to create new genotypes, which are based on genes responsible for adapting total or specific of the plant against environmental factors, thus representing character responsiveness in the "genotype - environment" and "host - parasite - environment". New variations of genetic recombination are formed in the case.

To creating the genotypes resistant to some or other factors in of the environment, it is necessary to look for varieties homeland initial selection (center of origin) "parasite and host." In the event co-evolutions "parasite" and "host", within the natural range of spread, form relationships adaptation of organisms that includes strength and accommodating. The basic feature of the relationship "host - parasite" is a monotype reaction on the environment, so what is beneficial to the parasite is beneficial for the host.

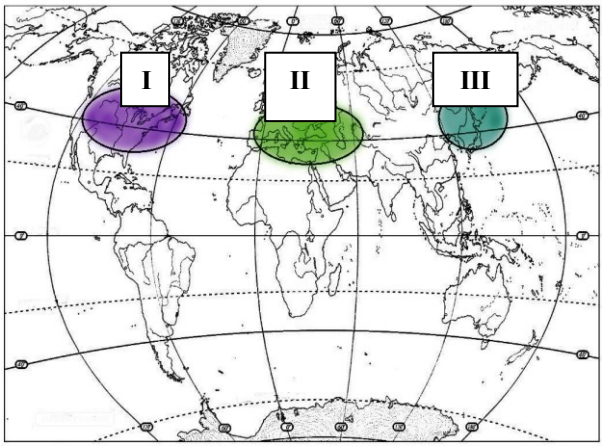

Fig. 2. Natural areas of spreading of vines the genotypes in relation to environmental factors.
I. The genotypes of vines in South eastern North America: *M.rotundifolia* Michx.; *V. labrusca* L.; *V.riparia*, *V.rupestris* etc. resistant to pests and diseases as: *Phylloxera vastatrix* Planch., *Plasmopara viticola* Berl. & De Toni, *Uncinula necator* (Schwein) Burrill etc.
II. The genotypes of Euro-Asian of vines: *V.vinifera* L. ssp. *sativa* D.C.; *V.vinifera* L. ssp. *sylvestris* Gmel.
III. The genotypes of vines in East Asia *V.amurensis* etc., with high resistance to low temperatures during the winter.

Of course, in an environment with pedo-climatic conditions which differ from those of the center of origin, these reactions may change, which could lead to a negative impact on the environment and living organisms.
The genotypes of vineyard interspecific used as donors characters agro-technological outstanding in the improvement of the vine helps create new varieties of vines with durability, productivity stable, high quality fruit from will be achieved derivatives organic wine.
Using the biological potential of interspecific the genotypes derived products will lead to higher quality wine, in terms of organic farming, which requires reducing the use of synthetic chemicals and natural pest and disease control.
Taking into account the areas of spread of the genotypes of vines, such as pests and diseases conclude that the genotypes of grape vines by the area of spreading by South-eastern North America is the center yes in creating the genotypes interspecific resistance increased against biotic and abiotic factors of the environment (Fig.3.).
As a result of the interspecific hybridization of species of vines *V.vinifera* L. and *M.rotundifolia* Michx. It was succeeded by inheritance transmission capacity coexistence newly created genotypes in relation to this pest in the areal of habitation.

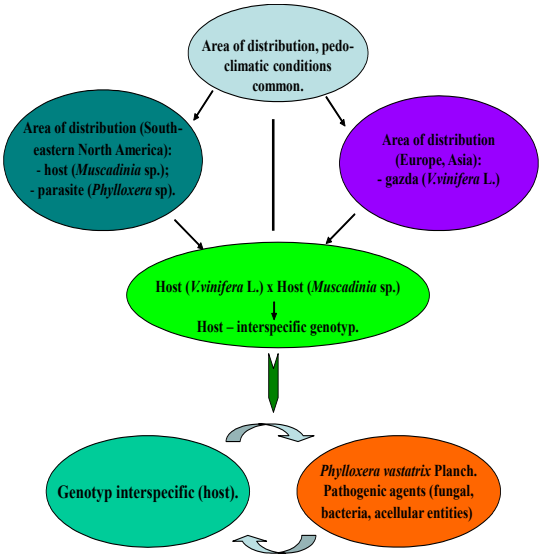

Fig. 3. Host (genotyp interspecific) – parasite.

Thus, the genetic code of the newly created genotypes are present gene responsible for the body's resistance to environmental factors.
Interspecific genotype result of interbreeding *V.vinifera* L. with *M.rotundifolia* Michx. possesses set of chromosomes from the diploid level 2n = 39 and consists of 48.72% of genetic material from genotype *V.vinifera* L. ssp. *Sativa* DC and 51.28% of genetic material from genotype *M.rotundifolia* Michx. (Fig.4.) [1-3, 6].

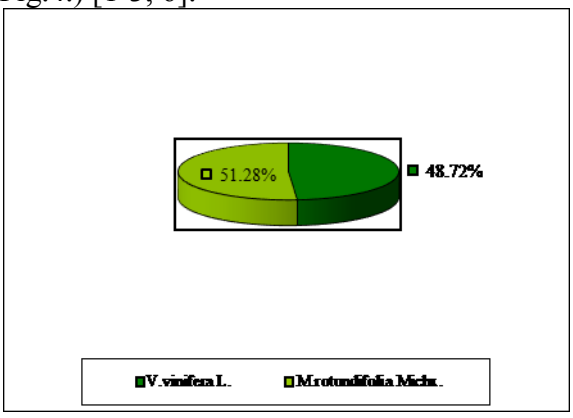

Fig. 4. Interspecific genotype F1. (2n = 39)

First generation interspecific genotype with diploid set of chromosomes 2n = 39, retro-

crossing him with maternal parental form *V.vinifera* L. ssp. *Sativa* DC, with the set of chromosomes 2n = 38, we get with the set of genotypes the interspecific BC1 diploid chromosomes level of 2n = 39.

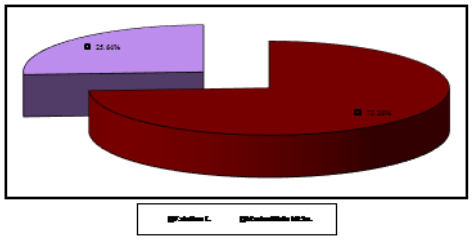

Fig. 5. Interspecific genotyp BC1. (2n=39)

Interspecific BC1 genotype consisting of 73.36% of genetic material from genotype *V.vinifera* L. ssp. Sativa D.C. and 25.64% of genetic material from genotype *M.rotundifolia* Michx. (Fig. 5.).
Interspecific genotype BC1 with diploid set of chromosomes 2n = 39, used in backcrossing with parental form *V.vinifera* L. ssp. *Sativa* DC, 2n = 38, we get BC2 genotypes, with the set of chromosomes diploid level 2n = 39 and 2n = 38.
Analysing the formula BC2 interspecific hybrid genotype, we can conclude that consists of 87.18% of genetic material from genotype *V.vinifera* L. ssp. *Sativa* D.C. and 12.82% of genetic material from genotype *M.rotundifolia* Michx. (Fig. 6.).

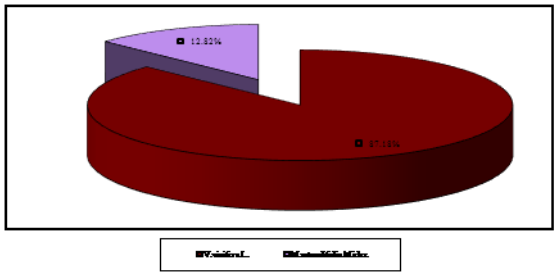

Fig. 6. Interspecific genotyp BC2. (2n=38)

It was BC2 interspecific hybrid backcrossing with parental form *V.vinifera* L. ssp. *Sativa* D.C. and other varieties the interspecific.
By examining the level of ploidy in the BC3 population interspecific hybrids it was found that they were diploid level set at 2n = 38.
The mechanism of resistance genotypes to pathogens, consists of groups of genes that are responsible for adapting to exogenous factors and resistance to pathogens (Fig. 7.; Fig.8.) [1-3, 6, 9, 10, 18, 19].

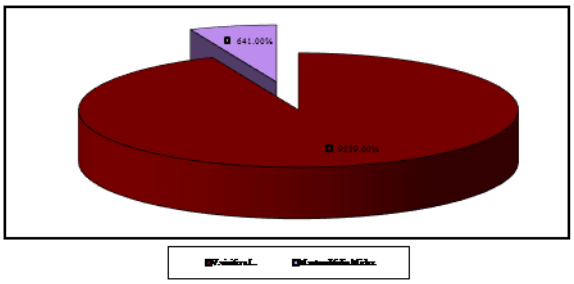

Fig. 7. Interspecific genotyp BC3. (2n=38)

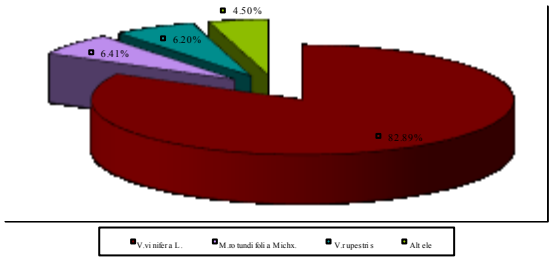

Fig. 8. Interspecific genotyp BC3. (2n=38)

CONCLUSIONS

The involvement of vines genotypes with enhanced resistance rhyzogene front of biotic and abiotic factors in the cultivation of vines will significantly diminish the impact on the environment thus contributing to improving agro-ecological communities.
The genotypes of spontaneous vines in the area of spreading from South-eastern North America is the main center to create interspecific genotypes with increased resistance to biotic and abiotic factors of the environment.
Although *V.vinifera* L. has great potential the genotypes of origin intraspecific genetic overcoming the barrier does not ensure the non-resistant against unfavorable environmental conditions in the area of cultivation.
The provenance of genetic complex genotypes interspecific vines, any order, as a result of heritability of characters expected, enables the creation and selection of genotypes that will underpin the production of raw material for the wine sector and in future will contribute to

the development direction of wine organic.

Creating of the genotypes resistant to some or other environmental factors, it can be successfully achieved only if the original homeland determine genotypes (center of origin) "parasite and host." As a result of development "parasite" and "host" under the natural range of distribution, form relationships adaptation of the body, including resistance "host" to "parasite" and accommodating "parasite" in habitat. The basic feature of the relationship "host - parasite" is a monotype reaction, so what is good for "parasite" is good and "host".

The implementation of the interspecific genotypes will reduce the number of chemical treatments applied in the technological process, this will reduce the environmental impact, increase the quality of products derivative would decrease production costs of planting material.

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THE EFFECTIVENESS OF THE USE OF PEAT ASH IN THE COMPOSITION OF PEAT NUTRIENT SOIL FOR GROWING TOMATO SEEDLINGS

Tatyana ANISIMOVA

National Research Institute of Organic Fertilizers and Peat (VNIIOU), 2 Pryanishnikov Str., Vyatkino, Sudogda District, Vladimir Region, 601390 Russia, Phone/Fax: + 7 4922 426010, Email: anistan2009@mail.ru

Corresponding author: anistan2009@mail.ru

Abstract

The article presents the results of studies on the use of nutritious soils based on peat and peat ash for the cultivation of tomato seedlings (Solanum lycopersicum L.). It was found that the most effective was the use of peat-ash compost with a ratio of components 1:4 and peat-ash-lupine compost (1:1:2). The results obtained confirmed their positive influence on the biomass growth of tomato plants, foliage and stem length.

Key words: *nutrient peat soil, peat ash, peat-ash composts, Solanum lycopersicum L., tomato seedlings*

INTRODUCTION

When growing seedlings of vegetable crops it is important the correct selection of soil and nutrient components for their production.
Practice has shown that to effectively solve problems, improve nutritional regime of soil substrates, diseases of vegetable crops with the use of chemicals is not possible [2].
Agricultural producers around the world face the problem of yield losses due to the accumulation of infection in soil and soils that leads to strong yield losses, which may lead to yield losses and reduced quality of commercial products [1, 5].
Numerous experiments and practice shows that every hundredweight conventional ash in its rational use can give an additional, depending on the culture, under which it is applied to 1 kg of grain, more than 4-5 kg of hay, 4 to 5 kg of potatoes or vegetables, etc.
All types of ash contain in its composition a significant amount of various grounds that determines their alkaline properties. The total neutralizing capacity of wood ash in the calculation of the calcium carbonate is 50-60 % of the weight of ash, peat - 20-30%, i.e. for every hundredweight of wood ash applied to soils, can replace of 0.5-0.6 kg carbonate of lime, peat ash – 0.2-0.3 C, respectively.
Ash is a good neutralizing agent and may be used instead of conventional calcium fertilizers. All species of ash in its composition are valuable fertilizers that contain, along with potassium, phosphorus and calcium, a considerable amount of useful plant nutrient substance and trace elements that play an important role in the life of plants [7, 8].
Peat ash is a product of the combustion of peat (power plants, boilers, etc.), mainly intended for liming (neutralization) of acidic soils.
When composting with peat ash neutralizes the acidity of the peat and enriches its mineral nutrients. Peat ash can also be used to obtain torfosol-Lupin compost, the advantage of which is that in them the nitrogen of peat organic matter, potassium and phosphorus pass into the ash available to plants [3, 7].
However peat-ash compost and peat-ash-lupin compost earlier widely used to fertilize field crops, and details their use in low-volume culture very little.
In this context, the purpose of the research is to develop recipes nutritious soils based on peat for growing seedlings of vegetable crops in smallholdings.

MATERIALS AND METHODS

The objectives of the research were: the determination of the efficiency of the

application of microbiological fertilizer nutrient soils based on peat; the formulation of peat and ash nourishing the soil for growing tomato seedlings; the formulation of peat-lupin-ash nourishing the soil for growing tomato seedlings.

In vegetation experiments conducted by the division of production and use of organic fertilizers and peat VNIIOU in 2012-2013, it was used soil nutrient, which is peat-ash compost (PAC) and peat-ash-lupin compost (PALC), obtained by passive composting for 8 months.

The study was carried out in conditions of film greenhouses.

The basis of soil nutrients was the peat – this option was adopted as a control. The study was performed according to the following scheme:

1. Peat control
2. Peat + ash (PAC) (1:1)
3. Peat + ash (1: 2)
4. Peat + ash (1: 3)
5. Peat + ash (1: 4)
6. Peat + ash + green mass of lupine (PALC) (1:1:1)
7. Peat + ash + green mass of lupine (2:1:1)
8. Peat + ash green + mass of lupine (1:1:2)
9. Peat+ ash + green mass of lupine (1:2:1)

In soil there were planted seedlings of Dubok tomato varieties. Corporotomy filled cell plastic cassettes designed for growing seedlings. The volume of one cell is 25 cm^3. The seedlings of tomato were planted in the cells one by one. Each variant was grown at 64 plants. The options laid in 4-fold repetition.

The determination of the total neutralizing capacity of peat ash in terms of calcium oxide was carried out in accordance with the method [6].

The agrochemical analysis of peat, ash, green mass of lupine, tohosomnia and torfosol-Lupin compost was performed in accordance with the methods [4,9].

The evaluation of the effectiveness of the studied composts (tortoreto) was carried out according to two criteria: a morphobiological criterion (the dynamics of growth, accumulation of plant biomass) and a chemical criterion (dry matter content, nitrogen, phosphorus and potassium in seedlings). The cleaning the sample of tomato seedlings was carried out in the phase of 6-7 leaves at the appearance of 1st flower brushes, for a different experience corresponds to the age of 55-60 days. In the course of a sample of seedlings was taken into account the weight of the aerial part and roots, linear length of plants, number of leaves on each plant[3]. Statistical analysis was performed using the program STATVIUA.

RESULTS AND DISCUSSIONS

The results of agrochemical analysis of initial components: peat, peat ash and green mass of lupine are presented in Table 1 .

Table 1.Agrochemical characterization of components of compost

Sample	Humidity,%	Ash, %	pH	Total, % on the raw substance			C,%
				N	P_2O_5	K_2O	
Peat ash	0.1	89.5	7.3	0.02	1.85	0.80	3.0
Top peat	74.0	15.5	4.6	0.25	0.08	0.02	42.2
Green mass of lupine	82.0	7.5	-	2.01	0.71	1.34	46.1

Source: Own determinations.

The total neutralizing capacity of peat ash in terms of calcium oxide made up 27-33%. The results of agrochemical analyses of the finished composts are presented in Table 2. The analysis of the obtained composts on total toxicity was made with the rapid method. The data obtained showed that the studied composts are non-toxic for plants.

Table 2. Agrochemical analysis peat-ash compost (PAC) and peat-ash -lupin (PALC) compost

Options	Ash, %	pH	Total, % on the raw substance			C,%	Toxicity, %
			N	P_2O_5	K_2O		
Control	5.6	4.0	1.18	0.28	0.01	47.2	21.3
PAC 1:1	60.1	7.2	0.59	0.78	0.21	23.2	5.6
PAC 1: 2	53.6	7.5	0.65	0.66	0.21	22.4	-
PAC 1: 3	59.5	7.4	0.32	0.58	0.24	20.2	6.9
PAC 1: 4	55.2	7.4	0.51	0.56	0.32	20.0	-
PALC 1:1:1	57.9	7.4	0.50	0.70	0.35	21.0	-
PALC 2:1:1	48.6	7.4	0.55	0.66	0.31	25.7	-
PALC 1:1:2	57.9	7.4	0.57	0.66	0.43	21.0	4.8
PALC 1:2:1	52.8	7.4	0.52	0.70	0.31	23.5	4.9

Source: Own determinations.

As a result of researches it is established that use of ash and green mass of lupine in compost mixtures with peat had a different effect on the development of tomato plants. The statistical processing of the obtained data showed that the introduction of peat ash and green mass of lupine part tortoreto had a significant impact on the qualitative characteristics of tomato seedlings (biomass, foliage, length of stem) in the options of experience, except for the variant with the ratio of peat and ash 1:2. The highest amount of biomass of the 1st plants was obtained in the variant with torfosol compost at a ratio of peat and ash 1: 4 and it was 6.3 g, which is 8.4 times more than in control (Table. 3, Fig.1).

Table 3. The effect of component ratios torfosol of composts on the quality of tomato seedlings

Options	The biomass of the 1st plants (natural moisture), g	The crude weight of the 1st plants, g		Linear length of plant, cm
		the above-ground part	Roots	
Control	1.2	0.9	0.3	5.3
PAC 1:1	3.8	3.1	0.7	15.8
PAC 1:2	2.5	1.9	0.5	13.2
PAC 1:3	3.6	2.8	0.8	20.8
PAC 1:4	6.4	5.2	1.2	24.5
PALC 1:1:1	3.3	2.6	0.7	18.2
PALC 2:1:1	4.8	3.8	0.9	22.,2
PALC 1:1:2	12.8	10.5	2.3	36.5
PALC 1:2:1	6.9	5.8	1.3	29.5

Source: Own determinations.

PALC have excelled themselves with the component ratio 1:1:2, the magnitude of the biomass of the 1st plants was 12.8 g and exceeded the control variant 17 times.

Use nourishing the soil with peat ash with different composition of components have influenced the chemical composition of plants (Table.4).

In the aerial part of seedlings grown on peat-ash the compost, the highest content of total nitrogen noted in the variant with the component ratio 1:4 it was 1.0%, while in the roots where its content was the lowest.

When growing seedlings on peat-ash-lupine the compost, the highest content of total nitrogen in the aboveground mass and roots it was observed in the ratio of components 1:1:2 and 1:2:1 to 1.08 and 1.20%.

Series 1-The above-ground part Series 2-Roots

Fig.1.The effect of component ratios in tohosomnia and torfosol-Lupin the composts on the formation of biomass 1st tomato plants

Source: Own design nased on experimental data

Table 4. The results of chemical analysis of tomato plants grown in peat-ash and peat-ash-lupine composts

Options	The above-ground part content, % for abs. dry substance		
	N_{total}	P_{total}	K_{total}
Control	0.48	0.22	0.51
PAC 1:1	0.85	0.43	1.70
PAC 1:2	0.80	0.72	1.60
PAC 1:3	0.74	0.43	1.60
PAC 1:4	1.00	0.53	1.53
PALC 1:1:1	0.80	0.53	1.84
PALC 2:1:1	0.80	0.53	2.00
PALC 1:1:2	1.08	0.62	2.40
PALC 1:2:1	1.20	0.58	2.52
Options	Roots content, % for abs. dry substance		
	N_{total}	P_{total}	K_{total}
Control	0.53	0.31	0.59
PAC 1:1	0.91	1.00	1.60
PAC 1:2	1.08	1.03	1.80
PAC 1:3	1.08	0.82	1.64
PAC 1:4	0.85	0.72	1.10
PALC 1:1:1	0.80	0.67	1.30
PALC 2:1:1	0.97	0.96	1.40
PALC 1:1:2	1.03	1.03	1.20
PALC 1:2:1	1.05	1.00	1.36

Source: Own determinations.

The minimum contents of nutrients in plants has been observed when growing seedlings on the peat.

Peat in this experiment can be considered as a substrate or as a basis of nutritious soil, and peat ash, and green mass of lupine in its composition are a source of nutrients for

tomato plants.

CONCLUSIONS

The obtained data testify the efficiency of the application of pear-ash and peat-ash-lupin composts as a soil nutrients for growing seedlings of tomato. The use of nourishing the soil with peat ash with different composition of components had a positive influence on the chemical composition of plants.

The introduction of peat ash and green mass of lupine part tortoreto had a significant impact on qualitative characteristics of tomato seedlings (biomass, foliage, length of stem) in the options of experience, except for the variant with the ratio of peat and ash 1:2.

The best biometric indicators of plants were obtained in a ratio of components in pear-ash compost 1: 4, peat-ash-lupin compost – 1:1:2.

The greatest biomass of the 1st plants was noted in the variant with pear-ash compost at a ratio of peat and ash 1: 4 and it was 6.3 g, which is 8.4 times more than in controls.

The peat-ash-lupin compost was the best option with the component ratio 1:1:2, the magnitude of the biomass of the 1st plants was 12.8 g and exceeded the control variant 17 times.

Peat can be considered as a basis of nutritious soil, and peat ash and green mass of lupine in its composition are a source of nutrients for growing tomato seedlings.

Given the short duration of the experiment, the data obtained can be considered advanced, despite of the statistically significant differences in the rate of quality characteristics of tomato seedlings.

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CONSERVATION OF RARE BREEDS THROUGH BY AN OPEN FARM VISIT

Mirela CĂRĂTUȘ STANCIU

"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, 5-7, Dr. Ion Rațiu Street, Sibiu, Phone/Fax:0269/211338; E-mail: mirela_stanciu2008@yahoo.com

Corresponding author: mirela_stanciu2008@yahoo.com

Abstract

The paper studied the importance of bio conservation of farm animals form rare breeds in context of them using for maintenance of local culture and tradition, tourist attraction and leisure activities. We are supporting to promote active and sustainable use of animal genetic resources and create an effective interaction among relevant stakeholders for an active exchange of knowledge on genetic resources. In our country the following species and breeds were registered as vulnerable in 2013: 1 breed of cattle, 2 breeds of goats, 10 breeds of sheep, Romanian Buffalo, 2 breeds of pigs, 1 breed of hen and 8 breeds of horses. Many local breeds hade played a central long role in the social and cultural life of rural populations. Bio conservation of rare breeds from farm animals help maintain biodiversity, improve the quality of agricultural products by promoting a sustainable agricultural production and fostering the sustainable development of rural areas.

***Key words*:** *rare breeds, bio conservation, rural heritage, alternative tourism models*

INTRODUCTION

Animal from rare breeds can be used as research and teaching material in history, ethnography, sociology and biology. They are part of cultural heritage (living cultural heritage).

There are a lot of reasons, for which small populations, also-called rare breeds, should be preserved. Some authors [10] has found the following list of arguments for conservation: economic-biological reasons, scientific reasons, cultural-historical reasons.

In UK exist a concept of a "Farm Park", as a breeding centre for rare breeds which function like touristic and education resource. This centre is a privately owned collection of British rare breeds in active breeding units. Its function like a public exhibition. [30]

Such an exhibition it could also has the role of information, training and teaching resource for local people. In this centre there are presented the advantages and disadvantages of the old local breeds. For visitors it could help them to understand and better appreciate the local culture. In this way the "Farm Park" support the local agriculture and its breeds.

The breeders need to find viable niche markets for their value-added products. They have not the capacity to invest in creating advertising or distribution networks. They bring people to the farm to know the rare breeds. [4]

In nowadays is a growing interest in "living history", and interactive learning. A farm witch grows animal from rare breeds offer the opportunity to the children's to interact with animals.

In the USA the interactive experience of "Living History" with historical settings brought back to old life from the past. An active farm can uses animals as teaching tools, and bring in attention the issues of livestock breeding, agricultural change and conservation.

The idea of "Farm Parks", "Living History Museums" and "Exhibition Farms" have no success in those countries were most people still have close links to the land. [9].

In countries with a developed tourism, there is a real possibility of linking the idea of living history, incorporating traditional skills, breeds and plant crop varieties into an exhibition.

MATERIALS AND METHODS

This work is based on investigation of bibliographic resources regarding the sustainable use of animal genetic resources.
We are been searched the livestock of endangered animal breeds and the national and European programs for bio conservation of them.

RESULTS AND DISCUSSIONS

The base of this work is to propose the founding of an opened farm which could function like an exhibition of different rare breeds. This farm can be part of package tour for the young generation. In France are a lot of farms with different function: teaching farms, discovery farms, farms that are open to visit, tasting and selling products from the farms.
Conservation and sustainable use of animal genetic resources was subject to United Nations Convention in Rio de Janeiro in 1992, and one of the main objectives of the Worldwide Action Plan and also one of the global FAO International Treaty on Genetic Resources for food and agriculture. [22]
The project aims to promote active and sustainable use of animal genetic resources and create an effective interaction among relevant stakeholders for an active exchange of knowledge on genetic resources. Knowing that some breeds were created and stabilized thousands of years ago and then improved naturally by man, cannot ignore the cultural and historical importance of these races. [1]
According to international standards, animal populations belonging animal husbandry genetic resources are: critical populations or considered missing, which have less than 100 females effectives; endangered populations, which have a number of females between 101 and 1001 heads; vulnerable populations, which have a number of females between 1000 and 5000 heads. [21]
The rapid evolution and technological civilization in recent centuries, involved a massive replacement of extensive production systems, primarily pastoral, with intensive systems. The danger of this rapid evolution has imposed looking in all areas of sustainable development pathways, requiring greater attention to conservation pastoral operating systems, which do not require finite resources, preserving landscapes and genetic resources. [20]
The knowledge and information plays a major role in vitalizing livestock production and proper management of genetic resources. Starting with this concept we believe that its necessary a collection of Romanian rare breeds which can function as a breeding centre with the goal of conservation, preservation and promotion of animals. This centre can promote the historical, cultural and aesthetic interest of the breeds.
The breeding centre for this rare races can become a high-interest subject for the press and television and can become a popular visitor centre for school groups, holiday organizers and tourists. These centre act primarily to draw attention to the changing face of agriculture, to the loss of historical breeds and are not large scale breeding centre. However, it can help to raise interest and awareness of indigenous stocks and is effective teaching tools regarding domestic animals and local/traditional products. [3;11; 13; 14; 25; 26]
Developed and developing countries differ with regard to their portfolios of genetic resources and the management of these resources. [7]
Taking into account the wide spectrum of environmental and economic circumstances and the versatility of many farm animal species, it should be possible to find good economic niches for many minority breeds. [19]
Examples of special uses (utilization of rare breed in production) for cattle, goats, horses and sheep are: attractive power in difficult conditions; production of "biological" food; production at school farms; production in prison farms; production in greenhouses for research & health; experimental animals in research; production of luxury furs; animals in part-time farming. [29] The same author finds use of rare breeds in conservation of natural environment and for human pleasure and recreation (animals in national parks, farm

animal parks and museums, agricultural and native place museums, riding for hobby and racing, social company of humans, pet-keeping, aid in bringing up children, maintenance of local culture & tradition, exhibition in zoos, tourist attraction, folk art, ceremonial purposes). [12; 28]

From this point of view we believe in choose for use of rare breeds animals for maintenance of local culture and tradition, tourist attraction and leisure activities.

Many local breeds are able to provide unique products that may be of a higher quality than those obtained from high-output commercial breeds.

Local breeds and their products may also be valued as a characteristic part of traditional farming systems. Moreover, many local breeds have long played a central role in the social and cultural life of rural populations – including religious and civic traditions, folklore, gastronomy, specialized products and handcrafts [6]

These characteristics can potentially be a basis for diversified livestock production, and increased profitability for local breeds.

In France the publication "Sheep raised for milk in the Pyrrenees in 2020" presents five scenarios for building a strategy of selecting a local breed: metamorphosis (milk market economy piedmont and mountain ecology market); territory and quality brands; pastoral traditions decline in the economy; double quality; nature and food; balanced development of border regions. [5; 23]

At European level there is a strategy regarding biodiversity conservation. [17]

The Communitarian program of conservation, characteristics, evaluation and use of the genetic resources in agriculture established conservation activities both in-situ and ex-situ. They have increased knowledge on genetic resources and created European database for species and breeds of farm animals. [16]

Rural Development programs have contributed to the conservation of genetic resources at farms level and encouraged farmers to conserve local breeds and crops by rewarding them. [8; 15; 24]

According to the data provided by the competent departments, in our country the following species and breeds were registered as vulnerable in 2013.

Tabel 1. Livestock breeding females belonging to breed endangered on species and breeds

Species	Breed	No. of females used at reproduction (head)
Cattle	Grey Stepe Local Breed	67
Bubalus	Romanian Buffalo	289
Swine	Bazna	22
	Mangalița	55
Sheep	Țigaie, Ruginie Variety	1,120
	Rațca	3,680
	Karakul of Botoșani	2,342
	Merinos of Palas	4,364
	Merinos of Suseni	300
	Transilvanian Merinos	268
	Cluj Merinos	203
	Palas Meet breed	635
	Palas Milk breed	224
	Back head Țigaie ofTeleorman	3,438
Goats	White of Banat	1,002
	Carpatina	1,661
Hens	Nake necked of Transilvania	457
Skil worms	Bombyx mori-family	4,250
Horses	Lipițan	260
	Furioso North Star	36
	Horse of Bucovina	8
	Huțul	83
	Gidran	35
	Arabian Shagya	68
	Nonius	38
	Romanian Sport Horse	52
	Romanian Semi dray-horse	62

Source: [18, 27]

All these breeds are characterized by rusticity, longevity, adaptability, resistance of disease

according to the conditions of maintenance and feeding.

CONCLUSIONS

For de global food security conservation of animal genetic diversity is essential. [30; 2]
We propose an opened farm which could integrate biodiversity conservation of farm animals with methods of alternative tourism. In this farm we can promote innovative practices with benefits for rural areas and rural peoples. In rural area are close ties to traditional and cultural values with local practices related to animal breeding and processing the local products.
In this model opened farm we propose a collection of rare breeds farm animals which can help maintain biodiversity. Applying the local cuisine we can improve the quality of agricultural products and promoting a sustainable agricultural production.
This model farm connected to tourism, will develop methods oriented towards traditional agricultural practices.
This opened farm to visitors will function like a centre for bio conservation of rare breeds. It can also function like a farm open visits for students, young people and tourists. It is possible to organize regular activities of alternative tourism in farm activities: workshops, local cuisine, tours knowledge, exhibitions of photography, drawing, painting, pedagogical models, reports, cultural days, debates on specific topics, watching movies and shows.
In this model farm they can be made:
(i)Research activities regarding in situ conservation of species and rare breeds of farm animals and studying their morpho-productive and reproductive characteristics.
(ii)To apply national conservation objectives for each species.
(iii)Recovery of traditional knowledge and acquiring specialized skills and knowledge required to work with local breeds.
(iv)Understanding the importance of preserving them.
(v)Integrating the use of obtained products from the protected genetic resources by involving small local industries, local restaurants and alternative forms of tourism. It can used recipes from traditional local cuisine.
(vi)Producing and promoting traditional products and including them in a list with products HNVF.
(vii)Produce and conserve the biodiversity of those species.

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ANALYSIS OF LOCAL LEVEL INSTITUTIONS' MICROCREDIT DELIVERY EFFECT ON THE LEVEL OF OUTPUT OF THE RURAL FARM HOUSEHOLDS IN GIREI AND YOLA SOUTH LOCAL GOVERNENTS AREA OF ADAMAWA STATE, NIGERIA

Udegbunam Edwin CHINONSO, Onu Inyanda JUSTICE

Modibbo Adama University of Technology, Department of Agricultural Economics and Extension, P.M.B. 2076, Yola, Nigeria, Phone; +2348037858314, +2348036050936, edwinudegbunam@gmail.com, justiceonu@yahoo.co.uk

Corresponding author: edwinudegbunam@gmail.com

Abstract

The study analysed local level institutions' (LLIs) microcredit delivery effect on the level of output of the rural farm households in Girei and Yola South Local Government Areas of Adamawa state, Nigeria. Multistage random sampling was used in selecting one hundred and twenty (120) rural farm households' member of the local level institution and data were collected through questionnaire administration. The result of multiple regression showed that microcredit significantly added to the level of output of the rural farm households with R square = 0.75, F statistic = 41.76 and it corresponding P-value= 0.0000. Therefore, LLIs microcredit delivery has significant effect on the rural farm households' poverty status and the study recommended that LLIs should be integrated into the current poverty alleviation programme and food security programme of the government. Also, make channels for loan delivery so as to empower its members financially as well as achieving the sustainable development goals of eradicating extreme poverty and food security.

Key words**:** *local level institution, microcredit, poverty, Nigeria*

INTRODUCTION

Local Level Institutions (LLIs) also known as Informal Financial Institutions (IFIs) had several definitions by researchers. Local Level Institutions are those institutions that embrace all financial transactions that takes place beyond the functional scope of various countries and other financial sector regulation [1]. These institutions are not controlled directly through major monetary and financial policy instruments but are created by individuals and groups with no legal status. They are referring as institutions that are not directly amendable to control by key monetary and financial policy instruments [7]. They carry out contract or agreement conducted without reference or recourse to the legal system to exchange cash and present for promise of cash in future. They emanate from the grassroots, bottom up demand of the poor for an appropriate financial service. In this study Local Level Institutions could be defined as those associations that substitute formal financial institutions, facilitating savings and ensuring easy access to credit to members and operating without direct control of the governmental financial authorities. The traditional/local institutions and groups are social and economic. Some serve both social and economic purposes in livelihood of their members. The social groups help in creating social capital, institutional identity, and relationships within, members' attitudes and values that govern interactions among them as a people. These contribute to economic and social development of the communities [8]. These communities have cooperative groups, religious groups, mutual associations groups, Age grade groups, social and friends' club and Fadama groups. The economic groups concern themselves with their mutual interest that revolve around solving problems of primary production and marketing of whatever is their products and services. Evidence is showing that local institutions can have an impact on developmental outcomes – growth, equity, and poverty alleviation. Social

capital as reflected in associational activity may lead to less imperfect information and hence lower transactions costs and a greater range of market transactions which can in turn lead to better outcomes [11].

Impact of micro-finance on the efficiency of wood-processors, tailors and hair dressers was explored and factors that affected their efficiency were found to be age, experience of the business, education level, training programs and microcredit [6]. Microcredit had a positive and significant effect on the efficiency of all the three categories of micro entrepreneurs. Also, impact of Microfinance on poverty reduction in Adamawa state was analysed with descriptive and inferential statistics and it was revealed that microfinance had a significant effect on the income of the beneficiaries [14]. Research on the extent to which microcredit impact on small scale farm production in Ondo state evaluated the production efficiency of farmers participating in the microfinance and the determination the of credit utilization on traditional farming in western Nigeria [3]. A multi-stage sampling technique was used to collect primary data using structured questionnaire from 100 beneficiaries from the selected financial institutions in the study area. The findings revealed that the beneficiaries had more farm resources and more productive than before. Data Envelopment Analysis was used to check the efficiency of 46 microfinance schemes [12]. They used poverty approach rather than production approach to see the efficiency of microfinance. Average technical efficiency score was recorded at 80% of the schemes. Age and the location of the schemes were found to have the significant impact on the efficiency of the microfinance using 2nd stage regression. The effect of microfinance on small-scale poultry production in Imo state, Nigeria was investigated using purposive and random sampling techniques [9]. The study found out that male respondents recorded higher poultry production than their female counterparts. This was attributed to the fact that they cover much distance in acquiring other inputs than their female counterparts which the business requires. It also observed that there is a significant positive relationship between volume of loans obtained from microfinance banks and poultry production, thus, indicating microcredit enhances poultry production in the region. Also, the effect of microfinance on small scale Poultry business in South West Nigeria had earlier been investigated [4]. Out of the total sample, 29% took loan from co-operative societies. Education level, business experience and number of birds in the farm were positive and significant. Funds intensity was highest for usage of inputs while it was lowest for the business experience. The role of microfinance in reducing poverty was carried with a sample of 100 microfinance borrowers which are maize farmers [1]. The impact of microfinance on socioeconomic well-being was found to be quite minor due to lack of entrepreneurial skills.

Therefore, there is the need to adopt new technology in the agriculture sector that requires credit [16]. Cobb-Douglass regression was used on the data from 1990 to 2008. Credit used for seed, fertilizer, pesticides, irrigation and tractors were strongly related with the agriculture gross domestic product. Impact of credit on agriculture production was found to be more than 80%. Thereby it was concluded that credit access had a very significant role in increasing agriculture productivity [16]. The determinants of the efficiency of poultry farmers using micro credit in one of the states of Nigeria applying SFA technique on a sample of 115 showed that microcredit was have a positive and the significant impact on the technical efficiency [15].

The local level institution microcredit delivery needs to be encouraged among rural farmers as an easy source of credit. Rural-farmers need to form groups or local institutions that enable them access micro loans from the groups or other formal lending financial sources. These rural farmers produce bulk of food consumed locally and some export crops which generate foreign exchange to the country.

MATERIALS AND METHODS

The study area was Yola South and Girei Local Government Areas of Adamawa State, Nigeria. Girei Local Government Area lies between Longitude 11º14’ E and Latitude 7º11’ N and Yola South Local Government

Area lies between longitude 12°28'E and latitude 9°14'N of the Equator and of the GMT [2]. The study area falls within the Northern Guinea Savannah Zone with land mass of 2,420.05km2 and a population of 512,849 [13].

The area is bounded by Song, Fufore, Demsa and Yola North Local Government areas to the south and east, to the north and to west respectively. There are twenty-two (22) wards in the study area; Toungo, Bako, Makama A, Malkohi, Adarawo, Bole-Yolde Pate, Namtari, Yolde-Kohi, Mbamba, Mbwaramoi and Ngurore wards in Yola South local government area and Girei I, Girei II, Tambo, Modire, Gereng, Dakri, Jera Bakari, Wuro Dole, Damare, Jera Bonyo and Goron in Girei local government area.

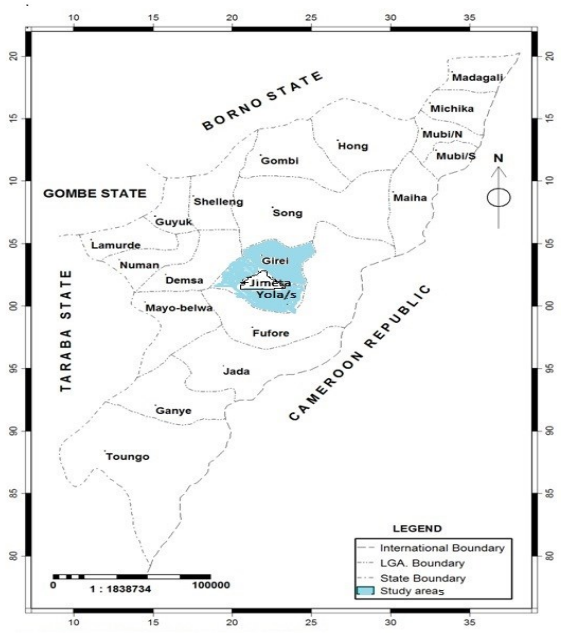

Fig. 1. Map of Adamawa Showing the Study Areas
Source: Own determination.

The rain season commences in April and ends in late October, while the dry season starts in November and ends in April. The mean annual rainfall of the area is about 1000mm [2]. The study area is generally suitable for agriculture due to the type of climate, landforms, and soil types it exhibits. The soil type around is generally loamy with alluvial deposits the river valleys suitable for cowpea production, marketing of agricultural produce. Large number cowpea marketers abound in both the two local government areas. Other crops produce in the areas are rice, maize, sorghum, groundnut, soy beans, millet, sweet potato, yam etc.

multistage random sampling technique to select the wards, local level institutions and farm households. List of registered local level institutions was collected from the local government secretariat. In the first stage, twelve (12) wards were randomly selected from the two local government areas. This was used as the sampling frame. The second stage was the random selection of two (2) local level institutions from each of the wards. This gives twenty-four (24) local level institutions. The last stage was the random selection of five (5) farm households' beneficiaries of local institutions' microcredit delivery in each of the selected local level institutions. This gives a total of one hundred and twenty (120) respondents to be sampled. Primary data was collected with the aid of questionnaire. Information collected include: socio-economic characteristics of members of Local Level Institutions such as; age, education level, household size, secondary Occupation, farms size, farming experience, annual income, amount of contribution by members of Local Level Institution etc. The outputs of the major crops grown by the respondents such as; maize, sorghum, millet, melon, soya bean, cowpea, groundnut, rice etc. were determined into Grain Equivalents. Multiple regressions like double-log, exponential, semi-log and linear production function were used to analyse the effect of micro-credit on the level of output of rural farmers. Double-log was selected among others based on the three (3) model selection criteria. The test for Multicollinearity, autocorrelation, heteroscedasticity, normality and specification error was carried with respect to the stated hypothesis below referencing Ordinary Least Squared (OLS) assumptions.

H_0: Residuals are not dependent i.e. there is independency among residuals
H_1: Residuals are highly dependent

H_0: Residuals are not serially correlated
H_1: Residuals are serially correlated

H_0: Residuals are not heteroskedastic i.e. residuals are homoscedastic
H_1: Residuals are heteroskedastic

H_0: Residuals are normally distributed
H_1: Residuals are not normally distributed

H_0: There is no specification error
H_1: There is specification error

Therefore, in all the stated hypothesis above, if the null hypothesis were not rejected it means the selected model specification is correct. The production function is the mathematical way of describing the relationship between the production of a given output and the factors affecting the production process [10]. There are various functional forms of the Production Function Analysis. These include Quadratic, Linear, Square root, Spillman and Cobb-Douglas methods. However, for this study the Cobb-Douglas Function will be used. The Cobb-Douglas functional form uses the formula:

$$Logy = b_0 + b_1 Logx_1 + ... + b_6 Logx_6 + \varepsilon_i$$

where: y = Output products in grain equivalents
x_1 = Microcredit in naira
x_2= Seeds in grain equivalents
x_3 = Herbicides and pesticides in litres
x_4 = Land in hectare
x_5 = Labour in standard man-day
x_6 = Fertilizer in kg
b_0 = Intercept
b_1– b_6 = Coefficients to be used
ε_i = Random variable.

RESULTS AND DISCUSSIONS

Multiple regression analysis like; linear, exponential, semi-log and double-log production function was used in analysing the effect of microcredit on the level output of crops. Table 1 shows the result of the four (4) model specification. The result revealed that linear has the value of R squared (0.842630), F-statistic (100.8419) and its corresponding p-value (0.00000). This implies that 84.26% of their level of output is as a result of the input used in farming. In other words, the regressors (microcredit, seed, herbicide and pesticide, fertilizer, land and labour) had explained about 84.26% of the total variation in the regress (level of output), while the remaining 15.74% remained unexplained variables. The F-statistic and its corresponding p-value showed the joint explanation of t-statistic and p-value in the regress. Linear has three (3) out of the six (6) of the explanatory variables significant at 5% which is acceptable because at least half of the explanatory variable has to be significant for a model to be selected.
The coefficients and signs are good in reference to statistic and economic theory. Exponential has R^2 0.639798 and Prob(F-statistic) of 0.000000 but has negative sign for microcredit which against the statistic and economic theory. It has three of the explanatory variables significant at 5%. Semi-log has R^2 = 0.741294 and Prob(F-statistic) = 0.00000, four (4) of the explanatory variables significant but has signs of seeds and land to be negative which is against the statistic and economic theory. Whereas the result shows that double-log has R^2 = 0.746692 and Prob(F-statistic) = 0.000000, five (5) of the explanatory variables significant and signs and coefficient concurred with the statistic and economic theory.

Diagnostic Tests

The model was subjected to several hypothetical tests as a criterion for model selection. In so doing the econometric criterion known as 2nd order test was considered to establish whether the estimates have desirable properties and whether there is a violation of ordinary least squared (OLS) method.
There exists no high correlation between any two independent variables and we fall to reject the null hypothesis. Multicollinearity makes significant variable insignificant by increasing its standard error. It makes the standard error to go up, t-value goes down thereby making the p-value high. Nonetheless, the study data is a cross sectional data but autocorrelation was test for and removed before any other test. This was because Eviews (Eviews 9) used in the analysis

presents such data as time series data. Table 2 showed that the residuals are autocorrelated (autocorrelation 1 with p-value of 0.39%) and it was removed and tested again (autocorrelation 2 with p-value 5.48%) which is above 5% meaning the null hypothesis is accepted. Heteroscedasticity test gave a p-value of 62.58% showing that the null hypothesis will not be rejected. Table 2 shows the result of the normality test, Jarque-Bera (0.064202) and its p-value (96%) which is above 5% meaning we fall to reject null hypothesis.

RESET which is the general test for the specification errors like: (a) omitted variables; where x does not include all the relevant variables. (b) Incorrect functional form; where some or all of the variables in y and x should be transformed to logs, powers, reciprocals, or in some other way. (c) where correlation between x and ε_i which may be caused by the measurement errors in X, simultaneous equation considerations, combination of lagged y values and serially correlated disturbances. Ramsey's RESET test results were shown in table 6 with t-statistic and its corresponding p-value (40.29%), F-statistic and its corresponding p-value (40.29%) and likelihood ratio and its corresponding p-value (37.44%). These results were above 5% showing that there was no specification error. Therefore, we fall to reject the null hypothesis.

Since all the tests failed to reject the null hypothesis, Cobb-Douglass model was selected as the best model specification. This can be stated as follows:

$$\log y = -2.41814 + 0.46029\log x_1 + 0.190081\log x_2 + 0.444584\log x_3 + 0.607708\log x_4 + 0.208203\log x_5 + 2.32600\log x_6 + \varepsilon_i$$

Table 1. Multiple Regression Result of Effect of Local Level Institutions' Microcredit Delivery on the Level of Output (Crop)

Model specification	**b_0**	**b_1**	**b_2**	**b_3**	**b_4**	**b_5**	**b_6**
Linear	-3012.6	0.05945	7.49248	695.438	292.659	8.93513	2.40729
t-statistic	-6.3395	6.44660	2.45464	7.02351	1.10816	0.94778	1.08143
P-value	0.0000	0.0000	0.0156	0.0000	0.2701	0.3453	0.2818
Exponential	5.85295	-00000	0.00249	0.19110	0.30104	0.01019	0.00111
t-statistic	31.6764	-0.0174	2.09508	4.96356	2.93159	2.78065	1.27803
p-value	0.0000	0.9862	0.0384	0.0000	0.0041	0.0064	0.2039
Semi-log	-57243	3591.28	-126.79	2433.67	-751.31	1308.77	3279.33
t-statistic	-8.3355	4.96300	-0.3413	4.23067	-0.9853	2.12444	4.47246
P-value	0.0000	0.0000	0.7337	0.0001	0.3273	0.0365	0.0000
Double log	-2.4181	0.46403	0.19008	0.44458	0.03391	0.30608	0.60771
t-statistic	-1.6485	3.00220	2.39550	3.61828	0.20820	2.32600	3.88022
P-value	0.1029	0.0035	0.0188	0.0005	0.8356	0.0224	0.0002
	R squared	F-statistic	Prob(F-statistic)				
Linear	0.842630	100.8419	0.000000				
Exponential	0.639798	33.45208	0.000000				
Semi-log	0.741294	40.59296	0.000000				
Double-log	0.746692	41.76000	0.000000				

Source: Own calculation.

Table 2. Autocorrelation, Heteroscedasticity, Normality and Ramsey RESET Test Results

Diagnostic tests	**Observed R-squared**	**Probability**
Autocorrelation 1	11.10890	0.0039
Autocorrelation 2	5.809488	0.0548
Heteroscedasticity	5.280032	0.6258
Normality	Jarque-Bera	
	0.064202	0.968409
Ramsey RESET	t-statistic	
	0.841760	0.4029
	F-statistic	
	0.708560	0.4029

Source: Own calculation.

CONCLUSIONS

The multiple linear regression analysis predicted the model, three out of the six of the variables were significant and R-square more-than 60% which are conventionally accepted. Double-log has five (5) of the variables significant which is highest with R-square 75%.

Although this doesn't mean that the model is well predicted, we subjected the model to diagnostic test.

Normally Eviews presents data as time series data and this led to removal of autocorrelation. The test for autocorrelation (0.0548), heteroscedasticity (0.6258), normality (0.968409) and Ramsey RESET (0.4029) showed that the model is well predicted and LLIs microcredit delivery is positive and significant in the level of output of the rural farm households.

Autonomous local level institutions should be integrated into the current poverty alleviation programme of the government. They should be made channels for loan delivery so as to empower its members financially as well as achieving the sustainable food security.

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THE EFFECT OF LOCAL LEVEL INSTITUTIONS' MICROCREDIT DELIVERY ON RURAL FARM HOUSEHOLDS' POVERTY STATUS IN GIREI AND YOLA SOUTH LOCAL GOVERNMENT AREAS OF ADAMAWA STATE NIGERIA

Udegbunam Edwin CHINONSO, Onu Inyanda JUSTICE

Modibbo Adama University of Technology, Department of Agricultural Economics and Extension, P.M.B. 2076, Yola, Nigeria, Phone; +2348037858314, +2348036050936, edwinudegbunam@gmail.com, justiceonu@yahoo.co.uk

Corresponding author: edwinudegbunam@gmail.com

Abstract

The study analysed the effect of local level institutions' (LLIs) microcredit delivery on rural farm households' poverty status in Girei and Yola South Local Government Areas of Adamawa state, Nigeria. Multistage random sampling was used in selecting one hundred and twenty (120) rural farm households' member of the local level institution and data were collected through questionnaire administration. The study showed that 58% of the rural farm household head respondents were poor and require N4,955.00K to come out of poverty. This is because their per capita consumption is below the poverty line. Moreover, the Lorenz curve and Gini index of 0.207174 showed that the income distribution and income inequality among the respondents are typical not high. The squared poverty index of 0.17 which measures the severity of the poverty, and took into account of the income distribution and inequalities between the poor and the rich it revealed that the poor rural farm households per person in relation to the population only required 17% (N5,615.67) of poverty line to come out of poverty.The logit regression revealed that microcredit significantly added to the model (poverty status) with Naglekerke R Square = 0.402 and Chi-square = 42.604 and corresponding P-value = 0.001. Therefore, the study recommends the need for the government to formulate policies targeting at improving the welfare of the rural farm households, their source of livelihood and improve the lot of low-paid workers by integrating LLIs into the current poverty alleviation programme of the government and make channels for loan delivery so as to achieve the sustainable development goals of eradicating extreme poverty.

Key words**:** *local level institutions, microcredit, poverty, income inequality, Nigeria*

INTRODUCTION

The rural poverty increases with sharp decrease in the standard of living of rural farmers. Inadequate capital is a major problem confronting small-scale enterprise including rural farmers in Nigeria. These rural farmers produce bulk of food consumed locally and some export crops which generate foreign exchange to the country. Poverty is the lack of command over basic consumption needs i.e. a situation of inadequate consumption level; giving rise to insufficient food, clothing and shelter [19]. While poverty can be seen as a situation of been moneyless and powerless [12]. As indicated in IBRD (1996) poverty in Nigeria is overwhelmingly a rural problem [17]. Empirical profile of poverty prevalence and factors influencing poverty among farm households is very important. Agriculture continues to be a fundamental instrument for sustainable development, poverty reduction and enhanced food security in developing countries. Moreover, 112.519 million Nigerians live in relative poverty and the conditions is alarming [18]. The North-West and the North-East had the highest poverty rates in the country in 2010 with 77.7 per cent and 76.3 per cent respectively. However, the South-West geo-political zone recorded the lowest at 59.1 per cent [18]. More worrisome is the fact that the poverty rate is rising at a time the Gross Domestic Product (GDP) growth rate is put at 7.75 per cent. per cent and 76.3 per cent respectively. The North-East geo-political zone has higher population of rural-farmers with farming as source of livelihood. These rural-farmers are faced with

the problem of unavailability of credits and inaccessibility to the available formal credit.

Local institutions' microcredit delivery and effects had been studied on rural farm households' poverty in Abia State [4]. The study analysed the farm households' mean contribution (savings) to the local institution; it examined the amount demanded by members, vis-a-vis disbursement by the local institution; poverty profile and effect of microcredit from local institutions on farm income and expenditure of rural farm households in Abia State while a study on impact of microcredit on poverty alleviation in Enugu East Local Council of Nigeria was conducted, estimating the level of access to credit and their sources; incidence, depth and severity of poverty among the rural populace [3]. Both study showed that microcredit delivered to rural farm households has positive effect in their poverty status. Recent study by International Fund for Agricultural Development (IFAD) showed that lack of formal credit affects rural poverty and encourages indigenous financial arrangements to take the place of missing formal finance [14]. Informal financial institutions such as microcredit programmes have positive effects on the welfare of the people [11]. It reduced poverty through microfinance and thrift societies. It also increased women empowerment, improved savings and purchase of agricultural inputs and ensured easy access to loans with considerably lower interest rates. Farmers' participation in savings and credit cooperative societies: mean per capita annual farm income and poverty reduction in Niger state, Nigeria was achieved [13]. While microcredit as a strategy for poverty reduction in Benue state, Nigeria was analysed [1]. The data from 274 respondents were analysed using descriptive and inferential statistics and revealed that microcredit has help in reducing poverty among the respondents. Another research on the impact of micro finance on poverty reduction revealed that access to microfinance is very important because it enables the poor to create, own and accumulate assets and smoothened consumption [16]. Moreover, it was observed that "sustainable access to microfinance helps alleviate poverty by generating income, creating families to obtain health care and empowering people to make the choice that best serve their needs [5].

The broad objective of this study is to analyse the effect of Local Level Institutions' microcredit delivery on the rural farm households' poverty status. The specific objectives are as follow:

i.Determine the poverty line, poverty incidence and poverty gap among rural households.

ii.Analyze the effect of microcredit on the rural farm households' poverty status.

iii. Analyze the income inequality among the rural farm households.

MATERIALS AND METHODS

This study was carried out in Yola South and Girei Local Government Areas of Adamawa State, Nigeria. Girei Local Government Area lies between Longitude 11º14' E and Latitude 7º11' N and Yola South Local Government Area lies between longitude 12º28'E and latitude 9º14'N of the Equator and of the GMT [2]. It has rain season from April and ends in October, while the dry season starts in November and ends in April. The mean annual rainfall of the area is about 1000mm [2]. The soil type around is generally loamy with alluvial deposits the river valleys suitable for cowpea production, marketing of agricultural produce. Large number cowpea marketers abound in both the two local government areas. This study adopted multistage random sampling technique to select the wards, local level institutions and farm households. List of registered local level institutions was collected from the local government secretariat. In the first stage, twelve (12) wards were randomly selected from the two local government areas. This was used as the sampling frame. The second stage was the random selection of two (2) local level institutions from each of the wards. This gives twenty-four (24) local level institutions. The last stage was the random selection of five (5) farm households' beneficiaries of local institutions' microcredit delivery in each of the selected local level

institutions. This gives a total of one hundred and twenty (120) respondents to be sampled. Primary data was collected with the aid of questionnaire. Inferential statistics such as; Foster-Greer-Thorbecke (FGT) Poverty Measures was used to determine the poverty line, poverty incidence and poverty gap among rural farm households, Logit regression model was used to analyse the effect of microcredit to the poverty status of the rural farm households and Gini-coefficient (Gini index) was used to analyse the income inequality among the rural farm households.

Poverty Measures

Foster-Greer-Thorbecke (1984) was used to determine the poverty status of beneficiaries of Local Institutions' microcredit [9]. The model is specified as:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{Z-Y}{Z}\right)\alpha$$

where:
Z = poverty line
N = total Sample
H = the number of poor (below poverty line).
Y = average household monthly *per capita* expenditure
α = poverty index which takes value of 0, 1 and 2
(1). When α = 0, the poverty index (PI) becomes Head Count Ratio or Poverty Incidence Index (HCR or PI) i.e. the proportion of people below the poverty line. It is used to determine the number of households having *per capita* expenditure below the poverty line. It is stated as: Po = H/n. where H is the head count. The PI (P0) gives the prevalence of poverty at a point in time.
(2). When α = 1, PI becomes the Poverty Gap Index (PGI) i.e. the aggregate short fall in expenditure of the household from the poverty line. It measures the difference between actual expenditure and minimum non-poverty expenditure. The proportion of the poverty line (value) that the average poor require to meet the poverty line; the lower the value, the lower the poverty gap. The PGI (P1) gives the depth of poverty at a point in time.
(3). When α = 2, PI becomes poverty severity index (PSI) i.e. PSI gives more weight to the poverty gap of the poorest. The closer the value is to 1 (100%), the harder the poverty condition of the household. The PSI gives the severity of poverty at a point.

Logit Regression Model

Logistic regression model was used to analyse the effect of microcredit and other socio-economic characteristics on the poverty status of the rural farm households in the study area.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_{11} X_{11} + \mu_w$$

where:

$$Y = Y_i = \ln \frac{P_i}{1 - P_i}$$

Y= annual average expenditure of the household/ total number of days in the year (365)
Y = the poverty status i.e. the probability which measures the total contribution of the independent variables in the explanation of the dependent variable in the model.
X_1=Microcredit
X_2=Age
X_3=Marital status
X_4=Educational level
X_5=Number of wives
X_6=Farm size
X_7=Household size
X_8=Main occupation
X_9=What do you do with the produce (Whether all were sold or consumed, more than 50% consumed or sold)
X_{10}=Gender
X_{11}=Family type
$\beta_0 - \beta_{11}$=coefficients

The Gini-Coefficient (Index)

The Gini coefficient was developed by the Italian Statistician Corrado Gini as a summary measure of income inequality in society [10]. It is usually associated with the plot of wealth concentration introduced a few years earlier by Max Lorenz [15]. It measures the ratio of the area between the Lorenz curve and the equidistribution line (henceforth, the concentration area) to the area of maximum concentration. Since these measures were introduced, they have been applied to topics other than income and wealth, but mostly within Economics [8][20]. When G is based

on the Lorenz curve of income distribution, it can be interpreted as the expected income gap between two individuals randomly selected from the population [20].

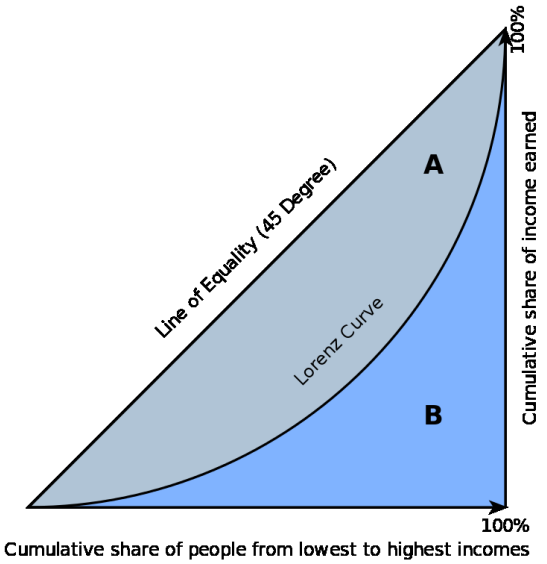

Fig. 1. Lorenz curve of income
Source: Own calculation

$$G = \frac{concentration\ area}{maximum\ concentration\ area} = \frac{A}{A+B}$$

The area under the Lorenz curve is more easily calculated as follows;

Recall the definition of the coordinates of the Lorenz curve. Given $y_1 \leq y_2 \leq \ldots \leq y_n$, it must be that:

$$q_i = \frac{y_1 + y_2 + \ldots + y_i}{y_1 + y_2 + \ldots + y_n} = \frac{y_1 + y_2 + \ldots + y_n}{Y}$$

(cumulative proportion of income)

$$p_i = \frac{i}{n}$$ (cumulative proportion of population)

With $q_0 = p_0$ and $q_n = p_n = 1$

The area of the triangle is given by:

$$Z_1 = \frac{\overbrace{p_1}^{base}\ \overbrace{q_1}^{height}}{2}$$

While the area of each trapezium is given by:

$$Z_i = \frac{\overbrace{(q_i + q_{i-1})}^{longbase-shortbase}\ \overbrace{(p_i - p_{i-1})}^{height}}{2}$$

As $q_0 = p_0 = 0$, the sum of all these areas give rise to:

$$Z = \sum_{i=1}^{n} Z_i = \frac{1}{2}\sum_i [(q_i + q_{i-1})(p_i - p_{i-1})]$$

for n=4

Note, Z is not the concentration area but the area under the Lorenz Curve. To calculate the concentration area (the numerator of the Gini Index) we subtract Z from the maximum concentration area (½) as follows:

$$Conc.area = \frac{1}{2} - Z = \frac{1}{2} - \frac{1}{2}\sum_i [(q_i + q_{i-1})(p_i - p_{i-1})]$$

therefore, Gini Index G is equal to:

$$G = \frac{\frac{1}{2} - \frac{1}{2}\sum_i [(q_i + q_{i-1})(p_i - p_{i-1})]}{\frac{1}{2}} =$$

$$1 - \sum_i [(q_i + q_{i-1})(p_i - p_{i-1})]$$

Or simply: $G = 1 - 2Z$

RESULTS AND DISCUSSIONS

Poverty Profile of the Rural Farm Households

The study adopted the expenditure approach in determining the poverty profile of the rural farm households. This is done by aggregating the total expenditure on food consumption and production by rural farm households. The poverty profile of the respondents was showed in the Table 1. The result showed that the poverty line (mean monthly household expenditure) was N33,033.33 per month. The poverty headcount index (poverty incidence) was 0.58. This showed that 58% of the rural farm household head in the study area were poor because their per capita consumption is below the poverty line.

Also, it showed that the poverty gap index (poverty depth) was 0.15. This showed that the respondents required 15% of the poverty line to come out of poverty. This amounted to N4,955.00 per rural farm household head per month. The result showed that the squared poverty index was 0.17. This measured the severity of the poverty, and took into account the inequalities between the poor persons. It revealed that the poor rural farm households per person in relation to the population, each

person (household member) needs 17% (N5,615.67) of poverty line to come out of poverty.

Table 1. The Rural Farm Households' Poverty Profile

Poverty indicators	Values
Mean monthly expenditure (N)	33,033.33
Poverty line (N)	33,033.33
Poverty headcount index	0.58
Poverty gap index (Poverty depth)	0.15
Squared poverty index	0.17

Source: Own calculation.

Effect of Local Level Institutions' Microcredit Delivery on the Rural Farm Households' Poverty Status

We check to make sure that the data to be analysed can actually be analysed using a binomial logistic regression before Analysing data using binomial logistic regression.

Therefore, let's take a look at some of these assumptions: #1. Dependent variable should be measured on dichotomous scale which we have the poverty status, #2. One or more independent variables can be either continuous or categorical variable, #3. There should be independence of observations and the dependent variable should have mutually exclusive and exhaustive categories, #4. There needs to be linear relationship between any continuous independent variables and the logit transformation of the dependent variable. These four assumptions were met: 1. Poverty status are measured dichotomy scale and nominal scale (poor=1 and non-poor=0), 2. Gender age etc. are continuous and categorical, 3. There is independence of observations and poverty status are mutually exclusive and exhaustive categories, 4. The Box-Tidwell (1962) procedure was used to test for linearity and since there was no significance interaction showing there is no problem [7].

A logistic regression was performed to ascertain the effects of microcredit, age, gender, what do you do with your produce, year spent in the institution, educational level, number of wives, family type, marital status, main occupation, household size and farm size on the likelihood of that farm households were poor. Table 2 showed that the logistic regression model was statistically significant, $X^2 = 42.604$, $p<0.005$.

Table 2. Logit Regression Result of Effect of Local Level Institutions' Microcredit Delivery on the Respondents Poverty Status.

Naglekerke R Square = 0.402 **Chi-square = 42.604 P-value = 0.001**				
Classification table				
Observed		Predicted		
		Poverty status		Percentage corrected
		Non poor	Poor	
Poverty status	Non poor	30	20	60.0
	Poor	14	56	80.0
Overall percentage				71.7
Variables in the Equation				
Variables	B	Wald	Sig.	Exp(B)
WDP		5.077	0.079	
WDP(1)	1.783	3.447	0.063	5.948
WDP(2)	1.241	4.337	0.037	3.459
Year Spent	-0.098	0.105	0.745	0.907
Education level	-0.296	0.819	0.366	0.744
Number of wives	-0.549	0.790	0.374	0.577
Family type		0.959	0.619	
Family type(1)	-38.902	0.000	0.998	0.000
Family type(2)	-39.577	0.000	0.998	0.000
Marital status		4.494	0.213	
Marital status(1)	-22.887	0.000	0.998	0.000
Marital status(2)	-1.996	1.961	0.161	0.136
Marital status(3)	-3.432	4.322	0.038	0.032
Gender(1)	.568	0.255	0.614	1.765
Age	-0.028	0.736	0.391	0.972
Main occupation		3.826	0.148	
Main occupation(1)	-38.144	0.000	0.998	0.000
Main occupation(2)	-39.392	0.000	0.998	0.000
Farm size	0.454	1.604	0.205	1.574
Household size	-0.030	0.179	0.672	0.971
Microcredit	0.000	1.247	0.264	1.000
Constant	81.009	0.000	0.998	1.519E35

Source: Own calculation.

The model explained 40.2% (Nagelkerke R^2) of the variation in the poverty status of the farm household and had 71.7% as Percentage Accuracy in Classification (PAC) which correctly showed that the model is good. The Wald test was used to determine statistical significance of each of the independent variables. The statistical significance of the test is found in the "Sig." column which the p-value. It revealed that microcredit (P=0.264), what you do with the produce (P=0.079), educational level (0.366), number of wives (P=0.374), marital status (P=0.213), age (0.391), main occupation (P=0.264), farm size

(P=0.205), added significantly to the model/prediction but family type (P=0.619), gender (P=0.614), and household size (P=0.672) did not add significantly to the model at cut value 0.5. "Exp(B)" column in the table 4 showed the chances to be poor is 1.765 times greater for males headed households as opposed to females, 0.136 times greater for widows as opposed to single and 0.032 times greater for widowers as opposed to single.

The Income Inequality Among the Rural Farm Households.

The Lorenz curve for income among the respondents is shown in figure 2 as calculated from table 5. The Gini coefficient of 0.207174 as calculated from the Lorenz curve showed that income distribution and inequality among is a typical distribution. These results showed that income inequality among the respondents is not high as the LLIs give platform for Adashe and other forms of loan facilities.

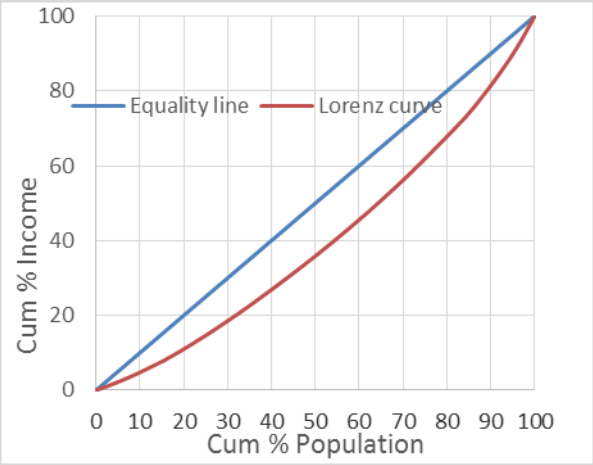

Fig. 2. The Lorenz curve of income, Girei and Yola South LGAs' LLIs' members.

Source: Own calculation.

Table 5. Income distribution for plotting Lorenz curve

Cum % Pop	Cum % Income
0.00	0.00
20.00	10.99
40.00	26.88
60.00	45.58
80.00	67.80
100.00	100.00

Source: Own calculation

CONCLUSIONS

The study showed that 58% of the rural farm household head respondents were poor and require N4,955.00K to come out of poverty. This is because their per capita consumption is below the poverty line and income inequality among them is typical. Moreover, the Lorenz curve and Gini index of 0.207174 showed that the income distribution and income inequality among the respondents are typical not high.

However, the squared poverty index of 0.17 which measures the severity of the poverty, and took into account of the income distribution and inequalities between the poor and the rich it revealed that the poor rural farm households per person in relation to the population only required 17% (N5,615.67) of poverty line to come out of poverty. Unlike strong income disparity discovered in Nigeria as a country. [6]

Also, the microcredit delivered to members is positive and significantly predict the poverty status of the rural farm households. The findings of the study therefore recommend the need for the government to formulate policies targeting at improving the welfare of the poor, source of livelihood and improve the lot of low-paid workers by integrating LLIs into the current poverty alleviation programme of the government and make channels for loan delivery so as to achieve the sustainable development goals of eradicating extreme poverty.

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LOCAL LEVEL INSTITUTIONS AND SOCIO-ECONOMIC ACTIVITIES OF THE RURAL FARM HOUSEHOLDS IN GIREI AND YOLA SOUTH LOCAL GOVERNMENT AREAS OF ADAMAWA STATE NIGERIA

Udegbunam Edwin CHINONSO, Onu Inyanda JUSTICE

Modibbo Adama University of Technology, Department of Agricultural Economics and Extension, P.M.B. 2076, Yola, Nigeria, Phone; +2348037858314, +2348036050936, edwinudegbunam@gmail.com, justiceonu@yahoo.co.uk

***Corresponding author**:* edwinudegbunam@gmail.com

Abstract

The study of local level institutions (LLIs) and socio-economic activities of the rural farm households in Girei and Yola South Local Government Areas of Adamawa state, Nigeria. Multistage random sampling was used in selecting one hundred and twenty (120) rural farm households' member of the local level institution and data were collected through questionnaire administration. The data were analysed using descriptive statistics to determine socio-economic characteristics and effect of microcredit to the rural community while analytical statistics like multiple regression was used the analyse the effect LLIs microcredit facilities delivery on the socio-economic activities of the rural farm households. The study revealed that the mean monthly cash contribution (Adashe) to the institution by the members was N8,216.67 and mean annul cash (Adashe) disbursement to the members by the institution was N91,000.00. Government and LLIs jointly put the basic amenities in some communities while they jointly sustain them in all the communities. The multiple regression model showed that LLIs' microcredit delivery had positive coefficients and greater than zero as expected but fall to predict the socio-economic activities of the rural farm households. Therefore, the study recommended that government to formulate policies that will include the LLIs into the current food security programs and poverty alleviation programs and make it a channel for loan delivery. The policies will be targeted at improving the welfare of the rural farm households, their source of livelihood, a typical income inequality and gender inequality in agriculture.

Key words**:** *agriculture, LLIs, microcredit, gender inequality, rural, Nigeria*

INTRODUCTION

The Local Level Institutions (LLIs) also known as Informal Financial Institutions (IFIs) had several definitions by researchers. Local Level Institutions are those institutions that embrace all financial transactions that takes place beyond the functional scope of various countries and other financial sector regulation [7]. These institutions are not controlled directly through major monetary and financial policy instruments but are created by individuals and groups with no legal status. Local level institutions can be referring to be institutions that are not directly amendable to control by key monetary and financial policy instruments [8]. The traditional/local institutions and groups are social and economic. Some serve both social and economic purposes in livelihood of their members. The social groups help in creating social capital, institutional identity, and relationships within, members' attitudes and values that govern interactions among them as a people. These contribute to economic and social development of the communities [10]. These communities have cooperative groups, religious groups, mutual associations groups, Age grade groups, social and friends' club and Fadama groups. The economic groups concern themselves with their mutual interest that revolve around solving problems of primary production and marketing of whatever is their products and services. Evidence is showing that local institutions can have an impact on developmental outcomes – growth, equity, and poverty alleviation. Social capital as reflected in associational activity may lead to less imperfect information and hence lower transactions costs and a greater range of market transactions which can in turn lead to better outcomes [12].

Moreover, individuals do not affiliate without expectations of some social, psychological or material rewards and the relatively high income status of the rural farm households has implication for households' welfare, expenditures as well as their cash contribution to their associations [6]. Informal Financial Institutions effect on socio-economic development with reference to Rotational Savings Credit Association (ROSCA) improves the economic condition of subsistence rural farmers through easy availability of finance for adequate storage facilities to protect their farm products from seasonal price dangle [15]. This enables the farmers to store their product until the prices are reasonable enabling farmers to reap the reward of high profits.

The broad of object of the study is the analyze the local level institutions' microcredit delivery effect on socio-economic activities of the rural farm households. The specific objects are;

i. Describe the socio-economic characteristics of the rural farm households in Yola south and Girei local government area.

ii. Describe the effect of local level institutions' microcredit delivery in rural community.

iii. Analyse the local level institutions' microcredit effect on the socio-economic activities of the rural farm households.

MATERIALS AND METHODS

The study was conducted in Yola South and Girei Local Government Areas of Adamawa State, Nigeria. Girei Local Government Area lies between Longitude 11º14' E and Latitude 7º11' N and Yola South Local Government Area lies between longitude 12º28'E and latitude 9º14'N of the Equator and of the GMT [2]. The study area falls within the Northern Guinea Savannah Zone with land mass of 2,420.05km2 and a population of 512,849 [13]. The rain season commences in April and ends in late October, while the dry season starts in November and ends in April. The mean annual rainfall of the area is about 1000mm [2]. The study area is generally suitable for agriculture due to the type of climate, landforms, and soil types it exhibits.

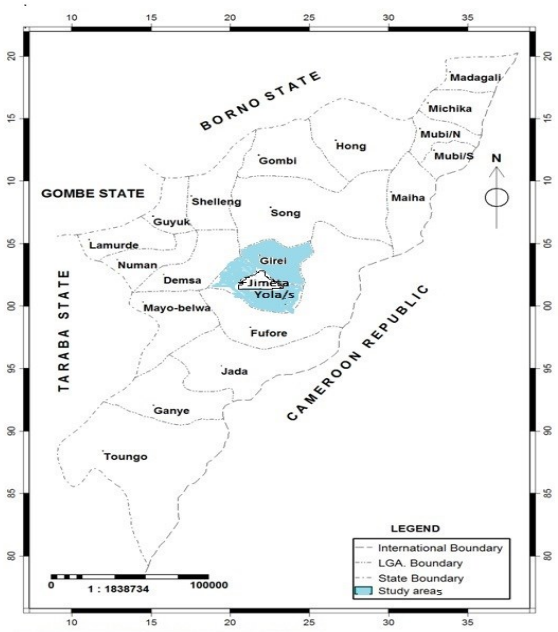

Fig. 1. Map of Adamawa Showing the Study Areas
Source: Own determination.

This study adopted multistage random sampling technique to select the wards, local level institutions and farm households. List of registered local level institutions was collected from the local government secretariat. In the first stage, twelve (12) wards were randomly selected from the two local government areas. This was used as the sampling frame. The second stage was the random selection of two (2) local level institutions from each of the wards. This gives twenty-four (24) local level institutions. The last stage was the random selection of five (5) farm households' beneficiaries of local institutions' microcredit delivery in each of the selected local level institutions. This gives a total of one hundred and twenty (120) respondents to be sampled. Primary data was collected with the aid of questionnaire.

Descriptive statistics such as: percentages, mean, table, frequency were used to describe the socio-economic characteristics of the rural farm-household, analyse of the effect of microcredit in the rural community and multiple regression used to analyse the effect of LLIs microcredit delivery on the socio-economic activities of the rural farm households in the study area. Following Zaman (1999) [15] and Ijaiya (2011) [11]

with some modification, the model for the analysis is stated as:

$$SEAsi = f(FLLIsi, VHCsi) \quad \ldots\ldots\ldots\ldots\ldots \, ..1$$

where:

$SEAsi$ = socio-economic activities proxy by the income generated by individual respondent from all socio-economic activities (farm and non-farm)

$FLLIsi$ = facilities provided by LLIs

$VHCsi$ = vector of household characteristic of individual respondent.

Also,

$$FLLIsi = \begin{pmatrix} FAOFi, FPTFi, FBHFi, FEDFi, \\ HBFi, BFi, PTFi, IFi, FAFi \end{pmatrix} .2$$

$$VHCsi = (GDRi, EDUi, OCCi, HHSi) \ldots\ldots\ldots 3$$

Substituting equation (2) and equation (3) into equation (1) gives a multivariate relationship equation:

$$SEAsi = f\begin{pmatrix} FAOFi, FPTFi, FBHFi, FEDFi, \\ HBFi, BFi, PTFi, IFi, FAFi, \\ GDRi,, EDUi, OCCi, HHSi \end{pmatrix}$$

$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$

The final step is estimating the equation using ordinary least square (OLS) as follows:

$$SEAsi = \beta_0 + \beta_1 FAOFi + \beta_2 FPTFi + \beta_3 FBHFi + \beta_4 FEDFi + \beta_5 HBFi + \beta_6 BFi + \beta_7 PTFi + \beta_8 IFi + \beta_9 FAFi + \beta_{10} GDRi + \beta_{11} EDUi + \beta_{12} OCCi + \beta_{13} HHSi + \varepsilon_i \ldots\ldots\ldots 5$$

where:

$FAOFi$ = Farm activities only microcredit facilities based on monthly contribution (adashe) and choice of the respondent.

$FPTFi$ = Farm activities and petty trade microcredit facilities based on monthly contribution (adashe) and choice of the respondent.

$FBHFi$ = Farm activities and built a house microcredit facilities based on monthly contribution (adashe) and choice of the respondent.

$FEDFi$ = Farm activities and education microcredit based on monthly contribution (adashe) and choice of the respondent.

$HBFi$ = Health bill loan facilities based on the respondent's request and LLIs' capacity.

BFi = Burial ceremony loan facilities based on respondent's request and LLIs' capacity.

$PTFi$ = Petty trade loan facilities based on respondent's request and LLIs' capacity.

IFi = Investment loan facilities based on respondent's request and LLIs' capacity.

$FAFi$ = Farm activities loan facilities based on respondent's request and LLIs' capacity.

$GDRi$ = Gender (F=0, M=1)

$EDUi$ = Educational background (No formal education = 0; primary education = 1; secondary education = 2; tertiary education = 3)

$OCCi$ = Occupation (Primary occupation: farm=0; civil servant=1; student=2; petty trade=3 and secondary occupation: farm=0; civil servant=1; student=2; petty trade=3)

$HHSi$ = Household size.

β_0 - β_{13} = coefficients

ε_i = Error term

The a-prior expectations or the expected behaviour of the independent variables (FAOFi, FPTFi, FBHFi, FEDFi, HBFi, BFi, PTFi, IFi, FAFi, GDRi, EDUi, OCCi, HHSi) on the dependent variable (SEAsi) in the model are FAOFi > 0:, FPTFi > 0:, FBHFi > 0:, FEDFi > 0:, HBFi > 0:, BFi > 0:, PTFi > 0:, IFi > 0:, FAFi > 0:, GDRi > or < 0:, EDUi > 0:, OCCi > 0:, HHSi > 0:, as an indication that the more the values of the socio-economic activities in the study area.

RESULTS AND DISCUSSIONS

The socio-economic characteristics of the respondents as shown in Table 1 showed that a total 75 respondents (62.5%) of the rural household heads in the study area were males while 35 respondents (37.5%) were females. This shows that male headed farm households were more interested in membership of local level institutions and have the ability to form social capital than female headed households. This result agreed with the findings that women headed households tend to have significantly lower membership and levels of overall civic participation in social networks than males [9][6]. Male dominance in farming activities may be due to the drudgery nature of agriculture [3]. The age of farm households head ranged from 20 to 61 years with a mean age of 41years. Table 1 showed that 79.2% of the farm households head were aged between 20 to 50 years. This means that most of the respondents were in their productive years which should have a positive impact on the

level of output. These findings, may be of some importance with respect to the membership, civic participation and delivery of microcredits to members. The result reveals that younger ages that is less than 31years (18.3%) who are the youth population is low. A mean age of 44years [1] and a mean age of 41 years [6] had been observed and it revealed that young small holder farmers were not many rural areas due to migration of young enterprising youths to the urban areas in search of with collar jobs and better social lives.

The result showed that 97 respondents (80.8%) of farm households head are married, 9 respondents (7.5%) farm households head are single and never married before, 8 respondents (6.7%) are widow and widower while 6 respondents (5.0%) are divorced. It was revealed that 94.58% of the beneficiaries are literate and this may have positive effect on the availability of family labour which may lead to increase in their level of production which can translate to higher income for the rural farmers [1]. The household size ranges from 1-25 with mean household size of 9. The household size ranging from 5-10 with 62 respondents (62.5%) was the highest. The household sizes are typical of most rural framing communities in Nigeria where household labour is the most dependable source of farm labour [14].

The table showed that mean number of years spent in local level institutions by the sample households was 3 years with ≥2 years (60.8%) the most frequent year. This indicates a relatively low membership experience in social networks in the study area. It has been reported that higher social capital benefits accrue to individuals with a relatively longer period of local organization affiliation [5]. It was noticed that individuals do not become a member without social, psychological and material rewards. The mean monthly income of the farm households in local level institutions was ₦42941.67. The relatively low income status of the farm households with 56 households (46.6%) having income range of ₦21,000-30,000 has implication for households' agricultural activity, welfare, expenditures as well as their cash contribution to their local institutions. The mean monthly expenditure of the farm households in the local level institutions was ₦30,033.33.

The result showed that 108 (90%) members of the local level institutions were literate possessing divers formal educational levels ranged from primary school education to tertiary school education. This revealed that educated farm households will generally appreciate the membership of local level institutions in order to receive and evaluate information for business improvement and productivity [4].

Table 1. Socio-Economic Characteristics of the Rural Farm Households

S/N	Socio-economic characteristics	Frequency	Percentage (%)
1	Gender of household head		
	Female	45	37.5
	Male	75	62.5
2	Age (years)		
	≤ 20	1	0.8
	21 – 30	21	17.5
	31 -40	34	28.4
	41 – 50	40	33.3
	51 – 60	20	16.7
	≥ 61	4	3.3
3	Marital status		
	Single never married	9	7.5
	Married	97	80.8
	Widow/widower	8	6.7
	Divorced	6	5.0
4	Household size		
	1 – 5	27	11.7
	6 – 10	62	62.5
	11 – 15	16	13.3
	16 – 20	9	7.5
	21 – 25	5	4.2
	≥ 26	1	0.8
5	Number of years spent in local level institution		
	≥2	61	50.8
	3	26	21.7
	4	33	27.5
6	Monthly income (₦)		
	≤ 20000	8	6.7
	21000 – 40000	56	46.6
	41000 – 60000	40	33.4
	61000 – 80000	12	10.1
	81000 – 100000	2	1.6
	≥ 101000	2	1.6
7	Educational level		
	No formal education	12	10.0
	Primary education	32	26.7
	Secondary education	31	25.8
	Tertiary education	45	37.5
8	Main occupation		
	Farmer	81	67.5
	Civil servant	31	25.8
	Student	8	6.7
	Petty trade	0	0
9	Secondary occupation		
	Farmer	39	34.82
	Petty trader	73	65.18

Source: Own calculation.

Majority of the respondents were farmers by profession (67.5%) while 31 (25.8%) were civil servants and 8 (6.7%) were students. Thirty-four respondents (34.82%) have

farming as their secondary occupation while 73 of the respondents (65.18%) have petty trading as their secondary occupation.

The result of the effect of local level institutions' microcredit delivery in the rural community is presented in table 2, 3,4,5 and 6. The monthly contribution (Adashe) was used as microcredit for farming activity, petty trade, education, built a house etc. While the mandatory membership dues are used for general running of the association and loaned to members who showed interest in loan. These contributions include payment of membership dues, marriage levies, health bill, burial levies, community project/ development levies, and so on.

The result showed that the monthly contribution (Adashe) ranged from N5,000 to N20,000 had mean contribution of N8,216.67 apart from mandatory monthly membership dues. The result showed the greater portion 70 (58.3%) of the members contributed poorly cash amount of ≤N5000 while 57 (47.5%) of the members received from N41,000 to N80,000.

Table 2. Monthly cash (Adashe) contribution of the respondents

Monthly Cash Contribution (₦)	Frequency	Percentage
≤5,000	70	58.3
5,100-10,000	25	20.9
10,100-15,000	11	9.1
15,100-20,000	14	11.7

Source: Own calculation.

Table 3 result showed that the annual contribution (Adashe) ranged from ₦40,000 to ₦200,000 and had mean contribution of ₦91,1004.

Table 3. Annual cash (Adashe) contribution of the respondents

Annual Cash Contribution (₦)	Frequency	Percentage
≤40,000	14	11.7
41,000-80,000	57	47.5
81,000-120,000	25	20.8
121,000-160,000	3	2.5
161,000-200,000	21	17.5

Source: Own calculation.

The result showed the greater portion 57 (47.5%) of the respondents received ₦ 41,000-₦80,000 cash contribution excluding loan received by interested members.

LLIs gave loan to members as shown in Table 4. The mean loan disbursement is ₦3666.7 and only 28 respondents received loan based on interest and LLIs' financial capacity. The biggest loan amount disbursed to members by the associations was from ₦5,100 to ₦10,000.

Table 4. Loan disbursement by Local Level Institutions

Loan Disbursed (₦)	Frequency	Percentage
≤5,000	4	14.3
5,100-10,000	13	46.4
10,100-15,000	5	17.9
15,100-20,000	4	14.3
≥20,100	2	7.1

Source: Own calculation.

Table 5 revealed that local level institutions' microcredit delivered to respondents were used in the rural community; 40 (33.3%) was used for farm activity only, 40(33.3%) was used for farming and petty trade, 22(18.3%) was used for farming and building of house while 18(15%) was used for farming and education. Basic amenities in the community were mainly built by government only (66.7%) while 33.3% were jointly built by government and local level institutions. The sustenance and maintenance of these basic amenities are done by both government and the local level institutions.

Table 5. Uses of the microcredit by the respondents

Activity	Frequency	Percentage
Farm only	40	33.3
Farm and Petty trade	40	33.3
Farm and Built a house	22	18.3
Farm and Education	18	15
Built basic amenities	40	33.3
Maintaining basic amenities	120	100

Source: Own calculation.

Table 6 showed that the loan given to members were used for several purposes with greater percent (46.4%) used for burial and 32.1% used for health bill.

Table 6. Uses of the loan disbursed by LLIs

Activity	Frequency	Percentage
Health bill	9	32.1
Burial	13	46.4
Petty trade	1	3.6
Investment	1	3.6
Farm	4	14.3

Source: Own calculation.

Petty trade and investment took 1(3.6%) of the loan respectively and 4(14.3%) of the loan was used for farming activity.

Table 7 showed that 38 (28.30%) numbers of the respondents consumed all their produce, 68 (56.70%) consumed more-than 50% of their produce and 18 (15.0%) sold more-than 50% of their produce while none sold all. The quantity of the produce consumed are mainly used as: (i). production on a farm, (ii). Utilization such as seed purpose, home consumption, gift to friends and relatives and kind wages to labour and (iii). Losses due to spoilage.

Table 7. What the respondents do with their produce

WDP	Frequency	Percentage
Sold all	0.00	0.00
Consumed all	34.00	28.30
More-than 50% consumed	68.00	56.70
More-than 50% sold	18.00	15.00

Source: Own calculation.

The linear multiple regression in Table 8 with R^2 0.151 is very poor. This showed that 15.1% variation in the dependent variable (socio-economic activities proxied by the income generated by individual respondent) is explained by the explanatory variables (effect Local Level Institutions microcredit delivery) and the vectors of the rural farm households' characteristics of Girei and Yola south local government areas of Adamawa State, Nigeria. The significant level of 5% gives calculated F-stat of 1.45 which less-than the tabulated F-stat. This implies that the explanatory variables do not have significant influence on the dependent variable (i.e. economic activities). Holding the vectors of household characteristics constant, the co-efficient and the associated t-values of the components of the effect of the LLIs' microcredit used in the study indicates that the amount used as credit facilities for farm activities only, farm activities and petty trade and farm activities and built a house, farm activities and education, and loan given for petty trade have the expected signs with coefficients greater than zero with respect to aprior expectations. Statistically, only the credit used for farm activities and petty trade, farm activities and built a house and loan given for burial are statistically significant to the socio-economic activities of the rural farm households at 5% level of significant. transaction purposes, funds provided for housing and for combating diseases have the expected signs.

Table 8. Linear multiple regression of LLIs and economics activities of the rural farm households

Exp. variable	Coefficient	t-value	Sig	F-stat	R^2
Constant	25807.758	4.751	0.000	1.451	0.151
FAOFi	0.059	1.217	0.226		
FPTFi	0.086	1.923	0.057		
FBHFi	0.088	2.801	0.006		
FEDFi	0.063	1.251	0.214		
HBFi	-.473	-0.670	0.505		
Bfi	-.652	-2.227	0.028		
PTFi	0.061	0.076	0.940		
Ifi	-0.215	-0.657	0.512		
FAF	-0.493	-0.948	0.345		
GDRi	-2040.938	-0.559	0.577		
EDUi	3038.706	1.471	0.144		
OCCi	527.449	0.182	0.856		

Source: Own calculation.

The model above falls to be predicted by the independent variables so we decided to transform the variables hoping that bringing assumed linear relationship will predict the model well. The multiple regression models in Table 9, Table 10 and Table 11 fall to show that the variation in the dependent variable (socio-economic activities proxied by the income generated by individuals' respondent) is explained by the explanatory variables (effect Local Level Institutions microcredit delivery) and the vectors of the rural farm households' characteristics of Girei and Yola south local government areas of Adamawa State, Nigeria.

Although, an analysis of the effect LLIs' microcredit delivery on the level of output of the rural farm households had been to be positive and statistical significant in the level of output. The rural farm households have farming as the major source of livelihood, when the greater percent of the farm produce (marketable surplus) are been consumed while lesser percentage of the produce are sold (marketed surplus) it affects the income they generate.

However, some of these crops are regarded as commercial crops (marketed surplus) e.g.

groundnut, soy beans, sorghum etc. table 7 gives more reason the LLIs' microcredit facilities delivered to the rural farm households could not be explain the overall socio-economic activities proxied by income generated by individual respondent.

Table 9. Exponential multiple regression of LLIs and socio-economics activities of the rural farm households

Exp. variable	Coefficient	t-value	Sig	F-stat
Constant	10.231	80.464	0.000	1.203
FAOFi	1.470E-6	1.304	0.195	
FPTFi	1.960E-6	1.869	0.064	
FBHFi	1.866E-6	2.537	0.013	
FEDFi	1.521E-6	1.284	0.202	
HBFi	-9.788E-6	-0.592	0.555	
Bfi	-1.246E-5	-1.820	0.072	
PTFi	5.720E-6	0.301	0.764	
Ifi	-3.364E-6	-0.440	0.661	
FAF	-9.827E-6	-0.808	0.421	
GDRi	-0.004	-0.042	0.967	
EDUi	0.061	1.258	0.211	
OCCi	-0.014	-0.205	0.838	

Source: Own calculation.

Table 10. Semi-log multiple regression of LLIs and socio-economics activities of the rural farm households

Exp. variable	Coefficient	t-valve	Sig.	F-stat
(Constant)	3357.456	0.183	0.855	1.297
lnFAOFi1	1447.472	1.023	0.309	
lnFPTFi1	1485.988	1.064	0.290	
lnFBHFi1	2150.642	1.625	0.107	
lnFEDFi1	1516.530	1.080	0.282	
lnHBFi1	-529.364	-.755	0.452	
lnBfi1	-966.761	-1.840	.069	
lnPTFi1	-0.971	0.000	1.000	
lnIfi1	-895.896	-0.579	0.564	
lnFAF1	-708.386	-.801	0.425	
lnGDRi1	-1726.244	-0.326	0.745	
lnEDUi	4510.673	0.953	0.343	
lnOCCi1	3384.058	0.733	0.465	

Source: Own calculation

Table 11. Double-log multiple regression of LLI and socio-economics activities of the rural farm households

Exp. variable	Coeff.	t-value	Sig.	F-stat	R^2
(Constant)	9.625	22.487	0.000	1.129	0.122
lnFAOFi1	0.047	1.435	0.154		
lnFPTFi1	0.049	1.515	0.133		
lnFBHFi1	0.061	1.967	0.052		
lnFEDFi1	.050	1.542	0.126		
lnHBFi1	-0.012	-0.710	0.479		
lnBfi1	-0.017	-1.385	0.169		
lnPTFi1	0.011	0.275	0.784		
lnIfi1	-0.014	-0.392	0.696		
lnFAF1	-0.013	-0.632	0.529		
lnGDRi1	0.021	0.172	0.864		
lnEDUi	0.076	0.690	0.492		
lnOCCi1	0.041	0.382	0.703		

Source: Own calculation.

CONCLUSIONS

The 35 (37.5%) respondents were females. This shows that male headed farm households were more interested in membership of local level institutions and have the ability to form social capital than female headed households. Although women still find their way into several agricultural activities and LLIs showed that given every opportunity, lifting some restricted bans like religious bans that limits women in agriculture they can be of good help in food security and economy at large.

The farm produces were mainly consumed by the farmer instead of selling them to generate income as a sign of poverty among the rural farm households. This affected the result of the model of LLIs and socio-economics activities of the rural farm households. The reason for this result can be linked to the fact that majority of the rural farm households are too poor to make bigger cash contributions to the LLIs.

Therefore, the study recommended that government to formulate policies that will include the LLIs into the current food security programs and poverty alleviation programs and make it a channel for loan delivery. The implication of the policies will be targeted at improving the welfare of the rural farm households, their source of livelihood, income distribution (a typical income inequality) and gender inequality in agriculture.

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HOUSEHOLDS IN THE ROMANIAN RURAL AREA - THEORETICAL MODEL

Lorena CHIȚEA

Institute of Agricultural Economics, INCE, Romanian Academy, Calea 13 Septembrie no.13, District 5, Bucharest, Phone/Fax:021/3182411; E-mail: chitu_lorena@yahoo.com

Corresponding author: chitu_lorena@yahoo.com

Abstract

Romanian rural area is stimulated by the activities of rural households as the main demographic, social, economic and cultural resources holder. The households are able to dispose of these resources as they see, based on the the conditions generated by social-economic-cultural environment of the community to which they belong. For an overview of the socio-economic development level at national and regional level, composite indicators are useful, without omitting, thou, individual indicators. This territorial profile analysis can highlight the particularities of each area.

Key words**:** *rural household, theoretical analysis model, sustainable development region*

INTRODUCTION

The entity that is targeted in the present paper is the rural household, an important actor of the rural area, holding the majority of resources (human, natural, social and cultural).

The main characteristic of rural household is that it is not fully subject to the modern economic laws, being rather governed by a series of less measurable principles (traditions, habits, traditional cultural patterns, etc.), which protected it in the moments of crisis, but also slowed it down in the adoption of technological, informational, economic and social progress.

In the present paper, the rural household will be treated as an element of the rural space, while the rural space will be considered a system that operates on the basis of internal resources, but also with external influences.

Having in view the multidimensional character of the rural space, of rural development and its regional and county related specificities, a matrix of relevant indicators will be proposed to highlight the main characteristics of rural households.

At world, European and national level, we identified a series of studies that have the rural household as main actor, as well as new analysis and interpretation modalities of social and economic problems at rural household level.

The result of the socio-economic analysis model of rural household will be a composite indicator with data at regional and county level, which is useful both for researchers and for the decision-makers at local, county, regional or national level. The composite indicator supplies useful information for complex comparisons across regions, as well as punctual aspects regarding the demographic, social, economic and cultural criteria. In order to get a picture of the development level, at national, regional and county level, the aggregate indicators are increasingly used, even though the individual indicators are not neglected. [5]

The opinions that support the development of composite indicators are related to the easier identification of common trends, in accordance with a series of indicators, being useful for certain comparisons across countries [13], and in our case for the comparative evaluation of the socio-economic situation of rural households at county level.

The opinions contesting the utility of composite indicators are related to the possibility of transmitting erroneous messages, in the case when these indicators are wrongly constructed or wrongly interpreted [12].

MATERIALS AND METHODS

The starting point in the present paper is represented by the review of recent literature on the existing theoretical and applied models, evaluating the rural area in social and economic terms, which should represent the scientific basis for the development of a theoretical model enabling us to highlight the rural household place in the development of the Romanian rural area, in the light of the direct implications generated by the changes that have been produced in the Common Agricultural Policy and in the Rural Development strategies in recent years.

Having in view the multidimensional character of the rural area, of rural development and of its regional, county and local specificities, a set of relevant indicators was proposed to highlight the prevailing socio-economic characteristics of rural households.

The selected set of indicators for constructing the theoretic model for rural households assessment is based on the available statistic indicators that are relevant for the objective had in view. In selecting the indicators, we have to take into consideration that not all the indicators have the same informative capacity as regards the observed phenomenon.

Indicators are statistical variables that lie at the basis of data transformation into relevant information. In order to supply significant information, the indicators must be interpreted in the context of the theoretical framework and of its purpose.

The rural development indicators must be based on available published statistical data, periodically collected, which are valid for different areas. The indicators must have the capacity to capture the changes of the investigated phenomenon in time. To meet these requirements, the rural development indicators often imply a reassessment of the well-known concepts and of the set of data in the context of rural policy changes.

The development and operationalization of a set of indicators are based on 3 principles:

-Relevance of utilized indicators, which should pursue a clear, well-defined purpose;

-Reliability: the indicators must have a solid scientific base and take into consideration the theoretical bases of the model. The indicator must have an intuitive explanatory power addressing all the potential users and not only the experts in this field.

-Availability: the indicators must be based on available statistical data.

In the Romanian specialty literature there are a series of rural area socio-economic analysis methodologies under the form of composite indicators; out of these indicators, we shall next mention the most important ones that lay at the basis of the construction of the theoretical model for the present paper:

- Sustainable development index at county and regional level based on 4 development dimensions for which 19 indicators were taken into consideration – 5 economic, 8 social, 3 institutional and 3 environmental indicators – [8]. The methodology used for the establishment of the set of indicators belongs to the *United Nations Commission on Sustainable Development*.

- Aggregate indicator on the current economic and social development stage, at country level, compared to other European countries, which is based on the average country ranks for 12 indicators, out of which 6 economic indicators with sectoral, energy, financial, etc. representativity and 6 social indicators concerning food, health, education, etc. [5] The method used is quite questionable, as equal importances are assigned to indicators.

- Global index of the current level of economic and social development of the administrative-territorial units from Romania; this index resulted from the cumulation of 68 indicators grouped into the following categories: natural potential, demographic potential, economic potential, dwelling, socio-cultural infrastructure, technical infrastructure, each indicator having a different share according to its assigned importance, but the summed up share of indicators reaches 100% [16].

- The Rural development index is a synthetic index for the entire rural space, for which the state indicators have been taken into consideration (physical and geographic criteria, dwelling, equipment, social, ecological) as well as the resource indicators

(demographic and economic criteria) [11].
- Aggregate indicator necessary for estimating the development potential of a locality, based on 25 de indicators grouped into 4 analysis criteria related to endogenous potential, environment factors, human capital and technical infrastructure [2].
- Synthetic rural household development index, in which information was aggregated in relation to land cultivation, development of livestock sector and productivity [3];
- Commune development index (CDI - Dumitru Sandu);
- Local social development index (LSDI – Dumitru Sandu).

Both in the international and Romanian literature, all the aggregation methods feature a series of particularities in relation to the selection and aggregation of primary indicators, more or less accepted, which comply with a certain generally accepted staging.

A composite indicator on the socio-economic situation of the Romanian rural household, at regional level, is useful both for researchers and for the policy-makers at local, county, regional or national level. The composite indicator supply useful information for complex comparisons across regions, as well as punctual aspects on the demographic, social, economic and cultural criteria. When the analysis is performed on a regular basis, at certain time intervals, one indicator can indicate the tendency of change within each criterion, as well as in time.

In order to get a picture of the development level at national, regional and county level, the aggregate indicators are increasingly used, even though the individual indicators are not neglected either [5].

RESULTS AND DISCUSSIONS

Theoretic analysis model

"The rural households are complex living systems (social, economic and spiritual) integrated into a specific environment, i.e. the rural environment" [3]. The rural environment functions as an open system, with a wide range of interconnected structures.

The heterogeneity of the rural space, determined by its geographic position, natural and socio-economic potential, accessibility, infrastructure and cultural particularities, directly influence the socio-economic behaviour of rural households. The paper will take into consideration the most important characteristics in order to identify the behaviour particularities of households.

The assessment of the socio-economic development level, in general, can be seen from two perspectives, a positive one related to the development potential and a negative one that takes into consideration the needs and the problems that a certain zone is facing.

In the design of the theoretical analysis model of the socio-economic potential of rural areas, the following analysis criteria are taken into consideration: the natural and anthropic criterion, the demographic criterion and the economic criterion.

Natural and anthropic criterion

Romania is characterized by the proportionality of relief units, which is unique in Europe and quite rare in the world [15]: 28% plains (altitude below 300 m), 42% hills and plateaux (altitude 300-1000 m) and 30% mountains (altitude above 1000m).

The natural capital specific to the rural space is characterized by a certain agricultural landscape under permanent change, yet the intensity and direction of change is quite different, resulting in major discrepancies between the rural localities; thus large non-cultivated areas emerged, as well as deserted villages (isolated villages, with difficult access), as well as villages where the living standard and living conditions are close to those from towns (peri-urban localities or localities with easy access to these) [7].

The anthropic landscape of peri-urban localities has been subject to deep changes, which determined the emergence of new houses and/or the modernization of the older ones. Thus, investments have been made mainly in the modernization of dwellings, but no significant investments have been made in the endowment of agriculture with modern means, in the agro-processing business or in non-agricultural business [4].

It can be noticed in the first place that modernization has taken place at the level of

intermediate rural areas rather than at the level of predominantly rural areas.

Having in view these general observations, for the analysis of the natural and anthropic potential of the Romanian rural area and the nature of changes that were produced, as well as of the regional differences, we shall have in view a series of indicators, namely:

Table 1. Indicators of household land resources subcriterion, 2014

	Agric. area per capita	Arable area per capita	Forest area per capita
TOTAL	1.50	0.97	0.69
MACRO 1	1.70	0.76	0.97
North-West	1.61	0.79	0.79
Center	1.81	0.71	1.19
MACRO 2	1.30	0.94	0.52
North-East	0.99	0.64	0.57
South-East	1.82	1.43	0.44
MACRO 3	1.21	0.99	0.33
South	1.29	1.04	0.36
Buc-Ilfov	0.51	0.49	0.13
MACRO 4	1.97	1.26	1.06
South-West	1.60	1.11	0.77
West	2.55	1.49	1.51

Source: own calculations, NIS 2014, Tempo online

-Household land resources subcriterion – considering that land is one of the most important production factors, as well as the main asset of Romanian rural households, this plays a considerable role in rural development.

The information on land resources is useful in orienting the economic activities of the household. In the proposed model we shall include the following indicators: *average agricultural/arable area per person,* which is a relevant indicator in orienting the local development strategies of a certain rural area; *forest area per capita,* which is relevant by the multiple role of forests for the rural communities – this has not only an economic and social role, but also a social and environment protection role.

The macro-region with the highest agricultural potential, in terms of the land area per capita, is Macro-region 4, region West respectively, which ranks well compared to the national average in the case of per capita forest area as well. The differences at county level are much more obvious.

Household equipment subcriterion – this subcriterion is important for illustrating the living conditions on the rural households, the access to public utilities (running water, sewerage system, gas supply network) being important both for people's comfort, for attracting investors and for environment protection.

A series of indicators will be considered for this subcriterion:

(i)*Average living area per person* is an indicator that captures the qualitative aspect of living conditions. It is worth mentioning that in the case of this indicator, the share of small dwellings is lower compared to the urban area.

(ii)Indicators – *share of localities with drinking water supply network, share of localities with public sewerage network, share of localities with natural gas supply network* – are relevant for the assessment of rural people's home comfort as well as of the rural people's health security (ensuring minimum hygiene conditions), for carrying out economic activities (and thus the existence of these networks increases the opportunities to attract investors in the area), as well as from environment protection perspective.

In the Romanian rural area, even though there are such utilities in a locality, the households may not be connected to them, most often financial reasons being invoked (connection costs difficult to be paid by people, as well as high costs for the endowment of dwellings with bathrooms and toilets).

Even a brief general examination of the living conditions makes it possible to get a picture of the regional differences regarding the living conditions.

Macro-region 1 benefits from the highest access to utilities, surpassing Macro-region 3 where the Region Bucharest-Ilfov is located, yet the differences at county level are much more obvious.

Having in view the importance of natural and anthropic resources in the analysis of the rural area development potential, this criterion was assigned the aggregation share value of 25%.

Table 2. Indicators of household equipment criterion, 2014

	Living area/ person	Share of localities with drinking water supply network	Share of localities with public sewerage system	Share of localities with gas supply network
TOTAL	19.22	74.45	26.56	23.10
MACRO 1	19.45	81.97	35.26	39.87
North-West	19.90	86.85	32.01	27.54
Center	18.89	76.47	38.94	53.78
MACRO 2	17.84	73.64	25.78	12.43
North-East	16.99	63.24	27.27	13.24
South-East	19.27	88.45	23.66	11.27
MACRO 3	19.74	69.69	16.15	27.59
South	18.78	70.13	13.87	23.70
Buc-Ilfov	28.61	62.50	53.13	90.63
MACRO 4	20.92	70.97	26.27	14.37
South-West	20.26	61.76	19.61	11.76
West	21.93	84.34	35.94	18.15

Source: own calculations, NIS 2014, Tempo online

Demographic criterion

The study on the demographic situation of the rural household is very important in understanding the viability of rural areas; the most important problems that the rural areas are facing are the demographic ageing and depopulation of many rural areas. In order to avoid this process, a series of specific social and economic measures are needed based on an accurate diagnosis.

The demographic evolution in different rural areas is strongly heterogenous, in close connection with the social and economic conditions specific to each area; thus we have rural localities with positive evolutions of population, located in peri-urban or tourism areas, where an urban-rural migration flow exists. At the opposite pole, with a negative demographic evolution, we have the isolated rural localities at a far distance from the great urban centers. Thus, we can highlight that the rural population evolution is in close connection with the development level of the rural communities (infrastructure, public utilities, and distance from the important towns) [7].

The demographic analysis is a core element in the analysis of rural household viability, of rural space in particular. In relation to the demographic capital importance in the diagnosis of the rural area development potential, the demographic criterion was assigned the aggregation share value of 30%. For the analysis of the demographic capital of the rural households, we have in view a set of subcriteria, namely:

Demographic growth factors subcriterion, characterizing the demographic situation and the demographic resource potential.

For this subcriterion we used indicators that capture *the natural increase of rural population* (*birth rate, death rate),* which characterize the population's natural renewal capacity and the migration phenomenon *(internal and external migration flows),* which illustrates the degree of rural area attractiveness. These two indicators are essential in knowing the demographic evolution of any rural area.

Table 3. Indicators of demographic growth subcriterion, 2014

	Natural increase	Birth rate	Death rate
TOTAL	-46,289	9.2	14
MACRO 1	-5,692	10.4	12.8
North-West	-4,355	9.9	13.2
Center	-1,337	11	12.3
MACRO 2	-13,376	9.5	13.4
North-East	-6,360	9.9	12.8
South-East	-7,016	8.8	14.3
MACRO 3	-13,424	8.6	15
South	-13,276	8.4	15.4
Buc-Ilfov	-148	10.7	11.4
MACRO 4	-13,797	8	15.4
South-West	-10,201	7.6	16.8
West	-3,596	8.5	13.4

Source: own calculations, NIS 2014, Tempo online

From the demographic point of view, there is no evidence of a unitary picture of the rural areas, as demographic differentiations exist both at regional, county level and at the level of local community. The regions with the most favourable demographic profiles are North-East and Center, even though they are very different in terms of their determinants – the region North-East has predominantly rural population, while the region Center has predominantly urban population.

While in the 1990s the natural increase of rural population was positive, in the year 2011 it turned negative in all the regions. The region Bucharest-Ilfov ranks first in this

respect (-210 persons) and the region Center comes next, yet at great distance from the former.

Besides the low birth rate and the high death rate, migration is another important element in the demographic evolution of the rural area.

The external migration is quite difficult to measure, this phenomenon exceeding the official data. The main countries where the Romanian rural population leaves temporarily for work are Spain, Italy, Germany and Great Britain. The migratory population profile is the following: young people, with medium educational level (Sandu, 2006).

The internal migration flow, after 1990, was from rural to urban areas; after 2000, the flows became equal. Yet, the equalization of flows did not mean stopping the migration flow, but rather its redirecting under the form of external migration [14].

Population ageing* s*ubcriterion is another subcriterion that characterizes the demographic regeneration capacity/incapacity; for this purpose the following indicators will be used: *number of inhabitants* in the rural area, *population ageing index* (ratio of population aged 65 years or over to the population aged 0-14 years in 100 persons) reflecting the demographic ageing of a society with major implications from the social and economic point of view; *population renewal index* (ratio of population aged 55-64 years to the young population aged 15-24 years) reflects the demographic renewal capacity so as to ensure the carrying out of economic and social activities in the communities they belong to.

The average population ageing rate is 102.81%, denoting a demographically aged population. The highest ageing rates are found in Macroregions 4 and 3.

The rural population renewal rate reflects the demographic renewal capacity to ensure the development of economic and social activities in the respective communities.

In rural Romania, it can be noticed that in 100 persons of working age (55-64 years), only 78 persons will be replaced by persons aged 15-24 years, thus creating a population deficit of 22 persons. The values of this indicator range from 63.90% in the county Vaslui to 136.87% in the county Hunedoara [6].

Demographic structure of rural household* s*ubcriterion – characterizes the household demographic viability, as well as the capacity of rural household to carry out production activities. The following indicators are used: *average number of persons on the household*; *share of households with only one person.*

Table 4. Indicators of subcriterion population ageing, 2014

	Rural population	Ageing rate	Population renewal rate
TOTAL	9,723,620	106.88	86.23
MACRO 1	2,345,876	94.72	87.99
North-West	1,295,103	99.99	87.40
Center	1,050,773	88.56	88.72
MACRO 2	3,433,046	92.70	75.99
North-East	2,152,573	85.80	69.00
South-East	1,280,473	105.93	88.96
MACRO 3	2,089,241	125.19	93.87
South	1,884,876	128.88	93.11
Buc-Ilfov	204,365	92.48	101.39
MACRO 4	1,855,457	136.21	96.29
South-West	1,123,960	150.79	91.82
West	731,497	114.92	103.28

Source: own calculations, NIS 2014, Tempo online

Table 5. Indicators of subcriterion demographic structure of rural household, 2011

	Average number of persons per household	Share of households with only one person
TOTAL	2.83	25.43
MACRO 1	2.87	23.85
North-West	2.88	24.03
Center	2.86	23.63
MACRO 2	2.80	25.88
North-East	2.80	26.02
South-East	2.79	25.65
MACRO 3	2.87	25.12
South	2.84	25.60
Buc-Ilfov	3.09	20.60
MACRO 4	2.80	26.88
South-West	2.71	28.38
West	2.95	24.24

Source: own calculations, NIS 2011, Tempo online

The average size of household is 2.83 persons/household, ranging from 2.58 persons/household in the counties Vâlcea and Mehedinţi to 3.10 persons/household in the counties Constanţa and Ilfov. It can be noticed that the situation across macro-regions is quite balanced in the case of this indicator. At

regional level, the regions Bucharest-Ilfov and West are on the first positions.

The differences between counties are even greater in the case of the indicator Share of households with only one person, which ranges from 19.66% in the county Constanţa to 31.93% in the counties Mehedinţi and Teleorman.

The social criterion has in view the services for the population related to the education and healthcare system. A healthy and educated population is an essential condition for the development of rural areas. The following subcriteria were taken into consideration:

- education: ensuring a quality education will have a direct impact upon the future labour force quality. The indicators related to this subcriterion -*average number of pupils per teacher*, *share of higher education graduates in total population aged 25-35 years, abandon rate in tertiary education* - reflect population's access to education, yet they capture only the quantitative aspect. Education represents a key element in rural development, in preventing social exclusion. A low educational level of the population from the rural households generates a low level of their incomes, limiting the development possibilities.

- healthcare: the populations's health status has a direct quality upon the quality of people's life, with important implications upon labour force quality as well. A healthy population represents a healthy labour force, which actively contributes to rural area development. The indicator had in view is *average number of inhabitants per family physician/dentist.* In most communes, only primary healthcare services are provided, while for the specialized services the rural residents rely on urban healthcare facilities.

Considering the importance of rural population education and health in the rural area diagnosis and development potential, the social criterion will be assigned an aggregation share value of 25%.

Economic criterion

Agriculture is the main economic activity in the Romanian rural area, while the non-agricultural economy (industry, services, tourism, etc.) has a low share. The farming activities are of subsistence and semi-subsistence type, resulting in a much lower living standard for the rural people than that of urban people. This farming type practice became a defining characteristic for the Romanian rural area [1]. However, one cannot ignore the social function of subsistence and semi-subsistence agricultural holdings; thus, by this type of farming practice, the rural people can meet their own food needs in the situation of insufficient cash incomes. These holdings also had a social buffer role in the periods of crisis [15].

The Romanian rural economy functions in a vicious circle, as the lack of money has resulted in the absence of alternative non-agricultural activities and a non-performant agriculture, which in their turn have led to insufficient incomes for competitive activities. A functional rural economy generates people's welfare in the rural area, which represents a main attractivity for the young population, which that may represent the driving engine of a competitive and performant economy.

Having in view the importance of the economic framework, the diagnosis analysis of the rural area development potential, the economic criterion has been assigned the aggregation share value of 25%. For the characterization of the economic activities to which the rural residents have access, the following subcriteria will be taken into consideration:

***- Size of economic activities* subcriterion,** providing quantitative information on the labour resources in the rural area; the following indicators will be used for this purpose: *rural population employment rate* (as ratio of employed population to total population 15-65 years) is an important indicator, as the employed population is a demographic factor that has a dual status in the rural diversification process: on one hand it is a restrictive factor by the high share of agricultural employment, and on the other hand there are favourable availabilities for the rural economic diversification process; the *labour force renewal index* (representing the ratio of young population 25-29 years to the population in the age group 15-24 years) is

relevant for the diagnosis on whether the current labour input is sufficient or not sufficient for the economic and occupation multiplication. The lower the values of this indicator, the lower is the diversification capacity of a rural area using the existing labour force.

- ***Size of agricultural activities* s*ubcriterion*** – the following indicator will be used: *share of population employed in agriculture* (as ratio of the population employed in agriculture to total employed population) is a relevant indicator for illustrating the agricultural employment issue. The high values of this indicator place Romania on the top position in the EU.

- ***Size of non-agricultural activities* s*ubcriterion*** - can be measured by the indicator *share of non-agricultural employed population* (as ratio of non-agricultural employed population to total employed population). The revitalization opportunities of rural areas are not linked only to the agricultural development potential, but also to the diversification potential of non-agricultural activities.

Table 6. Economic criterion indicators, 2014

	Empl. rate	Agric. empl. rate	Non-agric. empl. rate	Labour renewal rate
TOTAL	61.57	58.6	41.4	57.41
MACRO 1	53.97	45.5	54.5	59.08
North-West	60.83	51.9	48.1	58.49
Center	45.54	34.9	65.1	59.81
MACRO 2	62.16	70.2	29.8	54.71
North-East	68.65	75.3	24.7	52.86
South-East	51.43	58.8	41.2	58.15
MACRO 3	65.04	45.7	54.3	60.82
South	65.50	49.5	50.5	59.10
Buc-Ilfov	61.15	10	90	77.84
MACRO 4	66.23	66.6	33.5	56.96
South-West	72.66	77.3	22.7	53.71
West	56.89	46.5	53.5	62.03

Source: Territorial Statistics, NIS 2016

Yet the non-agricultural activities presuppose higher qualification of labour force, entailing higher and more reliable incomes. At the same time, the development of non-agricultural sectors, mainly industry and services, creates positive premises for a competitive agriculture practice by increasing the yields and production quality.

Taking into consideration all these criteria and subcriteria, the indicators for each criterion and subcriterion will be calculated, and finally these will be centralized under the form of a composite indicator on the socio-economic situation of the Romanian rural household.

CONCLUSIONS

The selection of the most adequate analysis model or rural households, across regions, had in view the analysis of the main rural development directions that also have an implicit impact upon the rural households, as well as a documentary analysis on the theoretical methods of socio-economic analysis of the rural area, of the rural households respectively.

This theoretical model of socio-economic analysis of the Romanian rural attempts to provide the theoretical premises for the identification of development particularities, for the hierarchization and grouping of counties according to their socio-economic potential.

Starting from the systemic particularity of the rural area in which the household is an important player, being the majority owner of the main (natural, human and cultural) resources, the proposed criteria, subcriteria and related indicators for the socio-economic analysis of households correspond to the main socio-economic development directions of the rural area.

The proposed indicators were selected taking into account the relevance in the characterization of the socio-economic development potential of rural areas and the availability of indicators.

Having in view all the criteria, subcriteria and indicators related to the proposed model, the next stage of this process will consist in their centralization under the form of a composite indicator on the socio-economic situation of the Romanian rural household.

The shares assigned to each indicator are equal, the same as in the case of subcriteria and criteria, considering that all the investigated dimensions (natural,

demographic, social and economic) have a major importance in the socio-economic development of the rural area.

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EVALUATION OF MACRO REGIONAL COMPETITIVENESS IN ROMANIA. CASE STUDY: MACRO REGION 1

Mihai Alexandru CHIȚEA[1], Ion DONA[2]

[1]Institute of Agricultural Economics, 13, Calea 13 Septembrie, District 5, 050711, Bucharest, Romania, Phone: +40213182411, Fax: +40213182411, Mobile: +40723586650, Email: mihai_chitea@yahoo.com
[2]University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Mărăști, District 1, 11464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Email: ion_dona@yahoo.com

Corresponding author: mihai_chitea@yahoo.com

Abstract

The present paper approaches the evaluation of competitiveness at macro regional level, compared to national level, focusing on Macro-region 1. The methodology is based on a model for the evaluation of the competitiveness of rural areas developed in Croatia, which was adapted to national specificities referring to available statistical data and structure of relevant indices. The preliminary results highlight a macro-regional competitiveness level lower than the national average, due, mainly, to the results obtained by the agricultural and specialization and innovation sectors. The paper represents a follow up of previous researches in the field of territorial competitiveness's evaluation at county and regional level.

Key words**:** *macro regional competitiveness, evaluation models, Romania*

INTRODUCTION

Performance evaluation at different territorial aggregation levels (national, regional and local) represents at present, more than in any other period, a main objective of nations and of different international economic and scientific organizations. Numerous evaluation models, developed at international level, are based on elements of different economic theories elaborated throughout time, among which we can mention the classical and neoclassical theories, the theory of competitive advantage and of economic clusters. Starting from the national level, a series of models have been adapted for competitiveness assessment at lower aggregation levels, i.e. regional and local. While in the case of the regional level, the models have numerous similarities with those designed for the national level, for the local level the models were generally developed by scientists, for the evaluation of competitiveness of certain specific zones, being adapted from the point of view of the statistical information available at this level to the purpose of investigation.

The present paper approaches the macro regional competitiveness evaluation compared to the national level, starting from an evaluation model developed in Croatia in the year 2012, and represents a follow up of previous researches in the field of territorial competitiveness's evaluation at county and regional level, based on the above model.

In a broad sense, the specialty studies define the territorial competition as the actions undertaken by the economic operators in a certain area to ensure the increase of the living standard of the people from the respective territory [4]. Jaques Poot is among the supporters of this defining modality, who considers that the territorial competition process is manifested at different levels: at town, regional and national level.

At micro-economic level, at the level of firms respectively, there is a relative consensus on the competitiveness concept, based on the capacity of firms to compete, develop and be profitable. At this level, competitiveness results from the capacity of firms/companies to constantly and efficiently produce goods

and services that meet the standards of open market, in terms of price, quality, etc. The higher the competitiveness of a firm, compared to other competitors, the higher is its ability to get a larger market share [7].

On the other hand, at macro-economic level, the competitiveness concept is much less defined, generating numerous discussions and contradictory debates. Despite the fact that the increase of a nation's/region's competitiveness is often at the core of economic policies, there are numerous discussions on what this really means and even if it is correct to approach this topic at macro-economic level. One of those who strongly contest the national competitiveness concept is Paul Krugman, who dedicated a great part of his studies to spatial development. Frequently referring to the situation in the United States, Krugman argued that: "The concerns about competitiveness are, as an empirical matter, almost completely unfounded …The obsession with competitiveness is not only wrong, but also dangerous … thinking in terms of competitiveness leads, directly and indirectly, to bad economic policies on a wide range of issues" [6]. These arguments are well-known by the macro-economic competitiveness concept supporters. Within what we can call a "consensual glance", there is an ample recognition of the fact that the improvement of a nation's economic performances cannot take place to the detriment of others and that productivity represent a core element of competitiveness.

Despite the existing controversies at academic and economic level in relation to the competitiveness concept and its implications, there are a series of definitions illustrating the existence of common characteristics, considered as component elements of the "consensual glance:

-"The competitiveness of a nation represents the degree to which the respective nation can produce goods and services under free and fair market conditions, which meet the requirements of international markets, while contributing to the increase of real incomes for its citizens …". [12];

-"Competitiveness can be defined as the degree to which a nation can, under free market conditions, produce goods and services that meet the test of foreign competition, while simultaneously maintaining and expanding the real incomes of its people." [10];

-"Competitiveness is the ability of a country to obtain a high, sustainable rate of the Gross Domestic Product per capita" [13];

-"An economy is competitive if its population can enjoy high and increasing living standards and a high employment rate, in a sustainable manner. More exactly, the economic activity level should not generate a foreign balance that is non-sustainable for the economy, neither to compromise the welfare of future generations.."[11].

Martin suggests that we can distinguish, from the above-mentioned aspects, the following characteristic elements of competitiveness at macro-economic level: high economic performance generally judged in terms of high living standards or of real incomes; frees market conditions for the goods and services produced by the respective nation; short-term competitiveness should not generate disequilibria leading to unsustainable high performance [7].

Taking into consideration these definitions of competitiveness, as well as several other definitions, Porter argues that the final purpose of competitiveness is to maintain or increase the citizens' real incomes, which is generally reflected by the living standard, by an increasingly high competitive performance of firms and sectors [9]. From this perspective, Cojanu *et al.* consider that: "competitiveness as policy element is a means to reach a goal; its ultimate target is represented by the increase of the living standard of the nation under free market and fair competition conditions". [3].

Addressing the issue of regional competitiveness definition and measurement in Romania, Mihaela Nona Chilian and Marioara Iordan consider that in its broader sense: "competitiveness can be defined as the capacity of a country, measured by comparison with other countries, to create and ensure an economic, social and political environment supporting the accelerated

creation of value added"; another proposed definition is the following: "competitiveness is the capacity to obtain high productivity on the basis of the innovative use of human, financial and material resources". [1]
Also at this level, i.e. at macro-economic level, Adina Criste, Elena Ana Moşneanu and Alina Georgeta Glod consider that national competitiveness is the "capacity of a nation to create and maintain, through adequate policies, an adequate environment that supports production with high value added in its enterprises, in obtain or retain a dominant position on the international markets" [5].
There are certainly other valuable contributions as well, both at national and international level, with regard to macro-economic or national competitiveness, referring to the conceptual framework and evaluation methods.
In this context, we would like to highlight Valentin Cojanu's contributions to the conceptual framework of territorial competitiveness and spatial development, as well as of their evaluation. In his study "A discussion on competitive groups of countries within the European Area of Integration", the author addresses the issue of grouping the European states into competitiveness clusters, focusing on the European economic integration that differentiates the random effect of the process of regional clusters formation on the basis of geographical neighbourhood from the hypothetical effect of competitive development supported by the homogenous integration areas. The objective of the approach was to bring further evidence during the debates on the competitive development conditions in the regional context of the European integration area. [2]
Many of these theories regarding territorial competitiveness have formed, throughout the time, the basis for the development of evaluation models by international, European and national institutions as well as by researchers and other academic representatives. Some models where adapted, from the upper aggregation levels to lower ones, taking into consideration various specific factors playing an important role at these levels and also the objectives of the researches undertaken.
The present paper aims to evaluate the competitiveness at macro regional level, compared to the national one, starting from the previous researches at county and regional level.

MATERIALS AND METHODS

Building up on previous work, the present paper turns to an adapted evaluation model, which was used for evaluating competitiveness at county and regional level, for the current objective of evaluating the macro regional competitiveness, compared to the national level, in Romania, with focus on macro region 1.
The original model developed in Croatia in 2012, for constructing a rural competitiveness index based on the sustainable rural development concept, consisted of a set of 16 indicators grouped into four components: human resources, non-agricultural sector economy, agricultural sector economy and other activities of rural households [8]. An average of indicators from each component was obtained, resulting four rural competitiveness sub-indicators, which were individually analyzed.
The calculation formula of the rural competitiveness index (RCI) was:

$$Xi = 100 (xi / X) / (pi / P),$$

where:
xi – selected variable for the investigated area; X – selected variable at country level; pi – number of inhabitants in the investigated area; P – number of inhabitants nationwide.
Starting from the study described above, we intended to adapt the model to calculate: a macro regional rural competitiveness index to measure the competitiveness of Macro-region 1, compared to the national level.
The indicators from the Croatian model were not available in the official statistical data sources from Romania. Other available statistical data series were identified, compatible with the unavailable indicators in terms of statistical significance. Thus, the Croatian model was adapted in accordance

with the statistical data available in Romania and the regional rural competitiveness index comprised four components in which 16 indicators were used.

The first component – human resources – included the following indicators: employed population (data at the level of the year 2014), population with higher education (data from 2010), young population, aged 0-20 years and population density (data from 2014). The second component – non-agricultural sector economy – included the indicators: turnover and value of exports, expressed in thousand euros, density of local active units in 1,000 inhabitants and net average salary, expressed in euro (data from 2014). The third component – agricultural sector economy – included the indicators: average size of agricultural holding (data from 2013), turnover, value of exports, density of local active units in 1,000 inhabitants and net average salary (data from 2014). For the last component – specialization and innovation – the following indicators were selected: share of employed population in the non-agricultural sectors, employees in research-development-innovation in 1,000 civil employed persons and share of crop production in total agricultural production.

Thus, for the adapted model, at macro-regional level, most data were extracted for the year 2014. However, there were two indicators for which the latest available data were from the year 2010 for population with higher education and from the year 2013 for average farm size [16], [14].

The calculation formula for the Rural Competitiveness Index (RCI) was taken over from the Croatian model and adapted to calculate the macro-regional rural competitiveness index. Thus, the formula was

$$Xi = 100 (xi / X) / (pi / P),$$

where:

xi – selected variable for the macro-region; X – selected variable at country level; pi – number of inhabitants in the macro-region; P – number of inhabitants at country level.

Table 1. Adapted pattern for competitiveness assessment at macro-regional level

Variable – Original pattern Croatia	Variable – Adapted pattern
Human resources	
Employed population in the rural zone (pers)	Employed population, thousand persons
Population with higher education (pers)	Population with higher education (pers)
The young population in the rural zone (pers)	The young population (pers)
The population density - pers/sq km	The population density– pers/sq km
The situation of the non-agricultural sector's economy	
GVA(Euro)	Turn -over rate– thousands euros
Exports' value Euro)	Exports' value- thousand euros
Investments in long term goods (Euro)	Density of local active units no/1000inhab.
The net average wage (Euro)	The net average wage (Euro)
The situation of the agricultural sector's economy	
The farm's average size - ha/farm	The farm's average size– ha/farm
GVA (Euro)	The turn-over rate–thousand euros
The exports' value (Euro)	The exports' value– thousand euros
Investments in long term goods (Euros)	The density of the local active units
The net average wage (Euro)	The net average wage (Euro)
Other generating incomes activities at agricultural farms' level	**Specialization and innovation**
The share of touristic farms	The share of employed population in non-agricultural sectors
The share of krafts' cooperatives	The salary workers in CDI at 10000 civil occupied persons
The share of processing farms	% crop production in total value of the production in agricultural branch
The share of farms gaining from other incomes' generating activities	

Source: adaptation after the pattern elaborated by O. Mikuš, R. Franić și I. Grgić, 2012

Each indicator was assigned a specific weight equal to that of the other indicators within the group; for each group an intermediate value of index (SI) was calculated, using the arithmetic mean; the resulted values for each group of indicators (SI) were used for the calculation of the Rural Competitiveness Index (RCI) macro-regional level through the calculation of the arithmetic mean of the values SI; it was considered that all components are equally important, having the same weight in expressing competitiveness.

RESULTS AND DISCUSSIONS

Before proceeding to calculate the rural competitiveness index at macro-regional and

regional level, we shall briefly present the main characteristics Macro-region 1.

The macro-regions and the development regions represent territorial statistical units without legal status, corresponding to the NUTS 1 and NUTS 2 level respectively (Nomenclature of Territorial Units for Statistics) as divisions of the European Union member states. These were created for the purpose to collect statistical data and do not have any administrative status/role or own form of governance or administration.

Photo 1. Map of macro-regions in Romania
Source: www.ro.wikipedia.org

Macro-region 1 comprises, from the statistical point of view, the development regions Centre and North-West, with a total area of 68,259 km² – accounting for 28.6% of Romania's total area and a population of 4,941,815 inhabitants (2014) – accounting for 24.8% of Romania's population [15].

The development region North-West is located in the north-western part of Romania and covers an area of 34,159 km², representing 14.3% of the country's total area; it is the 4th largest region among the 8 development regions. The region borders Hungary in its western part, Ukraine in the north, and the regions Centre, West and North-East in the middle. As regards the relief, the region is located in an interference area of various relief units, benefiting from a special natural and landscape heritage – 28% mountains, 30% hills and 42% river plains [18].

In the year 2014, the region North-West had a total population of 2,588,488 people, accounting for 12.9% of Romania's total population and a population density of 75.7 pers./km², under the national average of 83.5 pers./km². The network of localities consisted of 43 towns (out of which 15 municipalities) and 1800 villages organized into 403 communes. The most important municipalities and towns, at the level of the region, are the following: Cluj Napoca, Baia Mare, Oradea, Zalău, Bistrița and Satu Mare.

From the economic point of view, the most important development poles are represented by the towns Cluj Napoca, Baia Mare, Oradea, Zalău, Bistrița and Satu Mare. The main sectors that contribute to regional economy are the tertiary sector (of services), represented by a well-developed tourism sector, which puts into value the particular natural and cultural heritage of the region (thermal springs, salt mines, mountain tourism sector, cultural and ethnographic heritage), the secondary sector (industry and constructions) – represented by constructions, textile industry, machinery and equipment industry) and the primary sector – based on a high agricultural potential, in livestock production in particular and on the presence of large food industry enterprises.

The second development region from Macro-region 1, the region Centre, is located in the central part of Romania, with an area of 34,100 km² – representing 14.3% of the country's total area, ranking 5th in size among the 8 development regions. Through its location in the central part of Romania, the region borders 6 out of the other 7 development regions. The relief of the region is dominated by the presence of the Carpathians (that cover about half of the region's area), the hilly area of Transylvania Plateau and the depression area connecting the hilly area to the mountain area, while the plains are almost lacking [17].

In the year 2014, the population of the region Centre totalled 2,353,327 persons, accounting for 11.8% of Romania's total population with a population density of 69 pers./km2, significantly lower than the national average of 83.5 persons/km2. The network of localities was represented by 57 towns (out of which 20 municipalities) and 1788 villages organized into 357 communes. The most

important municipalities and towns in the region are Brașov, Sibiu, Alba Iulia, Târgu Mureș, Sfântu Gheorghe and Miercurea Ciuc.

As regards the labour market, in terms of employed population, the tertiary sector (of services) prevails, with 43.4%, followed by the secondary sector (industry and constructions) with 34.1% and the primary sector (agriculture, forestry and fisheries – 22.5%.

From the economic point of view, the polarizing centres are represented by the large towns and peri-urban areas, which concentrate a large part of the economic activities. The main sectors that contribute to the regional economy are the secondary sector (industry and constructions) – the machine-building industry and metal working, chemical industry, construction materials, wood, textile and food industries, the tertiary sector (of services) – fostered by growth in fields like transports, financial-banking services, telecommunications, as well as (mountain, balneary, cultural, agro-tourism) tourism as well as the primary sector (agriculture, forestry and fisheries) – based on a significant and diversified natural potential [17].

Table 2. The rural competitiveness Index – the Macro-region 1 versus national level, year 2014

Variables	Macro-region 1 pi = 4,941,815	National level P=19,913,193	Indicator (X_i) of Macro-region1 competitiveness National=100
	p_1/P = 0.248167		
Human resources			
Employed Population (thousand persons.)[1]	2,212.8	8,431.7	105.75
Higher education population (no.pers.)[1]	617,500	2,591,021	96.03
The young population 0-20 y.o (no.pers.)[1]	1,109,679	4,393,393	101.78
The population density (no.pers./sq, km)[2]	72.4	83.5	86.71
The mean of indicators in the first component (sub-index 1)			**SI_1 =97.57**
The non-agricultural sector's indicator			
The turnover rate (thousand euro) [1]	56,264,320.65	277,958,974.9	81.57
The exports' value (thousand euro) [1]	13,027,771	47,877,695	109.65
The local active units' density /1,000 inhab.) [2]	26.45	25.29	104.59
The net average wage (euro) [2]	336.83	384.27	87.65
The mean of the indicators in the second component (sub-index 2)			**SI_2 = 95.86**
The agricultural sector's Economy			
The average size of the agricultural farm (ha/farm) [2]	4.1	3.66	112.02
The turn over rate (thousand euro) [1]	1,525,797.61	8,078,655.54	76.10
The exports' value (thousand euro) [1]	389,853	3,695,231	42.51
Local active units density (active units /1,000inhab.) [2]	0.91	0.89	102.25
The net average wage (euro) [2]	267.29	285.74	93.54
The mean of indicators in the third component (sub-index 3)			**SI_3 = 85.29**
Specialization and innovation			
% of the employed population in the non-agricultural sectors [2]	73.9	72.7	101.65
The salary workers employed in RDI per 1,000 civil employed persons [2]	33.3	51	65.29
% of crop production in total value of production of the agricultural branch [2]	61	65.83	92.66
The mean of indicators in the fourth component (sub-index 4)			**SI_4 = 86.54**
The competitiveness index –Macro-region 1			***RCI = 91.31***

Source: own calculations based on NIS data Note: [1] – variable calculated with the formula: X=100*(xi/Xi)/(pi/Pi); [2] – variable calculated with the formula: X=xi/Xi*100

In the case of the first group of indicators, Human resources, the SUB IND 1 value was close to the national level - 97.57%. Here two indicators acted in the direction of increasing macro-regional competitiveness, and the other two in the direction of its decrease. Thus, the variable "employed population" exceeds by almost 6% the national level, while the variable "young population aged 0-20 years" is also above the national average. At the opposite pole, the variable that mostly acted in the direction of competitiveness decrease was "population density" – only 86.71% of the national average.

The non-agricultural sector performance in Macro-region 1, in the year 2014, was under the national level, by about 4%; the variables that decisively contributed to the decrease of macro-regional competitiveness level were the "turnover rate" – only 81.57% of national level and "average net salary" – by almost 12% lower than that at national level. At the

same time, we can notice the positive results in the "value of exports" and the "density of local active units", with values above the national average, thus offsetting the low values of the other two sub-indicators.

As regards the agricultural sector performance, this was by about 15% lower at the level of Macro-region 1, compared to the national level. Only two of five sub-indicators contributed to competitiveness increase, namely: "average farm size", by about 12% higher than that at national level, representing a favouring factor for the development in good conditions of modern agricultural activities and in obtaining increased yields, thus contributing to the achievement of good economic results", and "density of local active units". On the other hand, among the indicators that strongly influenced the competitiveness level decrease, we must mention the "value of exports" – less than 50% of the national average and "turnover rate" – only 76.1% of the national average.

The total value of SUB IND 4 Specialization and innovation calculated at the level of Macro-region 1 was by about 14% lower than the national average. The sub-indicator that mostly contributed to the competitiveness level decrease was "employees in RDI in 10,000 civil employed persons" – only 65.29% of the national average; the only sub-indicator from this group with a value above the national average was "share of population employed in non-agricultural sectors".

CONCLUSIONS

The competitiveness index calculated on the basis of the adapted evaluation model reveals a significantly lower competitiveness level (RCI 91.31) of Macro-region 1, compared to the national level. All the four groups of indicators contributed to a decreasing RCI, with SUB IND 4 "Specialization and Innovation" standing out, whose value was much under the national average. However, we must punctually observe a positive evolution in certain indicators from the four groups, among which we mention the following: "Employed population" – Group "Human resources", "Value of exports" and "Density of local active units" – Group "Non-agricultural sector", "Average farm size" and "Density of local active units" – Group "Agricultural sector", as well as "Share of employed population in non-agricultural sectors" from the Group "Specialization and innovation". However, these could not offset the values under the national average of the other indicators, so that the Competitiveness Index calculated for Macro-region 1 was finally under the national average.

Considering all these aspects, the initial hypothesis of the present study has been confirmed: the competitiveness level of Macro-region 1 was lower then national level, being determined by the unitary action of the four groups of indicators.

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EMPIRICAL EVIDENCES REGARDING THE RELATIONSHIP BETWEEN INNOVATION AND PERFORMANCE IN THE AGRICULTURE OF EUROPEAN UNION

Oana COCA[1], Gavril ȘTEFAN[2], Marilena MIRONIUC[1]

[1]Alexandru Ioan – Cuza University of Iasi, 11 Carol I Boulevard, 700506, Iasi, Iasi County, Romania, Phone: +40232 201 454, Mobile: +40745 640 793, Emails: oanacok@yahoo.com, marilena@uaic.ro
[2]University of Agricultural Sciences and Veterinary Medicine ”Ion Ionescu de la Brad”, 3 Mihail Sadoveanu Alley, 700490, Iasi, Iasi County, Romania, Phone: +40232 407 515 Email: stefang@uaiasi.ro

Corresponding author: oanacok@yahoo.com

Abstract

Innovation in agriculture occurs in response to the requirements of increasing the competitiveness of the agricultural sector, given the intensification of social and political pressures on combating the climate changes effects and ensuring food safety. Through innovation in agriculture is seeking for new solutions to increase the performance of economic entities in this domain and also to ensure sustainable development of the agricultural domain. The conducted research involved, first, a theoretical approach based on reviewing the specialized literature, which allowed, later, devising an empirical study on the relationship innovation - performance in agriculture, at the European Union level (EU-28). To answer the research question, in the study there were used the following data analysis methods: multiple linear regression analysis, correlation analysis, comparative analysis. The main results of the study show that, in most countries, agriculture has recorded performance gains. The highest levels of performance were recorded in those countries characterized by a high rate of investment in research - development and education of agricultural entrepreneurs. From the analysis of statistical relationships between indicators appears a positive influence of innovation on the performance of agriculture. Also, the results show that improving the economic performance is inversely related to the improvement of the environmental performance of agricultural entities, whereas the adoption of measures to minimize the consumptions of inputs does not ensure economic performance as it should be.

Key words**:** *agriculture, European Union, innovation, performance*

INTRODUCTION

The study of Dogliotii et al. [7] highlights the importance of innovation in agriculture for increasing productivity in this sector. They estimate that within 40 years, agricultural production must increase by at least 70% to ensure the population's food requirements. Most technological innovations were created to help farmers to increase productivity and quality of agricultural production and the latest innovation challenges are to reduce the environmental impact. Previous studies have identified at farm level, key features that influence innovation capacity, namely: resistance to shocks acting on the market, management solutions diversity of the shocks and flexibility in using available resources [6][10]. Market shocks that may occur are related to environmental protection [9], the legislative changes [12], the changes in consumer behavior [11].

Some researchers confirm the need for continuous innovation to achieve sustainable development of agriculture so as to achieve higher agricultural productions and to reduce the impact on environmental [16][30]. Since the decision of economic actors to engage in innovation activities is directly related to performance increase [24][32], it becomes important to analyze the relationship between innovation and performance in agriculture.

Based on the results and records of specialized studied literature, the paper aims to analyze the relationship between innovation and performance at the level of agriculture of

European Union member states (EU - 28).

From the literature review, we extracted the following conclusions on the impact of innovation on the performance of agriculture: i) innovation increases the productivity of factors [4][7][19]; ii) innovation reduce the dependence of agriculture to the natural factors, less controllable, with a positive effect on economic performance [20][2][18]; iii) innovation processes involves reduction of production costs from agriculture [28][17]; iv) innovation has a positive impact on the growth of the company's environmental performance by promoting resource conservation practices [14]. Based on these approaches on the relationship between innovation and performance, we intend to test the first hypothesis of research, namely: *H1: There is a strong and direct correlation between a country's agriculture performance and its innovative capacity in the field.* Numerous studies in the field have attributed to research in agriculture, a basic role for development of new solutions to increase agricultural productions [21][33], reducing the impact of natural factors on agricultural production [29][31] and increasing the degree of exploitation of natural resources [22]. Research - development activities (R&D) are the basis of the innovation process and the level of allocated expenditure to these activities directly influence the innovative capacity in the agriculture field and hence its performance [23][3][15].

Based on these approaches of researchers mentioned above, we formulated the second research hypothesis which we want to test:

H2: Increasing research - development spending favors the growth of agriculture`s performance.

MATERIALS AND METHODS

The research methodology was based on developing an empirical study on the relationship innovation - performance in agriculture at the level of the all 28 member states of the European Union (EU-28) by using the information available in Eurostat statistics [8]. Analysis period was chosen based on the availability of statistical data for all 28 EU countries. Whereas a part of indicators of appreciation of the innovation and performance of agriculture is calculated every 2 or 4 years (technical charging per tractor, degree of utilization of renewable resources in farms etc.), analysis was performed for 2006, 2010 and 2014 years. Comparative analysis of indicators for a four-year period highlights their long-term trend.

To answer research questions, the following methods were used for data analysis: linear regression analysis, correlation analysis, comparative analysis.

Discussion of variables

The dependent variable which reflects the performance of the agriculture`s field entities is the "*standard output per hectare*" (SO). This indicator is calculated as ratio between the total value of standard agricultural production or output and total used agricultural area (UAA). The total value of standard output relates to vegetable sector and does not include livestock production.

Closely related to research hypotheses, we selected the independent variables that can express the innovation influence on variation of dependent variable. The indicators included in the analysis were classified into indicators of agricultural innovation capacity and indicators of agriculture`s performance.

Indicators of agricultural innovation capacity

Technical charging per tractor (ITeh) expresses the number of hectares of farmland corresponding to a tractor and is calculated as a ratio between total utilized agricultural area and total number of tractors.

The share of agricultural area operated by managers with higher agricultural education in total UAA (Psup) is calculated as a ratio between the area exploited by managers with higher agricultural studies and total utilized agricultural area.

The human resource engaged in research and agricultural technology field per 1,000 people employed in agriculture (RH) is an indicator that characterizes the potential ensure of management of innovation process from agriculture domain. The indicator is calculated as the ratio between the total number of people aged between 25 and 64

who have higher agricultural study and/ or are working in research and agricultural technology domain and total number of people employed in agriculture multiplied by 1,000.

The share of R&D expenditure in agricultural gross value added (VAB) (Pcd) is an indicator that expresses as a percentage, the financial costs of public and private funding destinated to activities of research - development in agriculture of total agricultural gross value added generated at country level.

The share of organic farming area in total UAA (PEc) indicates the farmers`s adoption of innovations based on conservation of natural resources and protecting the environment, that helps to combat the negative effects of climate change. The indicator is calculated as a percentage ratio between agricultural land cultivated in ecological system and total UAA.

The degree of utilization of renewable resources in farms (Reg) is an indicator calculated as a percentage ratio between the utilized agricultural area exploited by farms owning equipments for producing energy from renewable sources (wind, solar, hidropower, biomass, biogas and other resources) (Sreg) and total UAA.

The share of arable area exploited in conservation/ no tillage system, in total arable area (Pmin) expresses the degree of adoption by farmers of innovative practices for soil conservation, for reducing the agricultural inputs and streamlining of fuel consumption. The indicator is calculated as a percentage ratio between arable land exploited in conservation system/ no tillage and the total arable area.

Indicators of agriculture`s performance

The share of agricultural gross value added in total GDP (VABa) shows the relative importance of the agricultural sector to form economic wealth of a country. The indicator is calculated as a percentage ratio between agricultural gross value added and total gross domestic product (GDP). A low relative importance of this sector indicates a high level of economic development [5].

The annual labor productivity (Wm) expresses the agricultural gross value added obtained per annual work unit (AWU), respectively is the newly value created by an full-time worker (employee or non-employee) of the agriculture field.

The indicator is calculated as a ratio between agricultural gross value added and the total number of annual work units.

The emissions of greenhouse gases (Ges) indicate the level of environmental performance of agriculture.

This indicator is calculated as a ratio between the total amount of emissions of greenhouse gases from agriculture and total UAA.

The reduction of this indicator may signal the implementation of technological innovations based on streamlining of agricultural consumption and management of agricultural wastes.

The consumption of NPK chemical fertilizers per hectare (Qig) express the level of chemical processing of agriculture and a high value of it can simultaneously increase agricultural production and cause the increases in pollution and quality reduction of agricultural products. The indicator is calculated as a ratio between the total quantity of active substance of chemical fertilizers NPK and total UAA.

The indicators included in the analysis are presented in Table 1.

The links between the chosen variables were tested by applying correlation analysis and multiple linear regression analysis.

Determining the intensity and meaning of statistical connections between numerical variables (x, y) was achieved by calculating the *Pearson correlation coefficient (r) (rxy)* and the *Pearson correlation report (R).* The existence of a statistical link between the variables was tested applying the *Student t test*.

Further was measured the degree to which the dependent variable *"x"* (standard output per hectare - SO) is explained by the independent variables chosen through multiple linear regression analysis. The data was processed using *IBM SPSS software functions - Version 20.*

Table 1. Evaluation indicators of innovation and performance in agriculture

Category	Indicator	MU	Symbol
1. Indicators of agricultural innovation capacity	1.1 Technical charging per tractor	ha/ tractor	ITeh
	1.2 Share of agricultural area operated by managers with higher agricultural education in total UAA	%	Psup
	1.3 Human resource engaged in research and agricultural technology field per 1,000 people employed in agriculture	people	RH
	1.4 Share of R&D expenditure in agricultural VAB	%	Pcd
	1.5 Share of organic farming area in total UAA	%	PEc
	1.6 Degree of utilization of renewable resources in farms	%	Reg
	1.7 Share of arable area exploited in conservation/ no tillage system, in total arable area	%	Pmin
2. Indicators of agriculture`s performance	2.1 Standard output per hectare	euro/ ha	SO
	2.2 Share of agricultural gross value added in total GDP	%	VABa
	2.3 Annual labor productivity	euro/ AWU	Wm
	2.4 Emissions of greenhouse gases	tonnes / ha	GES
	2.5 Consumption of NPK chemical fertilizers per hectare	kg a.s. / ha	Qig

Source: own contributions

RESULTS AND DISCUSSIONS

The analysis of relations between innovation and performance in the agriculture of the European Union member countries included the following research steps: i) descriptive and in dynamic analysis of indicators; ii) the statistical analysis of the relationships between indicators. We present below the main results obtained in the two phases of the study.

The descriptive and in dynamic analysis of indicators

Following the verification of the normality of analyzed variables, resulted the need of logarithmating of normally undistributed variables, so as to ensure the validity of correlation and regression analyzes.

Characterization of selected distribution variables was performed using descriptive statistics (Table 2).

Table 2. Descriptive statistics of variables

Variables	N	Min.	Max.	Mean	Std. Dev.
Technical charging per tractor	84	4.34	117.46	33.45	24.84
Share of agricultural area operated by managers with higher agricultural education in total UAA	82	.47	81.89	30.36	22.02
Human resource engaged in research and agricultural technology field per 1,000 people employed in agriculture	78	21.67	613.54	169.31	105.94
Share of R&D expenditure in agricultural VAB	84	.32	18.52	4.65	4.33
Share of organic farming area in total UAA	84	.10	19.50	5.79	4.48
Degree of utilization of renewable resources in farms	84	.01	66.39	9.25	15.41
Share of arable area exploited in conservation/ no tillage system, in total arable area	84	.23	62.50	35.74	16.27
Standard output per hectare	84	163.11	5595.03	1300.61	1006.12
Share of agricultural gross value added in total GDP	84	.21	7.18	1.60	1.22
Annual labor productivity	84	920.99	51102.41	10723.59	11622.99
Emissions of greenhouse gases	84	1.09	10.08	3.17	2.25
Consumption of NPK chemical fertilizers per hectare	83	20.64	189.27	84.71	37.54

Source: own contributions

It can be noted from Table 2 that the highest value of standard output per hectare was 1,584.17 euro/ ha, this being registered by Italy in 2014, and the lowest value of standard output was registered by Estonia in 2006 of 269.91 euros/ ha. The high values of the

standard deviations indicate large differences between the surveyed countries, in terms of performance of agricultural activity and of innovation activities.

The best economic performance was registered by commercial farms in Italy, which achieved a standard output of more than 1,400 euros per hectare each year. There is a growing trend of this indicator from one period to another, in most countries under review, as a result of the implementation of more productive technologies and of an efficient organization of work.

The productivities per hectare from Romania, Estonia, Finland and Latvia have the lowest values, less than 600 euro/ ha.

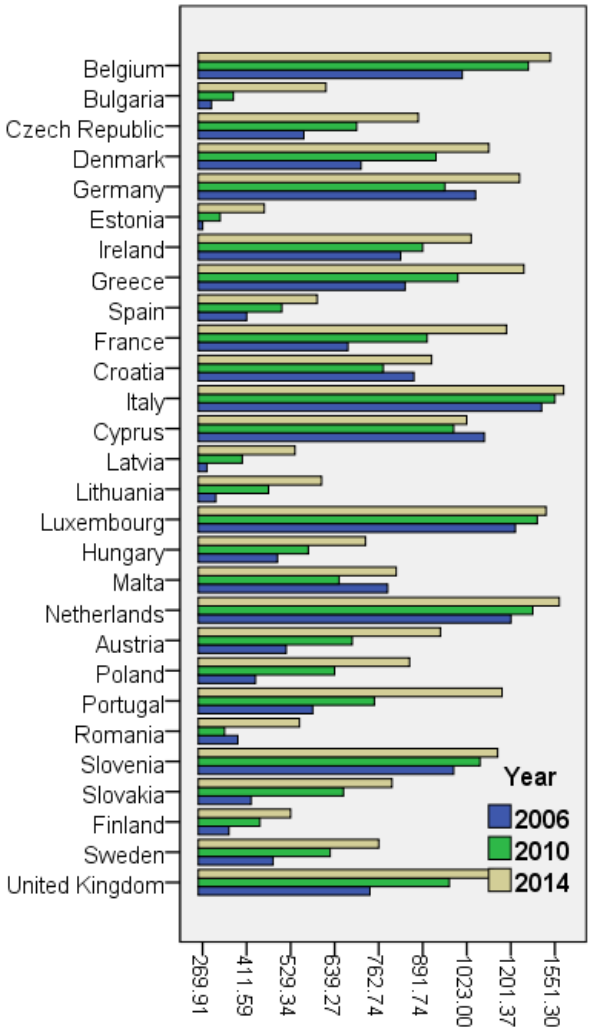

Fig. 1. The value of standard output per hectare (euro/ ha), EU-28 (processing after Eurostat)

We notice the unexpected presence of Northern countries among laggards on productivity, a phenomenon that can be explained by the fact that these countries are specialized in animal husbandry (especially pig breeding), and vegetable farming area has a reduced representation. In relative terms, the largest increases in the 2006 - 2014 period were recorded by Poland (104.31%) and Portugal (98.60%).

We present below the main results from the descriptive and in dynamic analysis of the indicators expressing the innovative capacity and performance of this sector in EU countries.

A first indicator that denotes the potential for innovation in agriculture is the *"technical charging per tractor*". A very high level of technological endowment is registered by countries like Slovenia, Malta, Austria and Cyprus with a tractor charging of less than 10 hectares. These values may reflect, on the one hand, a high potential of increasing yields in production technologies or can express the "underutilization" of technical capital, the increased of fixed costs with amortization and maintenance of technical capital, which have negative effects on economic efficiency, on the other hand. The lowest levels of endowment with tractors are registered in 2014, by Bulgaria (73 ha/ tractor), Slovakia (70 ha/ tractor) and Romania (69 ha/ tractor). In the analyzed period the technical charging per tractor decreased in all EU countries, except Greece. To determine the optimal charging on tractor, depth studies are needed at the micro level, to analyze the efficiency of investment in those capital goods that attract technical progress.

Along with technical capital used in agriculture, the human capital is a very important innovation resource for insurance of generation capacity of innovative ideas, for engaging in research - development and successful implementation of innovations. According to Eurostat, the highest percentage of areas exploited by managers with full agricultural studies were recorded in 2014 in the Czech Republic (77.00%), Luxembourg (67.00%), Slovakia (57.68%) and Latvia (55.18%). The largest absolute increases were recorded, in the period 2006 – 2014, by Latvia (11.79%) and Poland (9.92). Access to

information is facilitated by innovation and human capital, which is why the development potential of agronomic sector of a country is directly linked to the education of the farmers.
The lowest shares of areas exploited by managers with higher education in agriculture were registered in 2014, by Greece (0.89%), Cyprus (1.56%) and Malta (2.3%). About 17% of the agricultural land in Romania is exploited by entrepreneurs with full education in the field, which ranks Romania over Italy (11.90%), the Netherlands (12.09%) and other richer countries.
Another indicator that expresses the quality and the innovative potential of the human resources in agriculture is *the number of people engaged in research and agricultural technology field*. As analyzed, the highest levels of human capital endowment per 1,000 persons employed in agriculture, were registered in 2014 by United Kingdom (613 people), Germany (332 people) and Finland (309 people). The lowest values were recorded in 2014, by Greece (41.59 person/ 1,000 persons employed in agriculture), Romania (59,45 persons/ 1,000 persons employed in agriculture) and Portugal (68,69 persons/ 1,000 persons employed in agriculture). The overall trend, noticeable for the analyzed countries, is the growth of this indicator from one period to another, which can positively influence the growth of economic performance of the agricultural sector.
The macroeconomic indicator most used for general characterization of the innovation potential in an area is the share of research - development costs in the country's GDP.
Considering the analyzed field, we calculated based on Eurostat and OECD statistics, "*the share of R&D expenditures, in agricultural gross value added"*. In such countries as Denmark, Belgium, the Netherlands and Finland, the R&D expenditure represents more than 10% of the gross value added of the agricultural sector.
The lowest rates of investment in research were recorded in 2014, by Romania (0.56%), Bulgaria (0.96%) and Slovakia (1.12%), with negative effects on farm development and competitiveness on the international market. In Romania, it has recorded an absolute increase of this indicator by 0.24%, from 0.32% in 2006 to 0.56% in 2014. The increase of this percentage may be the effect of research - development project implementation, financial supported by the European Operational Programs carried out during 2007-2013. During that period of time, were funded 39 research – development - innovation projects in agriculture, by the Sectoral Operational Programme "Increase of Economic Competitiveness 2007-2013", with a total value of 85 million euros.
The efficiency of investment in research is influenced by the involvement of both public research organizations and private economic actors. Increasing the private sector involvement in research is driven by EU policies through the allocation of grants for research projects carried out by various partnerships between these categories of economic actors. For example, Romania dispose during 2014 – 2020 of one billion euros to fund research - development projects through the National Rural Development Programme - Measure 16 - Cooperation (EUR 31 million) (dedicated only to agriculture and agri-food industry) [25], Regional Operational Programme 2014-2020 - Priority Axis 1 - Technology Transfer (EUR 175 million) [27] and the Competitiveness Operational Programme 2014-2020, Priority Axis 1 - Research, technological development and innovation (RDI) (EUR 798 million) [26].
Analysis of relations between innovation and performance also included the conversion degree to organic farming. *The share of organic farming area in total UAA* indicates the farmer`s adoption of innovations based on conservation of natural resources and on protecting the environment, helping to fight against the negative effects of climate change. These also contribute to enhancing product quality and, thus, the selling price, with positive effects on business performance [31]. During the analyzed period, the countries that stood out by a share of over 10% of organic land are Austria, Czech Republic, Sweden and Estonia. The lowest percentages in organic crop (under 3%) were registered in Bulgaria, Malta and Romania.

One of the major constraints for farmers to grow organically is the lack of stable and less elastic price markets. The food consumption is characterized by high elasticity to price, especially in underdeveloped countries with a low purchasing power.

The degree of utilization of renewable resources in farms is an indicator which shows a certain degree of independence of farmers to conventional energy resources, with positive effects on lowering the production costs and increasing the environmental efficiency of agricultural technologies. The highest degrees of equipping for power generation from renewable sources were recorded in Finland (66.39%), Denmark (62.38%) and Luxembourg (59.92%). The lowest shares of renewable resources use, of less than 1%, were attained on farms in Romania, Bulgaria, Cyprus, Greece and Ireland. We appreciate that these countries have low environmental performance and does not contribute enough on combating climate change.

The main factors that constrain the use of renewable resources in these countries are represented by the lack of financing for such investments, the still low interest of farmers for protecting the environment and the difficulties in assessing the impact of new installations on economic and environmental performance.

The share of arable area exploited in conservation/ no tillage system, in total arable area express the adoption degree of innovative practices to conserve resources, among farmers. These practices fall under the category of process innovations, intensively studied by researchers [1][13]. The highest rates of exploited areas in the minimum work system or without tillage were registered in countries such as Finland, Sweden, Ireland and Bulgaria (50-60%). The lowest weights of soil conservation technologies adoption were recorded in Malta (8.80%), Denmark (15.60%) and Hungary (20.12%). In Romania, over 25% of arable land is cultivated in conservation or no tillage system. The overall trend shows the growth of this indicator from one period to another.

The share of agricultural gross value added in total GDP shows the nation's dependence on agriculture. The most significant absolute reductions of the relative importance of agriculture in the economy were registered in Romania (3.02%, from 7.73% in 2006 to 4.71% in 2014) and Bulgaria (1.55% from 6.12% in 2006 to 4.57% 2014). Nevertheless, the two countries continue to register the highest percentages for agriculture`s participation in GDP (over 3%), reflecting a strong dependence on agriculture and a lower level of economic development.

In countries like United Kingdom, Germany, Luxembourg and Belgium, the agriculture participates with less than 1% of gross domestic product. The formation of gross value added in European Union agriculture is dominated by four countries that together form 53.60% of total gross value added, as follows: France (16.7%), Italy (15.9%), Spain (12.0%) and Germany (9.0%). These countries have a rich tradition in agriculture and are characterized by large agricultural areas, an advanced level of technologies and a strong subsidizing of farmers. The four countries together form 45.7% of the utilized agricultural area in the European Union (174.6 million hectares). Romania participates with only 3.6% to the gross value added in agriculture of EU-28 and holds 7.5% of the total utilized agricultural area.

The annual labor productivity is an indicator of labor efficiency in the production process. At EU level, the average annual labor productivity was in 2014 of 12,481.60 euro/ AWU, up 34% compared to 2006 (9,341.76 euro/ AWU). Very high levels of labor productivity were registered in 2014 by Nordic and Western Europe countries, respectively the Netherlands (51,102 euro/ AWU), Denmark (37,841 euro/ AWU), France (31,635 euro/ AWU) and the United Kingdom (27,700 euro/ AWU). Labour productivity growth is directly related to technologies and the general level of economic development of the country. The lower labor productivities were registered in Eastern countries, namely in Romania (1,079 euro/ AWU), Latvia (1,306 euro/ AWU), Poland (2,372 euro/ AWU) and Hungary (3,019 euro / AWU).

The emissions of greenhouse gases indicate the environmental performance of agriculture and a low amount of emissions reflects a reduced impact of farming on the environment. Can noticed that the lowest emissions of greenhouse gases from agriculture were registered, during 2014, in Bulgaria (1.09 tonnes/ ha), Romania (1.29 tonnes/ ha), Lithuania (1.36 tonnes/ ha) and Estonia (1.38 tonnes/ ha). These results indicate a reduced intensification of agriculture, which has positive effects on environmental protection, but with possible negative effects on economic performance. Significant gas emissions from agriculture were recorded in Netherlands, Belgium, Malta and Cyprus, for more than 8 tonnes/ ha.

The previous indicator is in direct correlation with *the consumption of chemical fertilizers per hectare,* the latter being a main source of nuisance in agriculture, along with livestock manure. The amount of NPK chemical fertilizers per hectare express the level of chemical intensification of agriculture, and a high value thereof can simultaneously increase agricultural production, grow environmental pollution and decrease the quality of agricultural products. The biggest consumers of fertilizers, with more than 130 kg of NPK active substance per hectare, are the farmers from Belgium, the Netherlands and Malta. These three countries have the highest emissions of greenhouse gases from agricultural activities, within the EU. Small amounts of chemical inputs are used in holdings from Romania, Portugal, Luxembourg and Latvia (under 50 kg of NPK active substance per hectare).

Statistical analysis of the relations between indicators

Based on the information described in the previous section, we further conducted an analysis of statistical correlation and regression relation of indicators. Variables that did not show a normal distribution were transformed by logarithm. The results of correlation analysis of the dependent variable *"standard output per hectare"* with the independent variables were presented in Table 3.

Table 3. Testing the correlation between variables

Indicatori		**SO**
LN_Technical charging per tractor	*Pearson C. (r)*	-.449**
	Sig.	.000
Share of agricultural area operated by managers with higher agricultural education in total UAA	*Pearson C. (r)*	-.175
	Sig.	.115
LN_Human resource engaged in research and agricultural technology field per 1,000 people employed in agriculture	*Pearson C. (r)*	-.001
	Sig.	.996
Share of R&D expenditure in agricultural VAB	*Pearson C. (r)*	.329**
	Sig.	.002
Share of organic farming area in total UAA	*Pearson C. (r)*	-.096
	Sig.	.385
Share of arable area exploited in conservation/ no tillage system, in total arable area	*Pearson C. (r)*	-.003
	Sig.	.976
LN_Share of agricultural gross value added (VABa) in total GDP	*Pearson C. (r)*	-.322**
	Sig.	.003
LN_Annual labor productivity	*Pearson C. (r)*	.584**
	Sig.	.000
LN_Degree of utilization of renewable resources in farms	*Pearson C. (r)*	.346**
	Sig.	.001
LN_Emissions of greenhouse gases	*Pearson C. (r)*	.639**
	Sig.	.000
Consumption of NPK chemical fertilizers per hectare	*Pearson C. (r)*	.361**
	Sig.	.001

**. Correlation is significant at the 0.01 level.

The *Pearson* correlation coefficients (r), whose values, in module, are greater than 0.300 (with sig <0.01), are indicating the existence of moderate links between indicators. Thus, we see that there is a direct correlation between standard output per hectare (SO) and the following independent variables: the emission of greenhouse gases (r=+0.639); the annual labor productivity (r=+0.584); the amount of NPK chemical fertilizers per hectare (r=+0.361); the utilization of renewable resources in farms (r = +0.346) and R&D expenditure share in VABa (r=+0.329). This shows that the economic performance of agriculture is still dependent on the level of intensification of agriculture with chemical inputs, but also on the level of research – development investments in agriculture field. A high share of renewable indicates the presence of process innovations, which act on reducing operating costs and increasing environmental and economic performance of the company. Also, a good supply of agriculture with high trained specialists, namely those who have full

education in agricultural sciences or are working in research and agricultural technology, directly correlates labor productivity (r=+0.502) which aims at increasing performance. According to conducted analysis, there is a moderate inverse correlation between the standard output per hectare and the indicators: technical charging per tractor (r = -0.449) and share of agricultural gross value added in total GDP (r=-0.322). Mechanization and automation of farm processes are important elements in growing the agriculture performance because these reduce the time and costs required to perform agricultural works. Regarding the environmental performance, a low level of technical equipment correlates inversely with increasing the amount of greenhouse gases (r=-0.459), positively influencing the environment. We notice that a high performance in agriculture is obtained in countries with a low level of dependence on agriculture, which has a small contribution to national wealth formation (below 3%).
Regarding the training level of managers in the agricultural field, there is a direct correlation with the share of organic farming area (r=+0.300) and technical charging per tractor (r=+0.402). In other words, an educated manager who followed an academic training in agriculture is more attracted by the quality of organic production and environmental protection, than getting large amounts of conventional products.
The share of R&D expenditure in total agricultural gross value added is in a strong direct correlation with labor productivity in agriculture (r=+0.721) and the use of renewable resources (r=+0.621). It thus shows that innovation involves increasing the leverage of labor resources and energy.
Economically highly developed countries, among which agriculture has a relative importance of less than 2-3%, have a greater interest in technological innovations to reduce the environmental impact.

Given the dependent variable "standard output per hectare", it was analyzed the effect of the determinants on it, applying the *multiple linear regression analysis*.

Table 4. Regression equation of the dependent variable "standard output per hectare"

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	228.685	69.842	.612	2.829	.001		
	Share of R&D expenditure in agricultural VAB	21.489	1.462	.254	5.485	.001	.342	2.921
	Share of arable area exploited in conservation/ no tillage system, in total arable area	-2.741	1.575	-.124	-1.740	.018	.920	1.087
	LN_Technical charging per tractor	-145.802	36.962	-.321	-3.945	.000	.713	1.402
	LN_Annual labor productivity	170.228	36.688	.540	4.640	.000	.379	2.638
	LN_Emissions of greenhouse gases	291.208	72.939	.468	3.992	.000	.348	2.876
Dependent Variable: Standard output per hectare (euro/ ha)								
SO = 228,685 + 21,489Pcd - 2,741Pmin - 145,802LN ITh + 170,228LN Wm + 291,208 LN GES + ε								

Note: The interpretation of regression coefficients with independent variables transformed by logarithm is performed after their transformation: $\beta_i x \ln(101/100)$

Multiple regression analysis was based on *Backward* method, which involved the introduction of the 11 variables in the model, and gradually eliminating the independent variables which presented multicolinearity (were correlated with other variables in the model). According to the final model, it resulted the regression equation for the dependent variable as shown in Table 4.
The resulting regression equation after

logarithmic transformation of variables is as follows:

$$SO = 228,685 + 21,489Pcd - 2,741Pmin - 1,451 ITh + 1,694Wm + 2,898GES + \varepsilon$$

Analyzing the equation we see a positive influence of research - development spending ratio, labor productivity and emission of greenhouse gases on increasing agriculture performance, as measured by standard output per hectare. An increase in the R&D expenditure ratio by one unit will get an increase of 21.489% of the standard output per hectare. This relationship shows a very high dependence of agriculture`s economic performance so far as it invests in research, both at the public, and especially at the private economic level. Considering that labor productivity is directly related to attracting technical progress, we can reassess a positive influence of innovation on increasing agriculture`s performance. We also note that intensive technologies, consuming large quantities of inputs and producing high amounts of greenhouse gases positively influence a high level of economic performance. This relationship is evidenced by the negative value of the regression parameter for the share of arable area exploited in conservation/ no tillage system (β=2.741). Thus, following the model, an increase of one unit of the share of arable area exploited in conservation/ no tillage system will decrease to 2.741% the standard output per hectare. Limiting the number of agricultural work has benefits on soil structure and composition, by stimulating the biological activity in the soil, reducing soil erosion and increasing water storage. The influence of technical charging per tractor on economic performance is reversed, and one unit increase of the technical charging (a hectare) causes a decrease of standard output of 1.451%. It follows that the technical endowment of farms with more efficient tractors and incorporating an innovative technology is needed to ensure the growth of economic performance indicators. Based on these results we can say that improving economic performance is inversely related to increasing the environmental performance of agricultural entities, whereas the adoption of measures to minimize the consumption of inputs does not ensure the suitable economic performance.

CONCLUSIONS

By analyzing the macroeconomic key indicators characterizing the European Union agriculture revealed that in most countries, agriculture has seen performance gains, especially in those countries that have high rates of investment in research - development and in farmers education (such as Belgium Luxembourg, Sweden, the Netherlands). The dependence of nations on agriculture has decreased in most countries, a fact that supports economic growth and development.

Although Romania has significant natural resources for agriculture (7.5% of EU-28 agricultural area), the level of economic performance is low, with labor productivity far below the EU average and with low investment in research - development activities. Analyzing the statistical relationships between the indicators, it turns out that innovation has a positive influence on the agriculture performance, through increased spending for research - development - innovation and increased supply of specialized labor resources.

We appreciate that the analysis results support the validity of research hypothesis *H1: There is a strong and direct correlation between a country's agriculture performance and its innovative capacity in the field* and *H2: Increasing research - development spending favors the growth of agriculture`s performance.*

We consider the researchers and specialists in agriculture should focus on developing innovations that provide increased technical yields, raise the product quality and, consequently, their added value, under conditions of a reduced impact on the environment.

The research results helps us to better understand the impact of agricultural innovation capacity on the performance of this economic sector. This study may be a reference in decision making of innovation

investment at farm level, on the one hand, and the decisions on the macroeconomic level, resulting in policies of growth and development of the agricultural sector at international level, on the other side.

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THE EVALUATION OF INNOVATION IN AGRICULTURE. A META - ANALYTICAL STUDY OF LITERATURE

Oana COCA

Alexandru Ioan – Cuza University of Iasi, 11 Carol I Boulevard, 700506, Iasi, Iasi County, Romania, Mobile: +40 745 640 793, Email: oanacok@yahoo.com

Corresponding author: oanacok@yahoo.com

Abstract

Innovation is a key driver of growth and development of the agricultural sector. The importance of innovation in agriculture is supported by the effects that innovation has on performance improvement of the economic entities in this field, in relation with efforts. Organization's decision to engage in innovation or to use the innovation results is influenced by the perception that the company has on net benefits generated by such an approach. The purpose of the paper is to highlight the evaluation way of innovation process from agriculture domain, through a meta-analytical study on literature published in the field. Results of the study show that, in literature, the general purpose of innovation in agriculture is to reduce environmental impact, followed by the purpose of decreasing costs.The main agricultural innovations studied by researchers are those of process which involve the decrease of resources consumption, such as technological innovations of soil conservation and the precision innovations.The evaluation of innovation process is done mainly through indicators that measures the level of increase in production, the level of cost reduction and through the decrease of negative effects on environmental.

Key words**:** *agriculture, innovation, meta-analysis*

INTRODUCTION

Agriculture is still the main supplier of food for population and an important supplier of raw material for other industries (textile industry, energy industry etc.). Regarding the attraction level of innovation in production processes, the agriculture domain is seen as a weak user of information and high technology [14].

The pressure of population growth and climate change boosts the innovative process from agriculture to find solutions for increasing the agricultural productions, for increasing the product quality and reducing the environmental impact. We note that the supreme goal of innovation in agriculture is one great, justifiable and which respond to humanity challenges. Intensification of farming determined the increase of average agricultural productions per hectare with 180% in 2000 year, compared to 1870 year, driven by an increase of only 20% of production factors [13]. According to Martin-Retortillo and Pinilla [10], the labor productivity in agriculture has increased threefold during 1970 - 2000 period, thanks to the use of chemical products, to the development of biological innovations (biotechnologies, genetic improvements etc.) and technological innovations (new agricultural technologies, innovation of machines and farm machinery etc.).

In the last 15 years, the farmers began to use in production activity the computer technologies and special software systems for accounting and the financial organization of work and for a more efficiently monitoring of it [4][7]. Increasing the efficiency of agricultural activities is based on the interaction of farmers with new technologies and their ability to position itself in a flow of information. In other words, the economic entities in the field must collect and use a large amount of information from numerous domains such as: meteorology, agricultural inputs industry, biotechnology industry, the domain of agricultural research etc. The conventional and superintensives farming practices can cause soil degradation, waters contamination, loss of biodiversity, the reduction of control on pests and diseases and, finally, reducing of agricultural product quality and of safety for consumers's health

[6] [1]. A challenge of research in agricultural domain is represented by the protection of consumer health by providing some healthy agricultural products, without pesticide residues and with a richer nutritional value [17].

Knowing the fact that, in the economy, the company is the economic actor whose primary function is the production, rests to these the main role in the implementation of innovations and in achieving of sustainable development goals, undertaken by nations.

More specifically, the economic entities from agriculture must adapt their production technologies to the requirements of environmental protection and human health and, at the same time, to register economic efficiency. In these conditions, it becomes important the motivation of the agricultural enterprise in adopting innovations, respectively awareness of the benefits that it will get as a result of innovation. Previous researches have highlighted the importance of identifying net benefits brought by innovation for increasing the company`s performances, arguing in favor of the innovation in economic processes [15][12]. As the innovation process involves a chain of steps (from idea generation to implementation of innovations and obtaining benefits) and a complex system of participants (researchers, suppliers, businesses, consumers), its assessment involves choosing the most suitable areas for measurement and also for the optimal indicators of quantifying [3].

The innovation process has an predominantly qualitative character, difficult to quantify in money, with a high complexity. Due to this fact, the evaluation of innovative process and its impact on enterprise performance is a challenge for researchers. Researchers have identified a direct relationship between innovation and organizational structure, enterprise culture and management practices [9][8]. Thus, entities which take the decision to innovate start to make changes at the organizational level (reorganization of staff, engaging in partnerships with research organizations etc.) and to make expenditures in an aggressive way, to create a favorable environment for creativity and innovation [9]. All these expenses involved by the engaging in innovation activities must be justified by increasing the performance level of the economic entity in agriculture [5][2]. In other words, the need to obtain the efficiency from innovation activities becomes particularly important to turn innovation into a continuous process at the level of economic entity, which insures the growth of market competitiveness.

The research purpose is to highlight the assessment approaches of innovation process from agriculture by seeking answers to the following questions:

• *Which is the innovation purpose in agriculture?*

• *Which are the main types of innovations in agriculture?*

• *Which are the indicators for assessing the innovation impact on performance of economic entities from agriculture?*

MATERIALS AND METHODS

In order to answer the research questions it was realised a meta-analysis of the specialized literature by aggregating a large number of information identified in the literature. The meta-analytical study has a critical qualitative and quantitative nature whereas will be identified, quantified and reported facts and conceptual approaches coming from previous publications of the researchers.

The meta-analysis consists in a organized application of an ensemble of criteria defined by researcher, for classifying, measuring and analyzing the material content [11].Through this approach were analyzed informations taken from a large number of studies from innovation domain in agriculture, informations which concern the applied methodology of research, the analyzed phenomena, the indicators for assessing the phenomena etc.

The importance of this research method is given by the possibility of in-depth knowing of the studying level of the research problem among scholars and the possibility of correlating of independent results obtained from the analyzed studies [16]. The data was processed using *IBM SPSS software functions - Version 20.*

From the methodological standpoint, the meta-analysis involved the following steps:
i) choosing of online international databases;
ii) selecting the areas of interest;
iii) establishing the level of analysis;
iv) selection of articles on phases;
v) grouping the analysis concepts;
vi) coding the identified analysis groups;
vii) data analysis.

RESULTS AND DISCUSSIONS

The performed analysis was aimed on identifying key concepts, measuring their frequency and the association relations between them and obtaining results that can be generalized, regarding the evaluation of innovation in agriculture. In this section are detailed the steps that have been taken to achieve the meta-analysis of studies in the field and the main results.

i) Choosing of online international databases

To select the articles from the area of interest of our research, we chose two international representative databases, respectively *Science Direct (SD)* and *Web of Science (WS)*.

ii) Selecting the areas of interest

Were chosen from each database, the areas shown in Table 1, which binds directly or indirectly to our research question (assessment of innovation in agriculture).

Table 1. Selected areas of interest

Science Direct areas	Web of Science areas
Agricultural and Biological Sciences	Agriculture
Biochemestry, Genetics and Molecular Biology	Meteorology Atmospheric Sciences
Business, Management and Accounting	Business Economics
Computer Science	Computer Science
Economics, Econometrics and Finance	Biotechnology Applied Microbiology
Environmental Sciences	Environmental Sciences Ecology

iii) Establishing the level of analysis

After identifying relevant research areas we have defined keywords for seeking the targeted articles. Thus, were applied for the *"abstract, title, key words"* the search criteria shown in Table 2.

Table 2. Defining the structure of search criteria

Science Direct	Web of Science
"innovation" and "agriculture" and ("measure" or "evaluate" or "asses" or "metrics")	TI=(agriculture or innovation) and TS=(agriculture) and AB=(measure or evaluate or asses or metrics)

Also, at this stage we chose as types of interest publications, the *"journals"*. The period of analysis was between 1990 and 2016. After applying the selection criteria described above, resulted 454 articles, structured as shown in Figure 1.

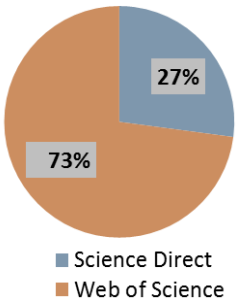

Fig. 1. Structure of identified articles, after determining the level of analysis

We note that, out of a total of 454 articles that met the search criteria, 73% of them are journls identified in Web of Science and 27% are journals identified in Science Direct.

iv) Selection of articles on phases

At the preliminary stage they were removed articles that were not available in *"full-paper"*, those that were duplicated in the two databases and those which were not written in English.

Table 3. Articles excluded in preliminary phase

Excluded articles	Database		
	SD	WS	Total
Total, of which:	**40**	**112**	**152**
- were not available in "full-paper"	35	64	99
- were not written in English	5	16	21
- were duplicated in the two databases	0	32	32

In drawing up the relevance of identified journals for our research, were excluded 81 articles after reading the abstracts and their`s titles (Table 4).

Table 4. Articles excluded by relevance

Excluded articles	Database		
	SD	WS	Total
Total, of which:	**20**	**61**	**81**
- excluded by title	11	23	34
- excluded by abstract	9	38	47

At the advanced selection of articles were excluded those articles that were rated with "NO" for at least two of the advanced quality criteria, according to Table 5. After the completion of the three-stage refining of the identified articles, in the analysis remained 74 articles, of which 34 articles were identified in Science Direct and 40 articles were identified in Web of Science. These articles represented the final studies used in analyzing the concepts related to evaluation of innovation in agriculture.

Table 5. Articles situation in advanced phase selection

Advanced selection criteria	Science Direct		Web of Science		Total	
	YES	NO	YES	NO	YES	NO
1. The article comprises at least one reason why it should be innovating in agriculture?	54	9	121	37	175	46
2. The article describes at least one type of innovation in vegetable agriculture?	42	21	102	56	144	77
3. The article describes at least one indicator for evaluating innovation in agriculture?	36	27	85	86	68	113
TOTAL SELECTED ARTICLES	**34**	**-**	**40**	**-**	**74**	**-**
TOTAL EXCLUDED ARTICLES	**-**	**29**	**-**	**118**	**-**	**147**

v) Grouping the analysis concepts

During this stage we have established the groups for analysis of the concepts that we want to identify (Table 6).

Table 6. Analysis groups

Group	Symbol	Group details
Innovation purpose	SI	The reasons for innovating in agriculture, both at macroeconomic and microeconomic level.
Process innovations	IPs	Innovations in agriculture that can be assigned to the innovation process (fundamental technological changes or new technologies and processes)
Product innovations	IPr	Innovations in agriculture that can be classified as product innovations (new or significantly improved characteristics).
Evaluation indicators	IE	Indicators through which has assessed the impact of the innovation process on the performance of economic entities in agriculture.

vi) Coding the identified analysis groups

For each analysis group were identified several concepts that have been described by key phrases found into the text of articles, expressing the same phenomenon. For the four groups of analysis were identified 19 representative concepts of characterizing innovation in agriculture, in terms of innovation objectives, the most studied types of innovations in agriculture and the indicators to assess the impact of the innovation on the performance of economic entities in agriculture.

The main identified dimensions were coded using numbers from 1 to 19. The detailed list of key expressions related to the 19 concepts, as they were identified in the articles, is presented in Appendix 1.

vii) Data analysis

The selected articles were described on the following qualitative criteria:

a) by publication year;
b) by methodology.

A percentage of 64.86% of selected articles were published in the last 5 years, which shows an increasing interest of researchers for studying the innovation issues in agriculture.

The trend of increasing the researchers`s interest for innovation in agriculture can be explained by the fact that the policies of states and supra-state organizations (the European Union, Food and Agriculture Organization of the United Nations, etc.) have the following priorities in the field of sustainable

agriculture: reducing resource consumption, increase food security and combating climate change.

Table 7. Coding the analysis groups

Group	Main concepts per group	Code	No. of articles in which the concept has been found
Innovation purpose	environment protection	SI1	21
	consumer protection	SI2	10
	decreasing the resources consumption	SI3	21
	increasing the farm performance	SI4	31
Process innovations	preserving technological innovations	IPs5	18
	precision technological innovations	IPs6	9
	crop organization innovations	IPs7	20
	innovations to reduce pollution	IPs8	21
	innovations for computerization of technology	IPs9	15
Product innovations	input innovations	IPr10	15
	genetic innovations	IPr11	8
Evaluation indicators	lowering costs	IE12	14
	production growth	IE13	17
	reducing the environmental impact	IE14	16
	productivities growth	IE15	14
	product quality growth	IE16	11
	strengthening of cooperation between farmers	IE17	10
	revenue growth	IE18	10
	copyright protection	IE19	3

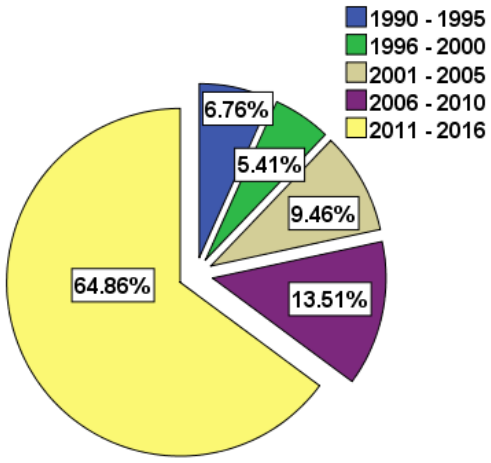

Fig. 2. Articles structure by publication year

In this regard, studies are needed to assess the impact of innovation activities on business performance, both at the economic and environmental level. Literature can provide important information for decision making in agriculture innovating and the researchers`s study results may be important elements for adapting national policies to the present economic realities.

Regarding the methodology used in the studies, have been identified the following categories of research methods used by the authors: sociological survey; case study; experiment; analysis of secondary data; others. Most of the analyzed articles fall into the categories: sociological survey (29.73%) and experiment (28.38%). Sociological surveys have mainly used tools such as questionnaire and interview, applied to farmers, researchers in the field and others actors.

Further we conducted a frequency analysis of key concepts and we have identified the following situations:

- the main goal of innovation in agriculture is to increase the performance (encountered in 41.89% of articles), followed by the environment protection and reducing the resource consumption, these having equal frequencies in 36.49% of articles;
- the most studied types of process innovations in agriculture are those aiming to reduce pollution (28.38% of articles), crop organization innovation (27.03% of articles)

and conservation innovation (24.32% of articles).

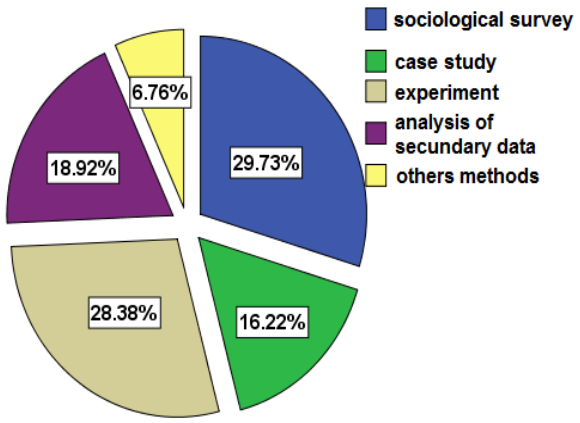

Fig. 3. Articles structure by methodology

These three categories of innovations presented in agriculture have a positive impact on the environment whereas
harnesses the natural potential of the area, helps to crop diversification and ensures the purpose of protecting the environment.
- in terms of product innovations, the highest frequency have the innovations on agricultural inputs (20.27% of articles), those containing new or significantly improved products ranging from pesticides, fertilizers, improvers etc.;
- assessing the effect of agricultural innovations is achieved in particular by measuring the increase in agricultural production (22.97% of articles) and quantify the reduction of environmental impact (21.62% of articles);
- the innovation evaluating indicator represented by copyright protection has the lowest frequency, being present in just 4.05% of articles. In agriculture, the majority of process innovations are being constructed on the existing knowledge or permanently generated in the organization, and obtaining copyright for such processes is very difficult to achieve [12].
The association relationship between qualitative variables was performed using the *multiple correspondence analysis* (MCA). Multiple correspondence analysis is an extension of correspondence analysis which allows to analyze the association relationship between several categorical variables.

Table 8. Model summary of MCA

Dimension	Cronbach's Alpha	Variance Accounted For		
		Total (Eigenvalue)	Inertia	% of Variance
1	.727	3.215	.169	16.919
2	.496	1.887	.099	9.934
Total		5.102	.269	
Mean	.642[a]	2.551	.134	13.427

To reflect the consistency of the chosen scale, the setpoint for *Cronbach's alpha* reliability coefficient should be as close to 1, and a limit of 0.7 is considered consistent for most researchers. Cronbach`s alpha coefficient has a value of 0.727 for the first dimension, which demonstrates the consistency and relevance of the chosen scale.
The two factorial axes explaine 26.9% of the total variance, and the first factorial axis explains 16.9% of variance, hence there are no big differences in the two axes.
By analyzing the correlation between the presence of the indicator *"increased performance"* and other indicators, we note the following:
- studies that assigns to innovation in agriculture, the role of improving the performance, included in the analysis the following indicators: strengthening of cooperation between farmers; revenue growth; lowering costs; production growth;
- studies that have not examined the role of innovation for *"increased performance",* included in the analysis the following indicators: innovations to reduce pollution; innovations for computerization of technology; preserving technological innovations.
The analysis of the association between indicators shows that the articles which presented as purpose of agricultural innovation, the environmental protection and resource consumption decrease, have evaluated the innovation through cost reduction and revenue increase.

CONCLUSIONS

The meta-analysis involved an exploratory conceptual analysis, to provide basic information necessary to conduct a future

empirical study at the level of economic entities in Romanian agriculture. Findings from systematic review of the literature can be summarized as follows:

i) researchers appeals mainly to sociological surveys and experiments to achieve their research regarding the innovation in agriculture;

ii) the main purpose of innovation in agriculture is seen as a response to climate change, that is to reduce the environmental impact;

iii) the most studied innovations are the process innovations that involve reducing the consumption of resources (preserving technological innovations, precision technological innovations, innovations to reduce pollution);

iv) the innovation is assessed in particular by reducing environmental impacts, increasing production and lowering costs.

The number of publications concering the assessment of innovation process in agriculture is increasing, as shown by the share of over 60% articles published after 2010. This shows the importance of the subject for researchers seeking to highlight or identify the effects of innovation in agriculture, on increasing performance at microeconomic and macroeconomic level.

Measuring the effects of innovation on performance in agriculture requires a complex and difficult to achieve process, given that most innovations in this field are based on existing knowledge or are created incidentally among the agricultural entities.

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APPENDIX 1

Detailed list of key expressions found in the articles

Group	Main concepts per group	Key expressions
Innovation purpose	environment protection	"pollution reduction" "reduce environmental impact" "improve environmental" "less environmentally damaging" "optimizing the environmental" "sustainable intensification" "improved environmental outcomes"
	consumer protection	"consumer protection" "consumer health" "a number of health benefits" "guidance on healthy and safe food products" "increases in food security"
	decreasing the resources consumption	"decrease of energy consumption" "fewer chemical inputs" "reduction in fuel" "labour costs were decreased"
	increasing the farm performance	"income growth" "performance growth" "increase farm wealth" "raise richness" "develop performance"
Process innovations	preserving technological innovations	"bio-mulch to conserve soil" "agri-environment conservation" "conservation agriculture practices" "aggradation-conservation agriculture" "controlled traffic farming" "no-till technologies" "minimum tillage"
	precision technological innovations	"institutional innovations" "targeted nutrient applications" "climate smart agriculture" "wireless sensor network technology" "GPS (global positioning system)" "husbandry GPS techniques" "physical and agrochemical mapping of lands"
	crop organization innovations	"production systems using georeferenced data" "crops in time (crop rotation)" "strip cropping" "cover crop cocktail" "crop diversification" "open pond algae agriculture"
	innovations to reduce pollution	"reducing gas emission practices" "greenhouse monitoring system" "Green Technological Foresight on Environmental Friendly Agriculture" "DMC systems for reduce risk of groundwater pollution"
	innovations for computerization of technology	"robot innovation" "ICT monitoring" "monitoring by sensors productions" "GPS mapping systems"
Product innovations	input innovations	"input-using innovations" "new fertilizer and pesticides" " biochemical new products"
	genetic innovations	"stress-avoiding innovations" "genetic resistance" "tolerance to pest, disease, or water stress" "biology plant technologies" "plant breeding"
Evaluation indicators	lowering costs	"reduction in fertiliser usage" "reduced fuel use" " increase resource efficiency " "efficient water consumption" "increasing the average yield" "reducing the costs with non-quality" "lower operating costs" "marginal cost of developing new technologies" "capitalization the natural potential" "reducing costs through minimum works"
	production growth	"increase in agricultural production"

		"increasing the output" "to intensify production" "allowing the farmers to increase the production" "enhance crop production" "increased food production" "seeking to improve production"
	reducing the environmental impact	"reductions in losses of all pollutants" "microbiological activity growth" "decrease in compacting of land" "carbon footprint reduction" "reducing energy consumption" "reduction of erosion" "landscape improvement" "reducing of greenhouse gases" "reducing of food waste" "reducing CO2 emissions"
	productivities growth	"increase profit" "gross margin growth" "improving labor productivity" "increasing agricultural productivity" "competitive prices" "price premium increase" "slightly higher price received" "overall increase in profitability" "farm profit increases" "increasing the profitability of cropping relative" "an increase in land productivity" "sustainably increasing agricultural productivity"
	product quality growth	"organic production growth" "development of quality feed" "quality organic products" "reducing of epidemics" "implementation of quality standards" "increased crude protein content in feed" "number of genetically modified hybrids" "number of improved plant" " improved quality of nutrition"
	strengthening of cooperation between farmers	"urban public involvement in agricultural networks" "development of urban agricultural innovation networks" "increasing education" "increasing communication to farmers" "linking farmers to innovation networks" "research – development expenditure outsourced"
	revenue growth	"increases the net household income" "income growth" "overall net income increased noticeably" "increases of maize grain sales" "signifycantly higher income stream" "rising real incomes" "maximizing yearly net income" "improve net household income and income stability" "improvement per unit of income" "income-related indicators have improved" "increases crop sale revenues" "improvements in grain sales"
	copyright protection	"new patents public owners" "new patents private owners" "patents renewed" "lifetime of patents"

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HONEY PURCHASE- PRESENT AND FUTURE ON THE ROMANIAN MARKET

Marian CONSTANTIN[1], Andreea Raluca CONSTANTIN[1], Raluca NECULA[1,3], Mihai-Radu COSTESCU[2]

[1]University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti, District 1, 11464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Mobile: +40744647410, Emails: marianconstantin2014@yahoo.com, andreearconstantin@gmail.com, raluca_nec@yahoo.com
[2]University of Craiova, Romania, Email: cmihairadu@yahoo.com
[3]The Bucharest University of Economic Studies, Faculty of Agrifood and Environmental Economics, 5- 7 Mihail Moxa Street, 1st district, Postal code: 010961, Bucharest, Romania, Email: raluca_nec@yahoo.com

Corresponding author: marianconstantin2014@yahoo.com

Abstract

The topic and structure of this paper is focused on investigating a current problem of the honey market in Romania, with references to the level and the purchase volume. The analysis of the quantities of purchased honey, carried out through the calculation and interpretation of the markers during the annual dynamics of the period 2003-2014, demonstrates an increasing trend. Knowing the prospects of the purchases of honey, according to the influence factors framed within the regression equations, is interpreted in a two-dimensional form: a rise in purchases by means of a successive increase of the influence factors; a decrease of purchases when these factors diminish. Simultaneously, irrespective of the alteration (±x) of the purchase price, of the earnings, or of the expenses, the trend of honey purchase is maintained (y). At the same time, one can remark differentiated rates that result into a high level of association of the factors that influence the purchase of the product honey. In the analyses that were made, the error deviations are within normal limits, and the values of the correlation coefficient express a high level of association of the factors that influence the purchase of the product honey.

Key words**:** *honey, market, purchase, price, regression function, residual standard deviation, forecast*

INTRODUCTION

By means of quantitatively and qualitatively differentiated forms, the market has represented the most concrete way to know food needs. In the current stage, the food needs for the product honey reflect a quantitative aspect, by the effective consumption per se, but also a qualitative aspect, connected to the consumption level which is present in the food structure [5, 6, 15]. The current paper, by means of a survey of the honey market, aims at knowing the purchase level for the product honey in Romania, and based on this, an estimation of the buying prospects [13, 15]. Actually, it is aimed to clarify the double aspect of this problem [4, 12]: *economic*, through the presence of this product on the market, which is obvious in the quantitative volume of purchases, which enables knowing the prospective level of the purchasing impulses dependent on the factorial changes of the market. Second, there is the *social* aspect, whose rising annual production and consumption markers is given by the sequence of the augmenting/diminishing factorial variables (±). As a result of the increase of the purchases demonstrates that the product honey is considered basic food in the nutritional perspective of the population, but when diminishing, it can tend to become a luxury product [6, 9]. The coordinates resulting from this paper draw the attention on the intensity of the influence factors which by augmenting/diminishing can modify the purchase demand for honey for the current stage in Romania [11, 13].

In this context, the paper aimed to investigate a honey market in Romania, with references to the level and the purchase volume.

MATERIALS AND METHODS

The topic of the level and purchase prospects of the product honey was structured methodologically, on the one hand, by presenting the current situation, on the other hand, by knowing the prospective level. The current situation was rendered by knowing the main markers which characterize the purchasing level of the product honey in reference to the purchase price, the consumption and the value of the purchased honey, the net nominal income, the expenses for purchasing food (out of the total and consumption expenses). The levels of these markers were analysed within the annual dynamics of the period 2003-2014 which were expressed in absolute values (kg./ month/ person), but also in percentages (in comparison to the year 2003) [2, 5, 7].

The data were collected from Romania's Statistical Yearbook and Food Balance Sheets, 2008-2015, provided by the National Institute of Statistics [10,16].

The prospective levels for purchasing the product honey were estimated by using functions (regression equations). Within these functions, the focus was on the interrelations between the resultative variable (y → purchase of honey) and factorial variables (x→ purchase price, consumption and value of the purchased honey, net nominal income, expenses for purchasing food) [3, 7]. The augmenting/ diminishing variations of the factorial variable (x±5%.....x±50%) were carried out at the level of the computation basis of the year 2014 (considered the last year of analysis). Thus, according to the augmenting/ diminishing of the influence factors, the purchasing level of the product honey, expressed in kg./ month/ person was estimated [1, 5].

RESULTS AND DISCUSSIONS

In the current paper, the level and particularly the purchasing prospects of the product honey could only be presented in a qualitative sequence (represented by a quantitative quantum present in the evolution of the years), along with the qualitative aspect (rendered by the presumptive knowledge of the markers within the honey market, given by the variations of the factors framed within the regression functions/equations).

1.The evolution of the situation of the honey market in Romania.

Table 1. The evolution of the markers level that influence the honey market in Romania [2]

Specification	UM	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Honey purchase price	Ron/kg.	7.48	6.71	4.10	4.30	4.55	6.15	7.72	8.79	9.99	10.04	11.46	13.83
	% in regard to 2003	100	89.70	54.81	57.48	60.82	82.21	103.20	117.51	133.55	134.22	153.20	184.89
Value of purchased honey	Ron/ month/ person	0.1974	0.2889	0.31	0.39	0.34	0.49	0.62	0.67	0.85	0.91	1.01	1.08
	% in regard to 2003	100	146.35	157.04	197.56	172.23	248.22	314.08	339.41	430.59	460.99	511.65	547.11
Honey purchase	Kg./ month/ person	0.018	0.023	0.024	0.031	0.027	0.036	0.042	0.040	0.044	0.044	0.047	0.48
	% in regard to 2003	100	127.77	133.33	172.22	150	200	233.33	222.22	244.44	244.44	261.11	266.66
Honey consumption	Kg./ month/ person	0.029	0.034	0.038	0.042	0.045	0.049	0.055	0.057	0.058	0.061	0.061	0.061
	% in regard to 2003	100	117.24	131.03	144.82	155.17	168.96	189.65	196.55	200	210.34	210.34	210.34
Net nominal income	Ron/ employee	484	599	746	866	1,042	1,309	1,361	1,391	1,444	1,507	1,575	1,697
	% in regard to 2003	100	123.76	154.13	178.92	215.28	270.45	281.19	287.39	298.34	311.36	325.41	350.61
Total expences	Ron/month/ household	595.45	750.2	936.28	1,158.68	1,275.20	1,620.25	1,729.99	1,734.85	1,786.31	1,856.17	1,939.66	1,915.24
	% in regard to 2003	100	125.98	157.23	194.58	214.15	272.10	29.05	291.35	299.99	311.72	325.74	321.64
Total consumption expences	Ron/month/ household	449.42	615.8	720.27	815.46	946.00	1,185.33	1,275.03	1,286.29	1,320.83	1,387.90	1,441.32	1,419.55
	% in regard to 2003	100	137.02	160.26	181.44	210.49	263.74	283.70	286.21	293.89	308.82	320.70	315.86
Expenses for purchasing food (out of the total expenses)	Ron/month/ household	135.76	169.54	215.34	257.22	280.54	359.69	385.78	383.40	407.27	415.78	436.42	415.60
	% in regard to 2003	100	124.88	158.61	189.46	206.64	264.94	284.16	282.41	299.99	306.26	321.46	306.12
Expenses for food products (out of the consumption expenses)	Ron/month/ household	177.97	237.08	264.33	290.30	338.66	425.53	455.18	457.91	476.81	502.41	521.75	492.58
	% in regard to 2003	100	133.21	148.52	163.11	190.29	239.10	255.76	257.29	267.91	282.30	293.16	276.77

Source: Coordinates of the Standard of Living in Romania, The Population's Earnings and Consumption and NIS, 2003-2015

Knowing the situation of the honey market is considered mandatory, by means of the evolution of the level of the parameters specific to this market [9, 12, 13].

For the period between 2003-2014, the following are presented: the level of the markers which are expressed both quantitatively (quantities of purchased honey), and value-wise (price, expenses, earnings). The values rendered in *Table 1* emphasise the main evolutionary aspects of the analysed markers and by means of annual and also correlative comparisons, the following data result:

- the honey purchase price within the analysed period is in a sequential growth, thus year 2014 records an increase of +84.89% in regard to 2003. For the same period, the value of the honey purchased by a household highlights a much higher increase (year 2014 records this growth of 5.47 higher compared to 2003). However, simultaneously, the quantity of honey purchased by a household represents an increase of 2.66 in comparison with the same years. As a result of the rendered comparisons, the following can be noticed: the value markers of the honey purchase prices record the lowest levels; the value level of the purchased honey is represented by means of very high increase rates; the honey purchase (expressed in physical units) records moderate increases.
- in reference to the honey consumption, one can notice an increase that in 2014 is of +110.34% compared to 2003. In addition, by means of the analysis of the net nominal income, one can notice that the increase for the same period is of +250.61%. One can infer a slower increase of the honey consumption in regard to the much higher increase potential of the net nominal income;
- the expenses analysis was structured from two perspectives: on the one hand, the total and consumption expenses, where one can notice similar increases (2014 in regard to 2003, the increases are of +221.64% and +215.86% respectively). On the other hand, the expenses for purchasing food out of the total and consumption expenses where, comparing the years 2014 to 2003, one can notice slightly significant increases (of +206.12% and +176.77% respectively). Or, out of the comparative analysis of the level of these percentages, the results are close variations, where one can notice a form of proximity of the influence of the structure of the markers of the total and food consumption expenses.

The variations with special reference to the percentages indicate existing differences within the market, with special reference to the stages of acquisition and delivery of the product honey.

2.The variations of the influence factor and of the prospective purchasing levels within the honey market. The prospects of knowing the evolution of the honey market represent an element of a particular necessity. Or, the level of the periods following the purchase, as an effect of the variation of the influence factors, displays a particular importance in the study of the honey market.

By using the regression functions, factors such as: price, value, purchased value, consumption, earnings and expenses (x), according to some specific variations, they influence the purchase level (y). By means of the variations rendered through augmenting/diminishing factors (*x±5%..... x±50%*), there were determined the resulting levels particularly necessary in knowing the prospective purchasing level which can be demonstrated within the honey market.

The values rendered in *Table 2* present these results, along with the used regression relations which were considered as computation basis.

Interpreting the results according to the methodological computation system (of factorial augmenting/ diminishing), the interpretative aspects which can be rendered are presented below.

(i)The value of the purchased honey and its purchase price constitute initial elements for the level of the prospective purchasing power. Thus, the results of the function which represents the influence of the value of purchased honey (y=0.0027+0.0855x−0.0416$\mathbf{x^2}$), as well as the purchase price ($y = 0.0158 + 0.0023x$), render the trend of a relative level, by

augmenting/diminishing the quantities of purchased honey. These levels that result from the computation are between 0.045 – 0.047 and respectively 0.032 – 0.064 kg./ month/ person (which at the level of the computation basis for 2014 is represented by the adjusted value of 0.047 kg./ month/ person).

Table 2. The resulting levels in the honey purchase (y), by altering the factorial variables (x)

Relation and denomination of the variables *y* = **resultative** *x* = **factorial**	**Function (regression equation) and the level of the computation basis, year 2014** *y(x)*	**Augmenting (+) and diminishing (-) variation**	**UM**	**Level of the results of the resultative variable *y* according to the variations (±) of the influence factor *x***			
				y(x±5%)	*y(x±10%)*	*y(x±15%)*	*y(x±50%)*
Influence of the ***value of the purchased honey (x)*** on the ***purchase of honey (y)***	$y = 0.0027 + 0.0855x - 0.0416x^2$ *y(x)* = 0.047 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.046	0.046	0.045	0.032 *
		Diminishing factor *x* (-)	*kg./ month/person*	0.047	0.047	0.046	0.037 *
Influence of the ***purchase price*** of the product honey ***(x)*** on the ***purchase of honey (y)***	$y = 0.0158 + 0.0023x$ *y(x)* = 0.051 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.049	0.051	0.052	0.064
		Diminishing factor *x* (-)	*kg./ month/person*	0.046	0.044	0.043	0.032
Influence of the ***honey consumption (x)*** on the ***purchase of honey (y)***	$y = 0.0027 + 0.3794x + 5.5060x^2$ *y(x)* = 0.046 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.050	0.053	0.056	0.084
		Diminishing factor *x* (-)	*kg./ month/person*	0.043	0.040	0.037	0.019
Influence of the ***net nominal income (x)*** on the ***purchase of honey (y)***	$y = 0.0110 + 0.0148x + 0.0046x^2$ *y(x)* = 0.049 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.052	0.055	0.057	0.078
		Diminishing factor *x* (-)	*kg./ month/person*	0.047	0.044	0.042	0.027
Influence of the ***total expenses (x)*** on the ***purchase of honey (y)***	$y = 0.0129 \cdot 1.9533^x$ y(x) = 0.046 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.050	0.053	0.056	0.088
		Diminishing factor *x* (-)	*kg./ month/person*	0.044	0.041	0.038	0.024
Influence of the ***expenses for purchasing food*** (out of the ***total expenses) (x)*** on the ***purchase of honey (y)***	$y = 0.0127 \cdot 20.8589^x$ y(x) = 0.045 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.048	0.051	0.054	0.084
		Diminishing factor *x* (-)	*kg./ month/person*	0.042	0.040	0.037	0.024
Influence of the ***total consumption expenses (x)*** on the ***purchase of honey (y)***	$y = 0.0126 \cdot 2.5176^x$ *y(x)* = 0.047 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.050	0.053	0.057	0.090
		Diminishing factor *x* (-)	*kg./ month/person*	0.044	0.041	0.038	0.024
Influence of the ***expenses for food products*** (out of the ***consumption expenses) (x)*** on the ***purchase of honey (y)***	$y = 0.0105 + 0.0344x + 0.0707x^2$ *y(x)* = 0.045 kg./ month/person (adjusted value)	Augmenting factor *x* (+)	*kg./ month/person*	0.047	0.050	0.053	0.075
		Diminishing factor *x* (-)	*kg./ month/person*	0.042	0.040	0.037	0.023

Source: Own calculations based on NIS, 2016

(ii)Regarding the honey consumption and the net nominal income, considered as influence factors (x) on the resultative factor- purchase of honey (y), the regression equations ($y = 0.0027 + 0.3794x + 5.5060x^2$ and respectively $y = 0.0110 + 0.0148x + 0.0046x^2$) render the variations by the same trends, the levels being marked by slightly augmenting/diminishing rates. The result is that, irrespective of the increase of honey consumption, and also of the earnings, a slow trend is maintained of some of the augmenting/diminishing rates of the honey purchase (the level of the computation basis for purchase in 2014, being represented by 0.046 and respectively 0.049 kg./month/person) [14];

(iii)The expenses constitute a basic element in interpreting purchases, reason for which the focus was on the influence of the factorial variables rendered structurally. References were made regarding the influences of the total expenses together with the expenses for purchasing food (x), on the honey purchase (y). The exponential form of the results of the regression equations ($y = 0.0129 \cdot 1.9533^x$ and $y = 0.0127 \cdot 20.8589^x$), render significant augmenting/diminishing rates. The result was that both the level of total expenses, and of those allocated exclusively to the food purchase influence in the same direction the trend of honey purchase (trend emerging according to the regression equations, where the level of the computation basis for purchasing, year 2014, is represented by 0.046 and respectively 0.049 kg./ month /person);

(iv)The influence of the total expenses, as well as those allocated exclusively to the food purchase (x) on honey purchase (y), by means of the results of the used exponential functions ($y = 0.0126 \cdot 2.5176^x$ and $y = 0.0105 + 0.0344x + 0.0707x^2$), reveal proportional increasing/ decreasing trends for the purchase of honey. The trends rendered by means of the succession of stages (±x), where the computation basis for the purchase of

honey (y which is represented in the regression equations whose level of the computation basis is for purchase, year 2014, is represented by 0.047 and respectively 0.045 kg./ month/ person) emphasize successive augmenting/ diminishing rates with a significant condition. It should be remarked that the last increasing stage (x → ±50%) for purchase reaches 0.090 and respectively 0.075 kg./ month/ person.

3.Substantiating the influence factors of purchase of the product honey by using residual deviation and correlation coefficient.

The residual deviation which frames the set of used regression functions/ equations confirms the analytical validity from a methodological point of view. It is rendered by values between 0.002 and 0.006 which are considered minimum. The correlation coefficient with values between 0.862 and 0.994 expresses the certain correlative form of the resultative and factorial variables (y/x).

Table 3. The level of the residual deviation and the correlation coefficient (x/y) regarding the factors which influence the purchase of honey in Romania

Structure of the correlative functions (x/y)	**Residual Deviation**	**Correlation coefficient (ratio)**
Influence of the ***value of the purchased honey (x)*** on the ***purchase of honey (y)***	0.001	0.994
Influence of the ***purchase price*** of the product honey ***(x)*** on the ***purchase of honey (y)***	0.006	0.862
Influence of the ***honey consumption (x)*** on the ***purchase of honey (y)***	0.002	0.988
Influence of the ***net nominal income (x)*** on the ***purchase of honey (y)***	0.002	0.985
Influence of the ***total expenses (x)*** on the ***purchase of honey per household (y)***	0.002	0.991
Influence of the ***expenses for purchasing food (***out of the ***total expenses) (x)*** on the ***purchase of honey (y)***	0.002	0.990
Influence of the ***total consumption expenses (x)*** on the ***purchase of honey (y)***	0.002	0.990
Influence of the ***expenses for food products per household (***out of the ***consumption expenses) (x)*** on the ***purchase of honey (y)***	0.002	0.986

Source: Own calculation.

The study showed that irrespective of the alteration (±x) of the purchase price, of the earnings, or of the expenses, the trend of honey purchase is maintained (y) [3, 7].

The error deviations are within normal limits, and the values of the correlation coefficient express a high level of association of the factors that influence the purchase of the product honey [4, 8].

As a result of the study, the hypotheses of error distribution which are reflected in the residual distribution (error estimations) express the hypotheses of error distribution within normal limits. At the same time, the correlation coefficient (by means of the deviations from hypotheses of error distribution) is significant by the levels that were rendered, which expresses a high degree of association of the factors that influence the honey purchase.

CONCLUSIONS

The honey market is linked to demand which in the current paper highlights for Romania the level and purchase prospects of this product, where for the study that was made, the following conclusions can be emphasized:

- As a result of the analysis of the levels of annual honey purchases, one can notice an increase, which, within the market is linked to the purchase price, earnings and the consumer's expenses potential. For the analysed markers, one can remark differentiated rates which in the succession of the years are determined by the influence of the factors which manifest themselves by means of the stages of acquisition and delivery of the product honey.
- By interpreting the results issued by the computation methodological system (as a result of augmenting/diminishing rates

through the regression equations) the prospective purchasing levels of the product honey were outlined. The result was that, irrespective of the factorial alteration ($\pm x$) that was represented by the purchase price, earnings, and expenses, the same honey purchasing trend is maintained (y), but in differentiated rates which express a high degree of association of the factors that influence the purchase of the product honey.

-The hypotheses of error distribution reflected in the residual deviation, expressed the error deviations within normal limits, where the correlation coefficient was added, the result being a high degree of association of the factors which influence the purchase of the product honey [5].

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ORGANIZING SINGLE ENTRY ACCOUNTING, IN AN AUTHORIZED NATURAL PERSON. CASE STUDY

Daniela CREȚU

University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Mobile:+40740207985, E-mail:danielacretu5@yahoo.com

Corresponding author: danielacretu5@yahoo.com

Abstract

In this paper it is showed how to implement the single entry accounting system with a case study in a P.F.A. (authorized natural person) in Călăraşi county, which has as main activity: "Growing of cereals (except rice), of vegetables and plants producing oil seeds" - CAEN code - 0111, which organizes and manages the single entry accounting in compliance with the regulations in force on accounting and complements the journal of receipts and payments, the inventory book and other accounting documents foreseen by the legislation in force on the activity of PFA. It is presented the circuit and how to register and use the financial accounting forms, with concrete data from accounting record of PFA taken into consideration in order to demonstrate the effectiveness of this accounting system, compared with the double entry accounting which requires the application of the regulations valid to economic operators, until and including the level of balance without preparing annual financial statements. Although, according to the new accounting regulations, the natural persons having incomes subject to taxation from agricultural activities, forestry and fisheries, can organize double entry accounting on their option, the analyzed PFA proposed to maintain single entry accounting.

Key words: *accounting, single entry, authorized natural person, journal register, inventory register*

INTRODUCTION

Patrimonial accounting organization is an obligation established by law for all legal entities and natural persons which were allowed to carry out their own activities and have the capacity of a trader [6].

Decentralization of the economy determined the occurrence and development of free initiative requiring the trader to take the risk in its activity because the activity it performs is made under competition conditions. In order to keep and resist this fight the trader must know the results of its activity so that from the incomes to cover its expenses and to obtain also profit [7].

Single entry accounting represents the set of records and financial accounting documents, which serve to record in the accounting, in a chronological and systematic way, of the economic and financial operations recorded in the justification documents [5].

The persons who manage the single entry accounting can use the accounting financial forms provided by the regulations in force or part of them, depending on the specific elements of their activity, so that they allow determining the information needed to meet the obligations provided by the laws in force [1].

The authorized natural persons (other than the independent professions) intending to develop an economic activity as authorized natural persons are obliged to register and to authorize the Trade Registry Office. Single-entry accounting is kept in Romanian language and in national currency. Any economic and financial operation at the time of making them are recorded in a document highlighting the single-entry accounting, thus acquiring the status of justification document. The justification documents highlighted in single entry accounting make liable the persons who drawn them.

MATERIALS AND METHODS

In order to highlight the single entry accounting of the operations made by PFA, the following accounting records were used [8]: the journal

of receipts and payments (code 14-11/b) Inventory Register (code 14-1- 2/b), in strict accordance with their destination, in order and complete so as to allow at any time to identify and monitor the economic and financial operations carried out.

The journal register of receipts and payments (code 14-1-1/b) serves at the chronological record of all amounts received and paid both in cash and through bank accounts. The inventory register (code 14-1-2/b) serves to register the nature of the assets and inventoried debts. [2]

The patrimony elements are highlighted in the accounting, at the entry value, respectively cost of acquisition, production or market price, based on the justification documents certifying their acquisition. [9]. For each type of activity, ***the sheet for various operations*** was drawn, in which documents were recorded in chronological order, and monthly totals in the sheet for various operations were recorded in ***the Journal on various operations***, grouped on types of activities. ***The total incomes from the journal on various operations represents the income of PFA***.

RESULTS AND DISCUSSIONS

The case study on the system of implementing the single entry accounting was made within a P.F.A. (authorized natural person) in Călăraşi county, which has as main activity: "Growing of cereals (except rice), of vegetables and plants producing oil seeds" - CAEN code – 0111. [10]

The crop structure in the farm is specific to the plain area in the Southeast part of the country. When choosing the initial crops, it was considered how these crops use the productive potential of the land and the income generated from their sale.

The production structure in the period 2013-2016 contained: wheat, maize, sunflower, barley, fodder plants, soya, rape seed and seed lot, an annual average area of about 170 hectares. [10]

It is noted that the incomes exceed the costs every year, so that the farm activity ends with profit. The year 2016 records the highest efficiency of the activity, the profit recorded being the highest in the analyzed period, as it is showed in figure 1. [10]

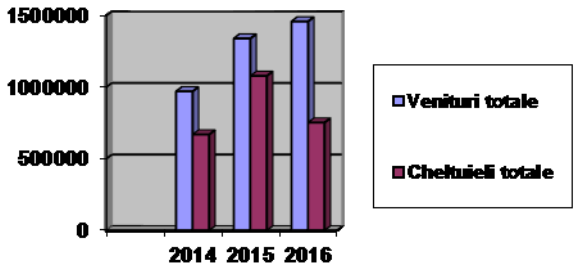

Fig. 1.Evolution of total incomes and costs (LEI)

The single entry accounting of the expenses is made on types of expenses incurred in the direct interest of the activity [11]: expenses for purchase of raw materials, supplies, inventory items and goods; expenses on works executed and services provided by third parties; expenses incurred by the taxpayer for the execution of works and services to third parties; the rent for the space in which the activity develops, for machinery and other equipment rented, used in developing the activity, based on a lease contract; interests on bank loans; expenses related to commissions and other banking services; expenses on insurance premiums; expenses on advertising and publicity; post expenses and telecommunications fees; energy and water expenses; Transport of goods and passengers; expenses on delegation, re-location and travel; Staff expenses; expenses with taxes other than income tax; expenses representing the state social security contributions etc.

For each type of expense, ***the sheet for various operations*** is drawn up and their total monthly is registered in ***the Journal for various operations*** for expenses and subsequently in ***the Journal of receipts and payments***. Only those expenses that are related to the achievement of incomes and are paid during a fiscal year are allowed to deduct.

In order to record the incomes from independent activities, the taxpayers use, depending on the specific activities and own needs, specially printed forms, series marked and numbered: ***receipt, invoice, purchase***

order, storage sheet of the forms with special regime, monetary, extract from the schedule of payments.

Gross income is the income collected during a calendar year, regardless of the period in which the benefits were made. For each type of activity developed ***a sheet for various operations*** will be drawn up, that will record all documents in chronological order, and monthly totals in the Sheet for various operations will record in the ***Journal on various operations,*** grouped by types of activities.

The total income in the Journal for various operations represents the taxpayer income.

The taxpayers who receive in cash all income they achieve can highlight these incomes only ***in the Journal of receipts and payments***, it is no longer mandatory to drawn up the Sheet for various operations and implicitly therefore the Journal for various operations.

If taxpayers paying value added tax (VAT), the incomes, excluding value added tax, are taken for determining the taxes of the columns of the Journal for sales, it is no longer mandatory to draw up the sheet for the various operations and implicitly the Journal for various operations for the incomes achieved.

If that fiscal electronic devices are used, in accordance with the legal provisions, the income record is made based on fiscal report of daily closing and the Special Register, made if the electronic devices are broken. [11]

Net income or tax loss is determined as the difference between total sums collected from ***the journal of receipts and payments*** and the tax depreciation expenses of the assets and rights, highlighted in the ***Sheet for various operations,*** and the total amounts paid, highlighted in the journal of receipts and payments, to which the sums paid to purchase depreciable assets, are added and total non-deductible expenses.

Net income or tax loss will be influenced by the payments and/or receipts made in advance, which relates to other future fiscal years.

Also, PFA makes the general inventory of the assets: at the beginning of the activity; at least once a year; at the ending of the activity; as well as in other situations provided by law; in accordance with the laws on organizing and making the inventories of assets and liabilities.

In table 1, an extract is showed, as model of Register-Inventory, made by the analyzed PFA. [3]

Table 1. Register Inventory Code 14-1-2/a. at 31st December 2015

	Name of assets inventoried	Inventory number	Date of purchase	Type and number of document	Entry value	Exit value	Value included on expenses	Exit value
1	2	3	4	5	6	7	8	9
1	Furniture office	14	15.03.11	Invoice	1468	2021	913	-
2	Means of transport	15	05.04.11	Invoice	12,600	2021	72,560	-
3	Sprayer machine	16	11.02.12	Invoice	6,890	2022	26,340	–
4	Fertilizer spreading machine	17	15.03.12	Invoice	23,670	2022	11,540	-
5.	Hall	18	21.04.12	Expense estimate	54,670	2032	11,430	-
Made by,				Verified,				

This register is numbered and is completed without erasures and without leaving blank lines. It is archived together with the justification documents that were the basis for completing it. In **the Journal of receipts and payments, PFA** records both the economic and financial operations made in cash, and those made by the current account at the bank in chronological order, depending on the date of completion or entry of documents. It serves as: document for recording the receipts and payments; document for setting out the financial situation of the taxpayer which organizes double-entry accounting; evidence in litigation.

It is drawn up in a single copy, making the recording of the operations based on the justification documents, separately, on each operation, without leaving any blank lines. The operations recorded are totalized annually.

In the Journal of receipts and payments operations **are recorded not only in cash but also those made by the current account at the bank.**

In Table 2, it is showed an extract - model of centralizing situation on the records of invoices received and settled during December 2015 - March 2016, drawn up by PFA.

Table 2. Centralizing situation. Invoices to be paid to providers

	Date of invoice issue	Due date	Number of invoice	Provider	Sum -LEI-
1	2	3	4	5	6
1	11.12. 2015	20.02 2016	TSV05779	S.C. Turist service S.R.L.	18,709.68
2	14.12. 2015	20.01. 2016	CTPRO1 022792	S.C. PROAGROSER VICE	63,471.74
3	09.01. 2016	18.02. 2016	ILENE28 239	S.C. Enedum Com SRL	3,580.00
4	06.02. 2016	24.03. 2016	14246	S.C. Mag Distributie SRL	7,142.40
5	12.02. 2016	24.03. 2016	12509	S.C. EURO Consult SRL	596.00
TOTAL					

This centralizing situation allows authorized natural persons to have access to rapid and accurate information on payments to be made on the due date and to follow the due date of each invoice.

As a corollary of this centralizing situation, a summary of the debts may also be made, following the same model, allowing to monitor in the available account the amounts to be received for the issued invoices.

Table 3. Sheet for various operations- Depreciation of tangible assets

No crt	Date	Document Type / Number	Explanations	Sum
1	10.01	Accounting note 02	Depreciation of fixed assets	11,340
Total Month				**11,340**
2	10.02	Accounting note 07	Depreciation of fixed assets	11,340
Total month **Cumulated from the beginning of the year**				**11,340** **22,680**
3	10.03	Accounting note 13	Depreciation of fixed assets	11,340
Total month **Cumulated from the beginning of the year**				**1,340** **34,020**

For these categories of operations either sheet for separate various operations are opened or statements are prepared using cumulative documents reflecting such amounts. So, **the issued invoices and not collected and the invoices received and unpaid** are highlighted in the sheets for various transactions or cumulative documents are drawn, reflecting the situation of these amounts, **not in the Journal of receipts and payments.**

Table 4.Sheet for various operations – Obligations to social insurance budget

No crt	Date	Document Type / Number	Explanations	Sum
1	09. 01	OP 107	Registration and payment of obligations to BAS	712
Total month				**712**
2	18. 02	OP 119	Registration and payment of obligations to BAS	384
Total month **Cumulated at the beginning of the month**				**384** **1096**

Table 5.Sheet for various operations-Obligations to the State Budget

No crt	Date	Document type / Number	Explanations	Sum
1	09. 01	Payment order OP 108	Payment of salary tax	96
2	20. 01	OP 111	Payment of income tax from agricultural activities	15,480
TOTAL MONTH				**15,576**
3	18. 02	OP 120	Payment of salary tax	58
TOTAL MONTH **CUMULATED FROM THE BEGINNING OF THE YEAR**				**58** **15,634**

Table 6. Sheet for various operations- APIA Subsidies

No crt	Data	Document Type / Number	Explanations	Sum
1	23. 01	OP 1412	Recording and collecting subsidy	51,034.15
Total month				**51,034.15**
2	03. 02	OP 2763	Recording and collecting subsidy	14,364.73
Total month **Cumulated from the beginning of the year**				**14,364.73** **65,398.88**

Table 7. Sheet for various operations – Diesel Provider S.C. OMV PETROM

No crt	Data	Document Type / Number	Explanations	Sum
1	18. 02	BF 263	Fuel purchase	1654.12
Total month				**1654.12**
2	27. 03	BF 643	Fuel purchase	1210.42
Total month **Cumulated from the beginning of the year**				**1210.42** **2,864.54**

By the position "amounts collected" it means that the invoice issued but not collected in the same year, is not considered gross income.

Further on, foe each activity is opened the Sheet for various operations- Depreciation of tangible assets.

Table 8.Sheet for various operations-
Spare parts - Provider S.C. Enedum SRL

Nocrt	Data	Document Type / Number	Explanations	Sum
1	09.01	INVOICE FACT. ILENE28239	Purchase from provider	3,580
	Total month			**3,580**

Tabel 9. Sheet for various operations- Spare parts- Provider S.C. PROAGROSERVICE

Nocrt	Date	Document Type / Number	Explanations	Sum
1	14.12	INVOICE FACT. CTPRO1022792	Purchase from provider	63,471.74
	Total month			**63,471.74**

Monthly total in the sheet for various operations will be recorded in ***the Journal for various operations***, grouped on types of activities, as it is showed in Table 10.

Table 10. Journal for various operations

Date	Document Type / Number	Operation	Receipts	Payments
09 01	N.C. 1	Recording of deductions and salary deduction to social insurance budget	-	96
09 01	N.C. 2	Recording salary tax	-	712
04 01	Fact. ILENE28239	PURCHASE of spare parts	-	3,580
10 01	N.C.03	Recording depreciation of fixed assets	-	11,340
15 01	F 051, of 28.11. 2014	Collects from S.C. Pioneer Hibrid Seeds Agro	330.147,36	-
20 01	OP	Tax on agricultural income	-	15,480
20 01	Invoice TSV05779	Purchase and settlement of fuel	-	18,709.68
2 .01	OP	Collecting subsidy from APIA	51.034,15	-
31 01	Statement of account	Bank fee	-	155.50
03 02	OP	Collecting subsidy from APIA	14.364,73	-
06 02	Fact. Nr. 14246	Purchase of chemical fertilizers from S.C. Mig Distributie	-	7,142.40
10 02	N.C.7	Recording of depreciation of fixed assets	-	11,340
12 02	invoice 12509	Recording of consulting services	-	248
18 02	N.C. 10	Recording of deductions and salary deductions from social insurances budget	-	384
18 02	N.C. 11	Recording of tax on salaries	-	58
18 02	BF 263	Purchase of fuel from S.C. OMV	-	1654.12
20 02	FACT. 0111	Purchase of spare parts S.C. Tadis	-	540.32
28 02	Statement of account	Bank fee	-	19
10 03	N.C.13	Recording depreciation	-	11,340
27 03	BF 643	Purchase of fuel from S.C. OMV	-	1210.42
	Total cumulated from the beginning of the year			

Total receipts and payments made, during the month, are recorded in the Journal of receipts and payments, as it showed in table 4. [11]

Table 11. Journal of receipts and payments
Cod 14-1-1/b

Date	Document	Type of operation	Receipts		Payments	
			cash	Bank	cash	Bank
2	3	4	5			6
09.01	OP	Payment of BAS	-	-	-	712.00
09.01	OP	Payment of salary tax				96
15.01	OP	Collected from S.C. PIONEER HIBRID	-	330.147,36	-	-
20.01	OP	CASS at lease contract	-	-	-	5,321.00
20.01	OP	Payment of tay on agricultural activities	-	-	-	15480.00
20.01	OP	Paid invoice. S.C. TURIST SERVICE	-	-	-	18709.68
20.01	OP	Paid invoice S.C. proagroservice SRL	-	-	-	63471.74

20. 01	OP	Paid invoice S.C. Folisol Trading	-	-	-	54838.80
23. 01	OP	Collected subsidy APIA	-	51034,15	-	-
30. 01	OP	Payment of invoice S.C. Porsche Inter Auto	-	-	-	112148.15
31. 01	Extras cont	Payment of bank fees				155.50
TOTAL MONTH 1			**-**	**381181,49**	**-**	**270932.87**

The authorized natural persons which keep single entry accounting do not draw up annual financial situations. The information on expenses, incomes and results is held in the Journal of receipts and payments.

CONCLUSIONS

Single entry accounting is a simplified accounting system, which is defined mainly by the following characteristics: it is an accounting based on highlighting receipts and payments; it does not work or operate such accounts; it requires simplicity and reduced workload; the number of documents and accounting records used is low compared to the double entry accounting; the number of tax statements mandatory to be submitted is low; verification balance or financial statements are not drawn up.

In general, PFA are liable for all assets as the natural persons. So, if there is a creditor of PFA, it may act also on PFA assets.

In order to avoid the risk of assets liability, PFA can separate the individual assets from PFA assets.

Although, according to the new accounting regulations [6], the natural persons which achieve incomes subject to taxation, in real system, from independent activities, assets leasing, if applicable, and those which achieve incomes from agricultural activities, forestry and fisheries, may organize double entry accounting by their option. The analyzed PFA proposed to maintain simple entry accounting.

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ORGANIC VITICULTURE - FOR WINE SECTOR DIVERSIFICATION OPPORTUNITY

Romeo Catalin CRETU, Petrica STEFAN, Dragoş-Marian MATEI

University of Agronomic Sciences and Veterinary Medicine - Bucharest, No. 59, Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax: +40213182888, Mobile: +40743.644.744, Emails: cretur omeocatalin@yahoo.com, stefanmarian2004@yahoo.com

Corresponding author: stefanmarian2004@yahoo.com

Abstract

Romania is part of the most important countries in the field of viticulture and wine production. According to statistics our country lies in the fifth place in Europe (after Spain, France, Italy, Portugal) and 11th place in the world (after the four countries mentioned above and the USA, China, Argentina, Chile, Turkey and Iran) [5],[21]. *The vine is mentioned in documents on this area since Dacians times. Major ancient historians wrote about wines from this part of world. The leader himself of the greatest Thracian state ever mentioned, Burebista, stopped cultivating vines due the problems created by the effect of the wine over his people. Linking these things: rich wine history and especially the tradition existing in all areas of the country where the vine is cultivated, we have a consistent picture of this beautiful and noble activities.*

Key words**:** *organic viticulture, Romania, turnover, wine production.*

INTRODUCTION

The wine market in Romania is an economic premise particularly important in the context of our country's integration into the socio-economic area and of the European Union. Taking into account the more resources we the Romanians can benefit, realistically appreciate that wine represents a good, in the same way that, at the level of the consumer, it is regarded as art, tradition, labour market, great thinkers and the philosophic for writers, linking creative manifestation and authors through the inspiration so hard to reach sometimes. What would the world be today without wine? More than just a consumer product, the wine represents a pillar of our society. "If the wine would disappear from human production, would be a vacuum in health and intelligence, an absence more appalling than all the excesses of which he is guilty." (Charles Baudelaire) Production and consumption techniques have evolved throughout history, civilizations and many technological advances. Surprising digital revolutions of the last years have not been the exception. Of course we cannot break the civilization and humanity. It can be said with certainty that it was and that still remains a staunch "ally" of good taste, culture of elitism, it integrates in solid mode, display of, without a doubt, inherent in any scientific, cultural events, sporting or creative human spirit. Its presence within the sacral-religious civilization presents us another facet of this eminently human product namely the identification with the springs the most intimate and sensitive human being [7].

In this context, the objective of the paper was to analyze organic viticulture and identify consumption of organic wines in Romania.

MATERIALS AND METHODS

The purpose of this paper is to identify the consumption of organic wines in Romania. For this purpose quantitative research was used to describe the behaviour of a population related to the studied matter, using quantification methods and statistical analysis in interpreting the results [10],[34].

The starting point for cross-sector success lies in existing conditions natural humus content, one high, ensuring sustained production, as

well as the crisis occurred after 1990 in the field of chemical fertilizers, this leading to their elimination. Part of financial impossibility to purchase chemical fertilizers as well as due to the ambiguous status of the people after the revolution in 1989, the "chemical removing" of soils occurred gradually creating the optimum conditions to practice this form of agriculture, like a niche, one in great fashion and highly sought after, especially due to favourable health effects arising from the consumption of organic products. Among the most important methods used in this purpose are: opinion of producers, surveys on the quality of wines, surveys on product sales and information and many more [2],[19],[20].

RESULTS AND DISCUSSIONS

The main producers of the wine market in 2016 according to turnover (>1,000,000 Euro)

In 2016, wine market value reached 218 Million Euro, being controlled by 25 manufacturers, whose turnover is at least 1 million Euros, representing between 45% - 49% of the total wine market in our country. Those are present every year in the competition to offer consumer the best wine deals and supplement the request through the diversification of market approach.

Table 1.The leading manufacturers of wine from Romania

Manufacturer	Turnover 2016 (mil.Eur)	No. ha	Turnover /Surface Euro	% Turnover Tot 25	% Total Turnover /Area
1. *Murfatlar Romania*	28.9	3,000	9,633	13.23	3.07
2. *Cotnari*	24.3	1,400	17,357	11.12	5.53
3. *Vincon Vrancea*	24	1,500	16,000	10.99	5.1
4. *Jidvei*	21	2,400	8,750	9.62	2.79
5. *Recas*	19.4	1,000	19,400	8.88	6.18
6. *Zarea*	12.1		-	5.54	0
7. *Angelli Spumante şi Aperitive SA*	11.5		-	5.27	0
8. *Cramele Halewood SA*	9.7	300	32,333	4.44	10.3
9. *Tohani SA*	9.1	500	18,200	4.17	5.8
10. *Vinexport Trade Mark SA*	7.1		-	3.25	0
11. *Senator Wine SRL*	6.5	850	7,647	2.98	2.44
12. *Ostrovit*	5.5	2,000	2,750	2.52	0.88
13. *Speed Husi SRL*	5.5	2,700	2,037	2.52	0.65
14. *Domeniul Coroanei Segarcea SA*	4.8	300	16,000	2.2	5.1
15. *Vinexport SA*	4.8		-	2.2	0
16. *Crama Ceptura SRL*	3.6	180	20,000	1.65	6.37
17. *Carl Reh Winery SRL*	3.6	252	14,285	1.65	4.55
18. *SERVE Ceptura SA*	3.5	110	31,818	1.6	10.13
19. *Casa de Vinuri Cotnari SA*	2.7	350	7,714	1.24	2.46
20. *Vinarte Total*	2.5	344	7,267	1.14	2.31
21. *Da Vino*	2	68	29,411	0.92	9.37
22. *Mera Com International*	1.8	200	9,000	0.82	2.87
23. *Vitipomicola Samburesti*	1.7	400	4,250	0.78	1.35
24. *Odobesti Vinex*	1.5	65	23,076	0.69	7.35
25. *Domeniile Sahateni*	1.3	76	17,105	0.58	5.4
TOTAL	218.4	17995			

Source: Ministry of public finance, financial Newspaper, www.crameromania.ro, sites, data processing [22], [27], [31], [33].

- The first category belong to one of the largest players in the market (Vincon, Murfatlar, Cotnari, Jidvei, Recaş), with between 9% and 13% of the total value produced by the 25 large manufacturers.
- The second category, more numerous, those with turnover between 5 and 10 million. A heterogeneous category including both manufacturers selling premium wine segment in the first instance and producer focuses on volume (Halewood, Princely House, Ostrovit, Slipcovers, New Delhi).

Finally, a last category belongs to those who subsist mainly on premium wine segment, HORECA distribution, and which is characterized by an orientation towards quality, trend what continues in the case of producers who are not included in this ranking

(the type of small wineries with less than 1 million euros turnover). Please note that large producers have developed production and marketing divisions of premium wines, but its share in the sum of their activity remains low compared to those one remember above. Much of the exports of wine can be found in the case of the 25 manufacturers present here and also a great deal of wine imports [23],[24],[28].

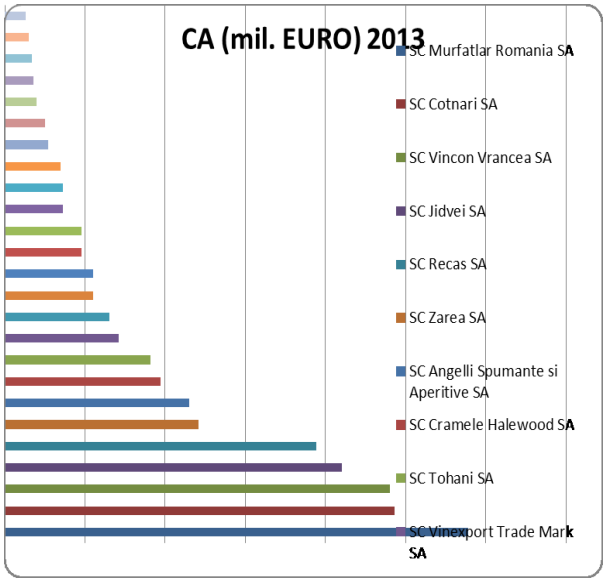

Fig. 1. Manufacturers' turnover in 2013
Source: data processing [12],[13],[14],35]

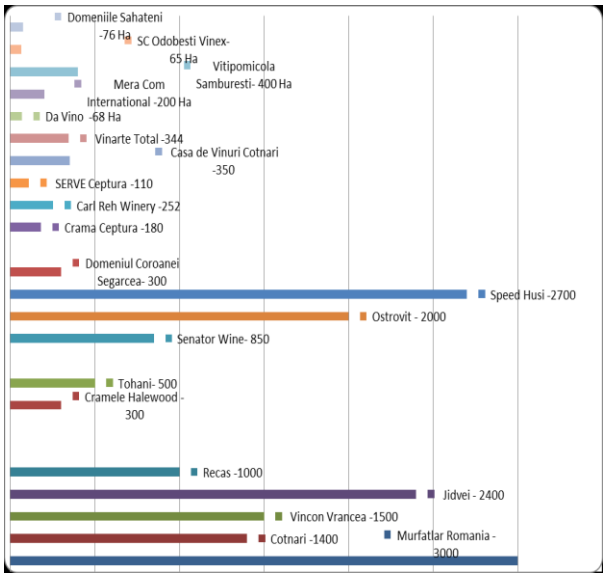

Fig. 2. Viticulture surface (no. Ha)
Source: data processing [12],[13],[14],35]

The chart helps us to highlight the ways in which access to European funding helps develop and strengthen the wine market. Those 25 producers sums of almost 18,000 ha. Most of them have received retraining programmes and replanting, and other funding programmes (SAPARD), making an eloquent calculation, we see that, through the reporting of aggregated turnover of their total area under vines owned, we get a sum of EUR 12,137/ ha [29],[30].

Proven efficiency is an example to follow and by other smaller producers. Of course, we have some of them who only process the wine, obtaining sparkling wine and special vermouth type, and other wine-based products. It is also interesting to point out that they control a market of about 45-50% of the total value of wine sold in Romania, although holding only 10% of the total area under vines of our country and only 20% of the area planted with noble vineyards [15],[16].

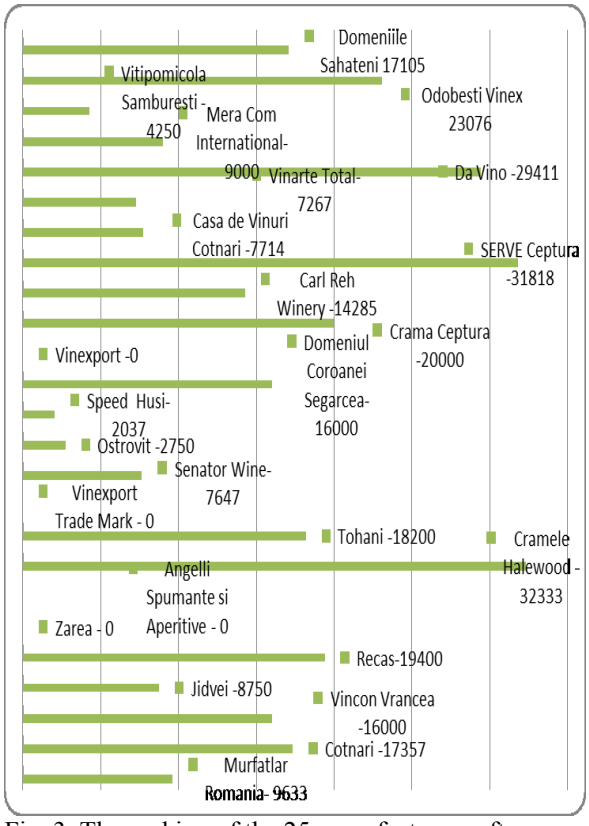

Fig. 3. The ranking of the 25 manufacturers after turnover (EURO/surface)
Source: data processing [12],[13],[14],35]

Figure 3 shows us another presentation of the 25 manufacturers present in this turnover ranking. Reporting of the total turnover of each producer, the number of hectares of vineyards owned by the same manufacturer, achieve some interesting results. Thus, with

the sum of 30,000 euros we find: Serve, Northampton and Da Vino, which is found on the premium segment of wine sold on the domestic market and each with vastly different vine-growing areas in size. Between 10,000 and 20,000 euros included: Murfatlar, Cotnari, Vincon, Recaş, Princely House, Carl Reh (Hussain), Săhăteni and Mera Com Domains (Gârboiu Cellar). We also have producers what are focused on segment of affordable wines and quantity or those who addresses aggressive price policy giving generous discounts [11].

The most appropriate way of opening an organic system is situated in the hilly and mountainous country and maximum ecological potential for agricultural production are between 10-15% of the total agricultural area. If in 2007 the eco market reached 2 millions euro, in 2014 reach over 200 millions euro, according to the website Bio Romania [17],[25].

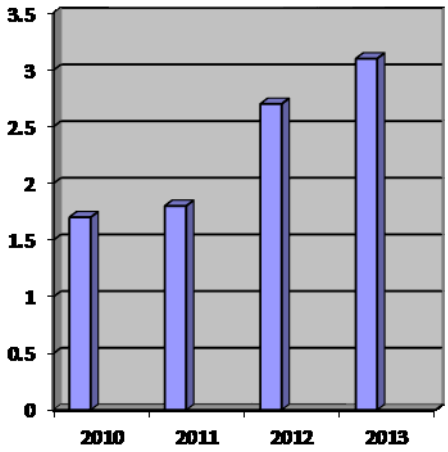

Fig. 4. Vineyards and orchards surfaces between 2010 and 2013
Source: data processing [12],[13],[14]

We can see from Fig.4. the existing situation in the bio from our country. In the year 2013 there is an area of 301,148 hectares, with a positive trend as regards the increase of the surface and the number of producers in the years to come. As regards the ecological living and established orchards, we note an increase every year, at the got into the study, with values from 1.69% of total organic area in 2010, from 3.12% of the total area of land bio in 2013. Vineyard, in 2014, there were 332 hectares certified organic, area which is between 0.19-0.18% of the surface of vineyards and orchards, and cumulative 0.11% of the total area under cultivation. The percentage of organic vineyards in the whole national wine stands at 0.18% [38].

Bio wine - In the universe of organic products, wines are special products, at the intersection of two markets - the organic products and the wines. The motivation for buying is different from that for other organic products. Sales channels and opportunities are globalized. This raises several questions to growers who are thinking about switching to organic farming. There is still much information to be centralized to understand the market for this type of product: the adjustment of supply and demand, prices, volumes available by product type and more others. Market development should be accompanied by an improvement in its observations on the operation - knowledge production, inventories, prices… Organic viticulture sector is one of the channels that recruits the most new entrants. The motivations of this conversion are manifold: coherence bio production and the production of local wine growers and consumer health protection, environment protection and water management, market attractiveness, aid for conversion. Public policies are favourable to biological viticulture. The increase in opportunities and support measures make this mode of production to become more attractive. From the 2012 harvest, a new phase has been overcome with the recognition and the possibility of using the term "organic wine", where the wine is made in compliance with European specifications. Until 1 August 2012, European legislation specifies bio production, biological production of grapes frame, but not winemaking, which is the reason for not talking about "organic wine", but about "wine produced from grapes bio". This time it was possible to use the term "biological wine" on their labels. Regulations implemented from 1 August 2012 establishes a series of rules in order to comply as much as possible real nature of the product, preserving at the same time, the diversity and quality of

wines produced from biological grapes [1], [11], [17].

Consumption of organic wine –

Regarding the consumption of "conventional" (traditional) wine, in Europe can be easily seen two major trends: a decrease in its main producing countries like France, Italy, Spain and growth or stagnation in the countries of northern Europe, USA and Japan. Regarding biological wines, however, this trend is totally different, blocking a general increase in all countries, even more important in northern countries than in the South [8], [36].

Bio wines know, lately an upward trend in European and global context. In the French market, for example, more than half of the wines of this type is sold directly from the grower to the consumer (36%) or through specialty bio stores (27%), it follow's the food hypermarkets (20%), wine merchants and other vendors and restaurant owners (17%).

This trend is reflected in several indicators: for example, in 2011, according to statistics, there were over 216,500 hectares of vineyards cultivated bio in the EU and in 2012, the first three growing areas bio in Europe have progressed: + 3% in Spain, + 6% in France and + 9% in Italy (Eurostat- organic crops). At the end of 2012 the area cultivated by organic standards represent 8.2% of French vineyards and the volume of organic wine sold in France was estimated at more than 855,000 HL in 2012, of which 60% sold in France and 40% exports with a value of 413 millions EURO [26].

Organic wine market

Market organization of import / export of wine differ in each country - some countries are strongly oriented towards export (Italy, France), others are big importers (Germany, Switzerland). This guidance is maintained in the case of biological wines. If organic wines are sold through the same channels as conventional ones, the relative importance of each varies. While organic wines are sold mainly in specialized stores or direct sales, especially, conventional ones can be found in supermarkets and even discounters. Biological development of the European wine is influenced by general market trends of wines. Consequently, no sector escapes the general debate on types of wines by the market and the opposition between traditional and modern wines (technological). Organic wine market is in rapid growth. This increase relates to all kinds and types of wines. The context is very favourable: stimulate consumer demand changes – the most important sales channels are for export, mainly to Germany. Specialized circuits are growing rapidly: selling through distribution chains is still underrepresented compared with conventional and market outlook varies by circuits and outlets. Differences in selling prices compared to conventional wines are important, but they illustrate and support differences in costs of production and yield. Several obstacles must be overcome in order to boost market: achieve reasonable sales prices for producers and attractive to buyers, adapting supply and demand clarification of the legal status of winemaking. Many winegrowers are increasingly are questioning the transition to organic viticulture. Bio wine market in recent years is growing. Reasons to move to this type of production are multiple: restricting the use of pesticides, direct financial aid granted for conversion, promotion campaigns for the consumption of bio products that help to stimulate demand. All indicators are positive, but one of them is still in a delicate situation: the retail market. There is a very strong consumer demand for quality products containing that protect both the environment and health. This is a sustainable trend of consumption [32], [37].

Quality of wines produced in biological viticulture has improved markedly in recent years, as evidenced by the numerous medals Bio wine producers participating in conventional wine competitions. The image is constantly evolving products, but customers expect the highest quality product. The market is growing internationally, with great prospects for trade (import-export) of bio wines.

The financial crisis does not seem to have slowed this development, although it is apparent a geographical redistribution of the export market in Germany represents an opportunity for the European BIO wines, especially those of the French. On the German

market there are several classes of consumers of bio wines: bio-typical consumer purchasing wines from specialized shops with new bio-products, consumers who frequent bio shops and buy these products, especially those for kids' range-wine enthusiasts, who buy wines for their quality. Other important markets for biological wines are: United Kingdom, Switzerland, Belgium, Luxembourg, the Netherlands, Scandinavia, North America and Japan. (Monique Jois, Hanna Sad, Otto Schmid, 2008) [3],[4],[18].

CONCLUSIONS

In conclusion, the transition from a niche market to one of great consumption will be achieved with the resolution of several issues:
- *Bio/conventional price* - agronomic risks inherent in biological wine growing how the culture can result in yield losses more important than in the conventional sector. The fixing of the selling price must be taken into account for these risks, as well as the increase in production costs in the system. At the same time, however, the difference between the price of a wine from organically and that of a conventional wine must remain reasonable to consumers attract. Current prices allow insurance costs, but nothing prevents their decrease if there is a minimum bid.
- *Adaptable offer-market* - quantities of bio-wine placed on the market are growing. This poses questions concerning the adjustment of demand and supply, the more so as this dynamic is becoming more widespread - an increase of supply to attractive prices may cause an increase in sales in the coming years [9].
Unfortunately, Romania barely manages to make the first 12 countries as its quantitative level of production of wine, due to oscillations of the recent years with undesirable effects. We overcome not only by countries with higher productive potential, but also of States lies at the level of our wine-growing areas or even in our wake. Thus, South Africa, Chile, Australia, New Zealand achieves higher yields, high quality and at a favourable level of their net costs, in comparison with the costs of our productions.

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ESTIMATIONS CONCERNING THE INCREASING OF THE WHEAT PRODUCTION IN PRAHOVA COUNTY

Daniela DANA[1], Irina-Adriana CHIURCIU[2], Valentina VOICU[3]

[1]Mihai Viteazul Technological Secondary-School, 17 Bucharest-Giurgiu, Calugareni, Giurgiu, Romania
[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Bucharest, Romania, irina.chiurciu@yahoo.ro
[3]National Research Institute for Soil Science, Agrochemistry and Environment Protection, 61 Marasti Blvd, District1, Bucharest, Romania

Corresponding author: irina.chiurciu@yahoo.ro

Abstract

The analysis aims to discover what methods can be applied such that the average of winter wheat production per ha would grow. The main objective of this study was to establish the mineral nutrition status of winter wheat in relation with the soil and climatic conditions in the SC Agrotehnic PAULESTI experimental plots. In order to evaluate the mineral nutrition status of plant, the macronutrients have been carried out when the plant, Renan cultivar, reached 4-5 cm height. The obtained data have been interpreted in relation with the optimum ranges of mineral content in dry matter mentioned in the specialty literature. Also, on the basis of soil data, the mineral fertilisation and lime recommendations have been established.

Key words**:** *wheat, mineral fertilisation, lime recommendations*

INTRODUCTION

In 2015, winter wheat crop covers about 36,803 ha, in Prahova County and the average production of wheat was 3,715 kg/ha. [3]
The yield increases can be considerably improved by a balanced fertilisation based on the periodical analysis of plant and soil fertility.
In these conditions, a good management concerning mineral and lime practices may be considered a main way to increase the yield of winter wheat crop. [2]

MATERIALS AND METHODS

For the study were taken and processed statistics from the National Institute of Statistics. The analysis of the production and marketing sector of winter wheat was based on a range of specific indicators, such as area cultivated with winter wheat; total production of winter wheat; average production per hectare of winter wheat.
In order to characterize the soil condition they were collected soil samples from 3 experimental parcels, in depth 0-20 cm, which were conditioned and analysed in agrochemical terms.
The plots belong to SC Agrotehnic SRL Paulesti, which is based in Prahova County and cultivates cereals.
The main analysis and determination made in soil samples were:
-soil reaction (pH), STAS 7184/13-88,
-humus total (Ht), STAS7184/21-82,
-total nitrogen (Nt), STAS 7184/285,
-exchangeable bases (SB), STAS 7184/12-88,
-hydrolytic acidity (Ah), the Kappen method,
-available phosphorus (P_{AL}) and available potassium (K_{AL}), STAS 7184/19-82, soils. In plant samples were carried out the following analytical determination of nutrient content: total N content by the Kjeldahl method, total P content by calcinations and colorimetric dosage with metavanadat and total K content by calcinations and dosing photometrically air-acetylene flame.
Analyses were carried out according to the Methodology ICPA ([4], [5]), and analytical data obtained were compared with some existing limits in specialty literature,

considered to be optimum.

RESULTS AND DISCUSSIONS

In 2015 the surface cultivated with wheat in South-Muntenia development region, in the private sector has increased by 4.88% compared to 2007, and in Prahova County with 43.64% in 2015 compared to 2007 (Table 1).

The largest area cultivated with wheat for South-Muntenia development region was recorded in 2009, of 638,938 ha, and the lowest in 2007 of 554,789 ha.

At Prahova county level, the highest wheat acreage was cultivated in 2014, of 38,567 ha, and the lowest in 2007 of 25,621 ha.

Table 1. Area cultivated with wheat in South-Muntenia Development Region and in Prahova county (ha)

	Property form	Year									2015/2007 (%)
		2007	2008	2009	2010	2011	2012	2013	2014	2015	
South-Muntenia Development Region	Private sector	554,789	608,911	638,938	625,996	595,788	632,570	594,367	587,186	581,873	104.88
Prahova County	Private sector	25,621	34,531	36,908	34,908	36,073	37,153	36,546	38,567	36,803	143.64

Source: National Institute of Statistics, Tempo-online, 2017; own calculations [3]

In Table 2 it is presented the evolution of wheat production for the private sector between 2007-2015. This recorded growths in 2015 compared to 2007, both in the Developing region, and in the County of Prahova.

Analyzing data in tables 1 and 2 it is noticed an increase in the total wheat production, although acreage does not register significant increases. This is because of the inputs used.

Table 2. Total wheat production in South-Muntenia Development Region and in Prahova county (tons)

	Property form	Year								
		2007	2008	2009	2010	2011	2012	2013	2014	2015
South-Muntenia Development Region	Private sector	691,254	2,149,755	1,485,800	1,637,340	2,276,356	1,687,009	2,240,005	2,199,886	2,350,185
Prahova County	Private sector	39,900	109,489	104,036	90,741	125,267	81,722	131,065	132,992	136,738

Source: National Institute of Statistics, Tempo-online, 2017 [3]

In terms of average production of wheat per ha, for the private sector (Table 3) in the same analyzed period, we observe significant increases of the values recorded due to the inputs used (224.15% for South-Muntenia Development Region and 138.60% for Prahova County).

Table 3. Average production of wheat in South-Muntenia Development Region and in Prahova county (kg/ha)

	Property form	Year									2015/2007 (%)
		2007	2008	2009	2010	2011	2012	2013	2014	2015	
South-Muntenia Development Region	Private sector	1,246	3,530	2,325	2,616	3,821	2,667	3,769	3,746	4,039	324,15
Prahova County	Private sector	1,557	3,171	2,819	2,599	3,473	2,220	3,586	3,448	3,715	238,60

Source: National Institute of Statistics, Tempo-online, 2017; own calculations [3]

To use the best methods that can be applied to increase average production per ha, have been made a series of ground tests in SC Paulesti SRL, on 3 Plots, as follows:

Soil agrochemical characterisation

In the SC Agrotehnic SRL Paulesti experimental plot, the soil reaction is very strong-extreme acid, Plot 1 - ph 4.75, Plot 2 - ph 4.4, Plot 3 - ph 4.79 (Figure 1); the hydrolytic acidity (Ah) is high, between 6.8 -

7.72 me/100 g soil (Fig. 2) and the sum of exchangeable bases had low values 5.59 - 6.92 me/100 g soil (Fig. 3).

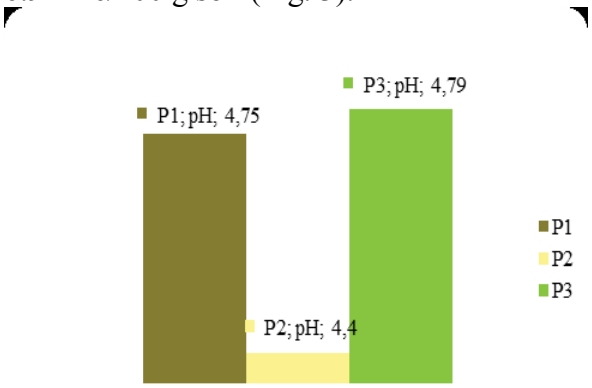

Fig. 1.Variation of pH in the experimental plots, SC Agrotehnic SRL Paulesti

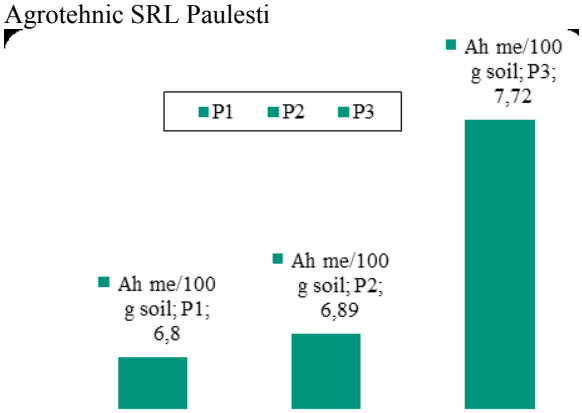

Fig. 2. Data regarding the hydrolytic acidity (Ah) in the experimental plots, SC Agrotehnic SRL Paulesti

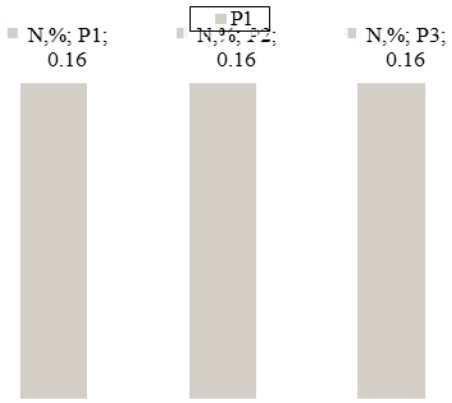

Fig. 3. Data regarding the sum of exchangeable bases (SB) in the experimental plots, SC Agrotehnic SRL Paulesti

The soil humus supply status is low (Fig. 4) and the soil nitrogen supply status is medium (Fig. 5).

The mobile phosphorus content is medium (Figure 6) and the mobile potassium content is low (Figure 7).

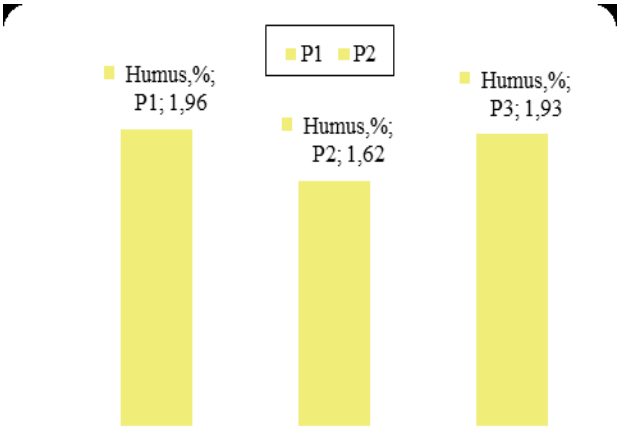

Fig. 4. Data regarding the humus content of soil in the experimental plots, SC Agrotehnic SRL Paulesti

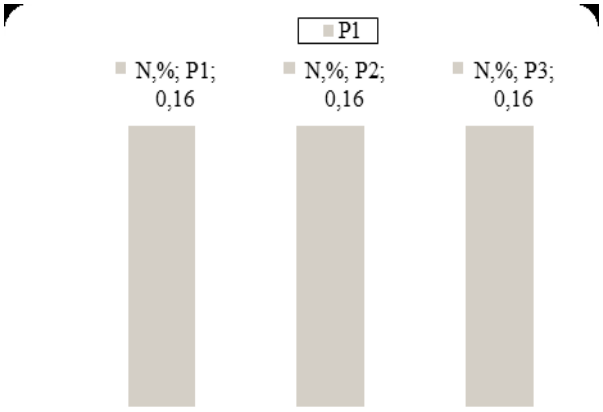

Fig. 5. Data regarding the total nitrogen content of soil in the experimental plots, SC Agrotehnic SRL Paulesti

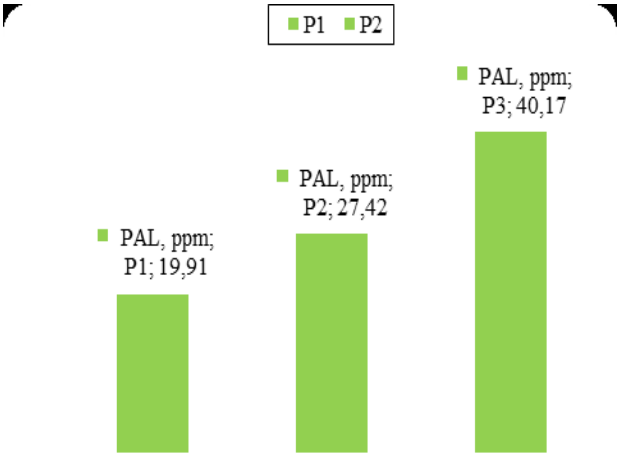

Fig. 6. Data regarding the mobile phosphorus content of soil in the experimental plots, SC Agrotehnic SRL Paulesti

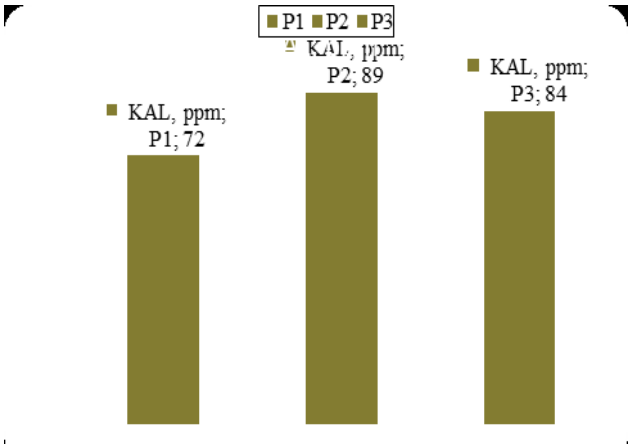

Fig. 7. Data regarding the mobile potassium content of soil in the experimental plots, SC Agrotehnic SRL Paulesti

The mineral nutrition status o winter wheat

The N and P content in dry matter vary in general, within optimal limit (Figure 8, Figure 9).

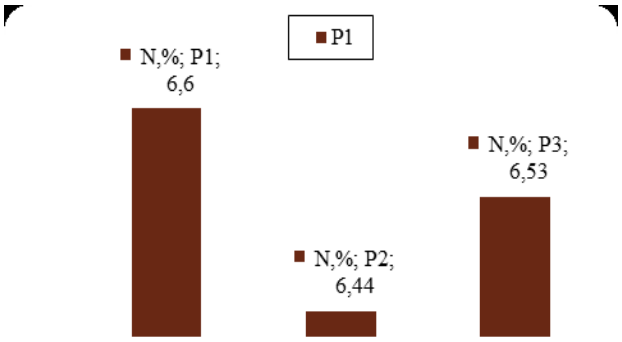

Fig. 8. Data concerning the nitrogen content in the aerial parts of winter wheat from experimental plots, SC Agrotehnic SRL Paulesti

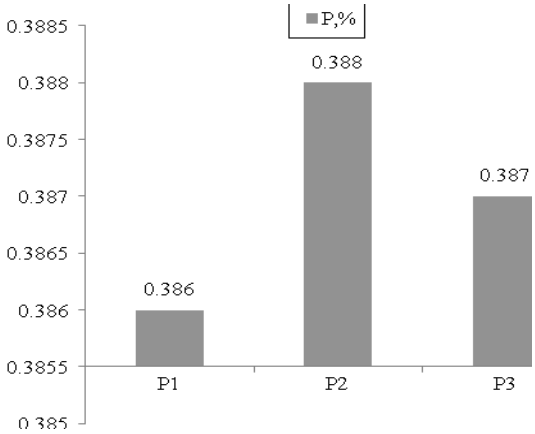

Fig. 9. Data concerning the phosphorus content in the aerial parts of winter wheat from experimental plos, SC Agrotehnic SRL Paulesti

The K content (Figure10) was below the lower optimal limit, 3.6% for K, which indicates a plant nutrition deficiency with this macronutrient [1].

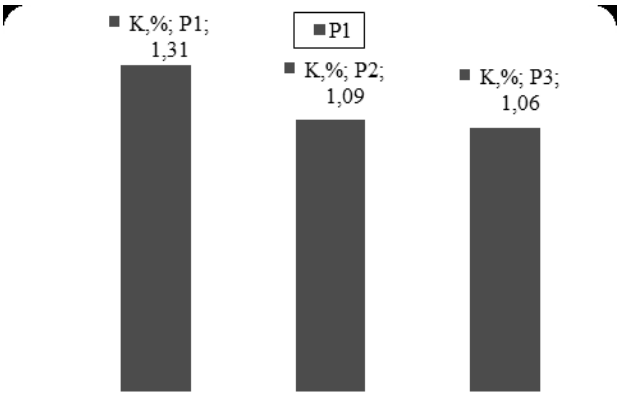

Fig. 10. Data concerning the potassium content in the aerial parts of winter wheat from experimental plots, SC Agrotehnic SRL Paulesti

The mineral fertilisation and liming recommendations for experimental plots in the SC Agrotehnic SRL Paulesti

The recommended fertilisers rates are calculated in relation to the available soil macronutrient content and expected yields (Table 4).

The liming recommendations are calculated in relation with base saturation degrees and sum of exchangeable bases (in ploughed layer, 0-25 cm) for field crops and perennial leguminous crops (Table 4).

Table 4. The fertilisation and liming recommendations for winter wheat in the experimental plots, SC Agrotehnic SRL Paulesti (expected yields 6 tons/ha)

Parcels	Available nutrient content from soil (kg/ha)			Recommended fertilisers rates (active ingredients/ha)			Liming rates ($CaCO_3$ t/ha)
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	
P 1	29	104	99	167	108	119	11
P 2	28	120	112	168	92	106	11
P 3	29	138	109	167	74	109	13

CONCLUSIONS

After analysis done on experimental plots of SC Agrotehnic SRL Paulesti, for winter wheat acreage in Prahova County having the same content available macronutrients in soil, the following recommendations were made to increase the average production per ha (expected yields 6 tons/ha):

- The application of nitrogen fertiliser in rate of 160 kg N/ha,
- The application of phosphorus fertiliser in rates of 70-100 kg P_2O_5//ha,
- The application of potassium fertiliser in rates of 100-120 kg K_2O/ha.

The lime rates vary between 11 and 13 t $CaCO_3$/ha in relation with soil reaction, initial base saturation degree and initial sum of exchangeable bases.

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MECHANISATION OF MEDIUM SOIL PLOUGHING ON FLAT TERRAIN 30 CM DEEP IN THE SOIL

Anișoara DUMA COPCEA, Radu ILEA, Casiana MIHUȚ

University of Agricultural Sciences and Veterinary Medicine of the Banat ,,King Michael I of Romania" Timisoara, 119, Arad Street, Romania, Phone: +4025627475, Fax: +40256200296, Emails: duma_anisoara@yahoo.com, ileaupc@yahoo.com, casianamihut@yahoo.com

Corresponding author: *duma_anisoara@yahoo.com*

Abstract

This paper presents the mechanisation technology of medium soil ploughing 30 cm deep in the soil given that the ploughing area is 100 ha (1000 m x 1000 m) and that the ploughing aggregate is made up of a Deutz Fahr 150 tractor and a LemkenEuropal – 4 reversible born plough. After choosing the movement direction, we identify the turning areas at the ends of the plot. At the beginning, the turning area is market by poles, and then we plough 6-8 cm deep. These marks point to the transport and working position of the plough. The turning areas are worked after the plot is ploughed.

Key words**:** *mechanisation, technology, exploitation Deutz Fahr*

INTRODUCTION

Plowing work is the oldest work that was applied to the soil and at the same time the most important work.

Ploughs fall into the category of agricultural machinery for soil and are designed to perform plowing, work through which is achieved the detachment of the ground in windrows, shredding and overthrow their depth being determined from the plowed soil layer, creating the conditions necessary for proper plant development .

They are also used for loosening soil (one of the most significant effects are achieved by plowing) and incorporation of crop residues in soil and organic fertilizer or chemicals.

Plowing is done by a loosening of the soil, the soil is incorporated in everything that exists on the surface and in depth structured remove surface soil; it is also used in weeds, diseases and pests control, and soil aeration is also done.

Plowing is assigned some drawbacks: it promotes soil erosion by water on sloping land, destroys soil structure when executed in adverse conditions of moisture and extra work is costly due to the large volume of soil that mobilizes him. [9]

In this context, the objective of the paper was to present the mechanisation technology of medium soil ploughing 30 cm deep in the soil given that the ploughing area is 100 ha (1,000 m x 1,000 m) and that the ploughing aggregate is made up of a Deutz Fahr 150 tractor and a LemkenEuropal – 4 reversible born plough.

MATERIALS AND METHODS

Exploitation parameters of the Deutz Fahr 150 tractor

The technical features of a Deutz Fahr 150 tractor (Figure 1) are:
Weight – 5700 daN
Power – 150 HP (112 kW)
Engine 100.6 – WT (displacement 6 l)
Nominal engine speed – 2300 rot/min
Maximum couple - 57 daNm
Tank capacity 230 l
Spins power outlet 1,000 rot/min.
Completely synthesised gearbox (redactor+inversor), 16 speeds ahead:
1-4L SR=0.36-0.82 km/h
1-4L=1.54-3.51 km/h
1-4N=4.6-10.54 km/h
1-4V=13.82-31.63 km/and 12 speeds back:
1-4L=1.54-3.51 km/h
1-4N=4.61-10.55 km/h
1-4 V=13.82-31.64 km/h

Technical features of the LemkenEuropal – 4 plough
The LemkenEuropal – 4 plough is a reversible born plough.
Its technical features are:
Weight – 4600 N
Body number – 4 double bodies
Working width – 1.2 m (30 cm/body)

Study on based energy.

Ploughing with a reversible plough is done after shuttle routes, with furrows oriented towards the same side of the plot. Ploughing depth is 30 cm.

The resistance force of a ploughing plough is:

$$R_{plug} = K_0 \cdot a \cdot b \cdot n = 5 \cdot 10^3 \cdot 0.3 \cdot 0.3 \cdot 4 = 1{,}800 \text{ daN},$$

where:

K_0 - specific soil resistance to ploughing on medium soil [daN/cm^2];
a - ploughing depth [cm];
b - working width of a body [cm];
n - number of bodies.

Working speed

By comparing the plough resistance to ploughing R_{plug} with the thrust F_t the tractor can develop, we choose the 2nd quick gear speed ($8.2\ km/h = 2.3\ m/s$) to plough.

Taking into account the sliding of the running gears ($\delta = 0.15\ \%$), the working speed is:

$$v_l = v_t(1-\delta) = 2.3(1-0.15) = 2\ m/s = 7.2\ km/h$$

Working capacity of the ploughing aggregate

The hourly real working capacity is calculated with the formula:

$$W_h^r = 0.1 \cdot B_l \cdot v_l \cdot K_s = 0.1 \cdot 1.2 \cdot 7.2 \cdot 0.8 = 0.75\ ha/h$$

The shift real working capacity is calculated with the formula:

$$W_{sch}^r = W_h^r \cdot T_s = 0.75 \cdot 8 = 6\ ha/sch\ .$$

RESULTS AND DISCUSSIONS

Calculus and making up the ploughing aggregates.

The technological exploitation chart of the ploughing aggregate (tractor Deutz Fahr 150 + born reversible plough LemkenEuropal – 4) contains the indices: working conditions (land features), cultivation requirements, aggregate features and aggregate preparation, land preparation, working organisation and quality control.

The working regime is established by taking into account engine and tractor load.

The chart also contains the most important organisation indices of the technological process (movement cycle duration, area ploughed, fuel consumption per ha).

The area to be ploughed is 1000 m x 1000 m (100 ha).

Working the land with the LemkenEuropal - 4 plough is done by moving the aggregates along linear routes (shuttle routes).

Preparing the land

This requires the following:

Checking and removing the causes that prevent the machines from working;

Identifying return areas and choosing the most efficient moving methods;

Dividing the land into plots and marking the line of the first turn.

Table 1. Exploitation indices of the tractor – plough aggregate Deutz Fahr 150 + LemkenEuropal – 4

Basic indices	Technological features	
Land features	Area to be ploughed	100 ha
	Plot length	1,000 m
	Land relief	flat
	Specific resistance	K0 = 5,000 daN/m^2
Technical requirements	Ploughing depth	30 cm
	Degree of plant waste incorporation	over 90%
Features of the aggregate and preparation	Working width	1.2 m
	Turning radius	5 m
	Adjustment of working depth	
	Adjustment of plough horizontality	
Land preparation	Width of turning radius	15 m
	Number of plots	4
	Marking control line with control furrow	
Work organisation	Hourly working capacity	0.75 ha/h
	Shift working capacity	6 ha/shift
	Fuel consumption	26 l/ha
	Movement pattern	shuttle route
Quality control	Measurement of working depth	Abatement: ±1 cm
	Control of plant debris incorporation	90%

Fuel consumption per ha C_{ha} is calculated

depending on the hourly consumption C_h^r and on the hourly real working capacity W_h^r:

$C_c = C_h^r / W_h^r = 35 : 0.75 = 26\ l/ha$

To plough 100 ha in 4 days, we need 4 ploughing aggregates.

Exploitation indices of the tractor – plough aggregate are shown in Table 1.

The technological mechanisation chart for ploughing contains the ploughing expenses per ha.

Expenses per ha are:

$C_S = C_m \cdot S = 2.66 \cdot 9 = 24$ RON/ha.

Fuel expenses C_c are established depending on the fuel consumption G_{ha} (l/working unit) and on fuel cost p_l (RON/l):

$C_c = G_{ha} \cdot p_i = 26 \cdot 5 = 130$ RON/ha

Expenses for the amortisation of the aggregate C_A are:

$$C_{Atractor} = \frac{V_i - V_r}{W_{sch}^r \cdot n_s \cdot n_z \cdot D} = \frac{45{,}000}{3 \cdot 250 \cdot 10} = 6$$

RON/ha

$$C_{Aplug} = \frac{V_i - V_r}{W_{sch}^r \cdot n_s \cdot n_z \cdot D} = \frac{7{,}000}{3 \cdot 250 \cdot 8} = 1.2$$

RON/ha

$C_A = 6 + 1.2 = 7.2$ RON/ha.

For the tractor, expenses for technical assistance are calculated with the formula:

$$C_{dttractor} = \frac{V_i \cdot G_{ha}}{C_n} = \frac{45{,}000 \cdot 26}{96{,}000} = 12.3$$

RON/ha

where:

V_i - inventory value (RON)

G_n - fuel consumption per service (l)

C_{ha} - fuel consumption per ha (l).

For the plough, technical assistance expenses are calculated with the formula:

$$C_{dtplug} = \frac{V_i}{W_n} = \frac{7{,}000}{2{,}000} = 3.5$$ RON/ha

where:

V_i - inventory value (RON)

W_n - work volume per service (ha).

Expenses for technical assistance of the aggregate are:

$C_{dt} = 12.3 + 3.5 = 15.8$ RON/ha.

Direct expenses per ploughed ha are:

$C_d = C_S + C_c + C_A + C_{dt} = 24 + 130 + 7.2 + 15.8 = 177$ RON/ha.

Table 2. Technological chart of ploughing mechanisation (expenses per ha)

Economic indices		**RON/ha**
Direct expenses, of which	C_d	**177**
- retributions	C_S	24.0
- fuel	C_c	130.0
-reduction in value	C_A	7.2
-technical assistance	C_{dt}	15.8
Auxiliary expenses	C_{ac}	**35**
TOTAL	C_T	**212**

Auxiliary expenses C_{ac} are expenses for main and auxiliary materials, for the storage and maintenance of the tractors and of agricultural machines. They are shown as percentage (15-20%) of direct expenses.

$C_{ac} = 0.2 \cdot 177 = 35$ RON/ha.

The total costs per ploughed ha are:

$$C_T = C_d + C_{ac} = 177 + 35 = 212$$

RON/ha.
Calculated technological indices are synthesised in the technological mechanisation chart of ploughing (Table 2).

CONCLUSIONS

Ploughing with a reversible plough is done after shuttle routes, with furrows oriented towards the same side of the plot.
Ploughing depth is 30 cm.
By comparing the plough resistance to ploughing R_{plug} with the thrust F_t the tractor can develop, we choose the 2nd quick gear speed ($8.2\ km/h = 2.3\ m/s$) to plough.
To plough 100 ha in 4 days, we need 4 ploughing aggregates.
Auxiliary expenses C_{ac} are expenses for main and auxiliary materials, for the storage and maintenance of the tractors and of agricultural machines. They are shown as percentage (15-20%) of direct expenses.

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MECHANISATION OF GRAIN MAIZE HARVESTING WITH SELF PROPELLED COMBINES

Anișoara DUMA COPCEA, Radu ILEA, Casiana MIHUȚ

University of Agricultural Sciences and Veterinary Medicine of the Banat ,,King Michael I of Romania" Timisoara, 119, Arad Street, Romania, Phone: +4025627475, Fax: +40256200296, Emails: duma_anisoara@yahoo.com, ileaupc@yahoo.com, casianamihut@yahoo.com

Corresponding author: duma_anisoara@yahoo.com

Abstract

The paper aimed to analyze the mechanization of grain maize harvesting using self propelled combines. The John Deere combine of the W series are highly powered, easy to maintain, effective from the point of view of fuel consumption, and available for a wide range of crops and working conditions. The main technical and functional features of John Deere combines of the W series are: Quick cutting, low height sowing platform. Working width between 4.3-10.7 m. Thresher equipped with a beater with 10 beating rails (Ø = 650 mm) ensuring full threshing and low grain breaking percentage. The shaker has a large separation area conferring full recovery of kernels and grains from the straws. The separation system is fed by helix converters avoiding the gliding of matter when harvesting on slope lands. Maize harvesting needs a large amount of labour and it needs to be done in the shortest time, particularly on the plots on which we cultivate winter cereals. There are three phases of ripening in the process of formation and maturation: Milk ripening; Yellow ripening; Full ripening with below 30% moisture. The calculus and making up of grain maize harvesting aggregates led to the conclusion that to ensure maximum working capacity and minimum fuel consumption, the combines must be ensured with the proper means of transport of the crop. The number of transportation should be correlated with hourly productivity and crop transport distances.

Key words: *mechanisation, combine, John Deere, maize, exploitation*

INTRODUCTION

Maize is one of the most important cereals and Romania. Maize cropping requires mechanized agricultural works.
Maize is harvested upon complete ripening when the grains contain below 30% moisture [3].
The process of formation and maturation of the maize gain lasts for about 50% of the vegetation period in maize and it covers three distinct phases: milk ripening, wax ripening, and full ripening. [1]
In this context, the purpose of this paper was to analyze the mechanization of grain maize harvesting using self propelled combines.

MATERIALS AND METHODS

The American company John Deere produces a wide range of self-propelled cereal harvesters for a wide range of farmers. [2]
Exploitation features of the John Deere W 550 combine features of the John Deere W 550 combine are shown in Table 1 below. [3]

Table 1. Exploitation features of the John Deere W 550 combine

THRASHER	
Beater diameter (mm)	660
Beater width (mm)	1400
Beating rails (N)	10
Standard range beater speed (rot/min)	450-980
Counter-beater size (mm)	750x1400
Post-beater diameter (mm)	400
Total thresher separation area (m^2)	1.50
Feeding flow of the thresher (kg/sec)	10
Beaters (N)	5
Beater length (m)	4.6
Shaker separation area (m^2)	6.4
Cleaning system	Dual-Flo
Ventilator speed (rot/min)	700-1525
Bunker volume (l)	8000
Worm download tipping (grades)	105
Bunker download flow (l/sec)	88
Straw chopping knives (N)	56 rotating, 54 stationary
ENGINE	
John DeerePowerTech Plus with 6 cylinders, turbo-compressor, air-air auxiliary cooling, Diesel	
Engine type	6068HZ482
Displacement (l)	6.8
Nominal speed	2400
Nominal power (kW/CP) ECE R120	202/275
Maximum power (kW/CP)	224/305
Maximum downloading auxiliary power (kW/CP)	22/30
Fuel tank capacity (l)	800
GEAR BOX	
Manual transmission 3 speeds	3 speed changes and mechanic break
Push Button Shift Transmission	3 speed changes and electric break

Source: Data sheet

Grain maize harvesting can be done when grain moisture is below 28%. [6]
After harvesting, maize grains dry down to 14-15% moisture. It is recommended to

harvest grain maize when grain moisture is below 17%. [5]
Harvesting is done with the straw cereal harvester. The header is replaced by a corn collector, and the wheat counter-beater in the thresher is replaced with a grain maize counter-beater.

RESULTS AND DISCUSSIONS

Maize was harvested as maize grains with a John Deere W 550 series combine equipped with a Capello 846 cob collector.
The technical features of the Capello 846 cob collector are:
Number of detachment sections – 8;
Distance between detachment sections – 75 cm;
Working width – 6 m;
Number of stem choppers – 8;
Number of chopping knives – 24 (8x3 per stem chopper);
Number of drawing rolls – 16;
Number of detachment plates – 16 (with hydraulic adjustment);
Number of conveyors – 16. The Capello 846 cob collector is operated by the cardan transmission of the John Deere W550 combine. The distance between the detachment plates is adjusted hydraulically depending on the thickness of the maize stems and of the cobs so that the stems may easily go through the plates and the cobs be prevented from passing and be detached from the stems. The stems are drawn by the rolls and chopped, while the cobs are carried by the conveyors to the thresher.
The hourly working capacity of the combine is determined with the formula:

$$W_h^r = \frac{3{,}600 \cdot q \cdot K_s}{m_b \cdot (1+\delta_p)} [ha/h]$$

where:
q - feeding flow of the thresher, given that the theoretical flow is $q = 10\,kg/s$ under normal working conditions and minding loss reduction, the real feeding flow is $q = 8\,kg/s$;
K_s - the time use coefficient $K_s = 0.80$;
m_b - grain volume per ha $m_b = 8000$ kg/ha;
δ_p - ratio between stalk volume and grain volume.
By replacing the data in the formula above, we get:

$$W_h^r = \frac{3{,}600 \cdot q \cdot K_s}{m_b \cdot (1+\delta_p)} = \frac{3{,}600 \cdot 8 \cdot 0{,}8}{8{,}000 \cdot (1+0{,}44)} = 2\ ha/h$$

The combine working capacity for a production of 8,000 kg/ha is 16 t/h, which means that the daily working capacity is 128 t/day or 16 ha/day. An area of 100 ha is harvested in 6 days.
Working speed is correlated with the feeding flow and working width.
Working width is 5.6 m (8 x 0.7). Taking into account the ratio between stalk volume and grain volume, the material weight 0.9 kg/m^2. For a real flow of 8 kg of material per second, the working speed of the combine should be 1.5 m/s, i.e. 5.4 km/h. Therefore, the working speed of the combine ranges between 5 and 6 km/h if we need to maintain the feeding flow constant.
Fuel consumption per ha is determined with the formula:

$$C_{ha} = \frac{\lambda_c \cdot C_{hn}}{W_h^r} = \frac{0.86 \cdot 56}{2} = 24\ l/ha.$$

where:
C_{hn} - hourly engine fuel consumption in nominal regime (56 l/h);
λ_c - correction coefficient taking into account engine load (0.86).
Fuel consumption is 3 l/t.
Production costs consist in indirect and direct expenses.
Direct expenses C_d are calculated with the formula:

$$C_d = C_S + C_c + C_A + C_{dt}$$

where:
C_S - remuneration expenses;
C_c - fuel expenses;
C_A - amortization expenses;
C_{dt} - aggregate technical service expenses.
Remuneration expenses depend on hourly wages S_h and on hourly productivity. A combiner's wages is about 4,000 RON/month for 22 working days per month, i.e. 176 h/month, which corresponds to an hourly

tariff of 22 RON/h.

Remuneration expenses per ha are:

$C_S = \frac{22\ lei/h}{2\ ha/h} = 11$ RON/ha, i.e. 1.25 RON/t.

Fuel expenses C_c are established depending on fuel consumption G_{ha} (l/working unit) and on fuel cost p_l (RON/l):

$C_c = G_{ha} \cdot p_i = 24 \cdot 5 = 120$ RON/ha, i.e. 15 RON/t.

Amortization expenses C_A are calculated taking into account the initial value of the combine V_i (546,000 RON), the residual value of the combine V_r (6,000 RON), the shift working capacity W_{sch}^r (20 ha), the number of shifts n_s, the number of working days per year n_z and the use duration D (10 years):

$C_A = \frac{V_i - V_r}{W_{sch}^r \cdot n_s \cdot n_z \cdot D} = \frac{546{,}000 - 6{,}000}{20 \cdot 1 \cdot 90 \cdot 10} = 30$

RON/ha, i.e. 3.75 RON/t.

Aggregate technical assistance expenses C_{dt} consist in technical maintenance expense, technical review expenses, and repair expenses. These expenses are determined for the entire use duration of the combine.

Aggregate technical assistance expenses are calculated with the formula:

$C_{dt} = \frac{V_i \cdot G_{ha}}{C_n} = \frac{546{,}000 \cdot 18}{650{,}000} = 15$ RON/ha, i.e. 2 RON/t.

where:

G_n - fuel consumption for the sue duration (650,000 l).

Direct expenses per harvested ha are:

$C_d = C_S + C_c + C_A + C_{dt} = 11 + 120 + 30 + 15 = 176$ RON/ha.

$C_d = C_S + C_c + C_A + C_{dt} = 1{,}25 + 15 + 3{,}75 + 2 = 22$ RON/t.

Auxiliary expenses C_{ac} are expenses for main and auxiliary materials, for the storage and conservation of agricultural machines. They are calculated as percentage (15-20%) of direct expenses.

$C_{ac} = 0.18 \cdot 176 = 32$ RON/ha, i.e. 4 RON/t.

Total expenses for the harvesting of 1 ha of maize are:

$C_T = C_d + C_{ac} = 176 + 32 = 208$ RON/ha, i.e. 26 RON/t.

Calculated technological indices are synthesised in the technological mechanisation chart of the grain maize harvesting operation.

CONCLUSIONS

Well organising grain maize harvesting by completely using the working time, by avoiding useless stops and useless movements, by using machines at their full potential and by observing specific fuel consumption asks for the proper plot working with the best method.

Useless movements of the machines occurs while turning at the end of the plots. Combine bunkers should be downloaded while working to prevent the decrease of daily productivity because of the stops.

To ensure continuous functioning, we need to ensure proper technical assistance (mobile workshop) for maintenance and repairs. It is extremely important to do the maintenance on a daily basis to avoid machine damage and stops. The failures occurring during work should be fixed in the shortest time possible.

It is recommended that the engine work at maximum speed to ensure proper functioning of the thresher.

To use the working time optimally, we need to take into account the correlation of the number of combines and the areas to be harvested, combine productivity and production per ha. This is particularly important during the short harvesting period when we need to avoid combine movement from one plot to another during the day, when harvesting is possible.

To increase the period of combine use, we recommend the cultivation of plant cultivars with different ripening phases; to reduce losses, we recommend the cultivation of fall-resistant crops.

During work, we need to correlate the moving speed with the state of the field so that the thresher be fed at optimum, constant levels to ensure maximum productivity and minimum

loss.

To ensure maximum working capacity and minimum fuel consumption, the combines will be ensured with the proper means of transport of the crop. The number of transportation means should be correlated with hourly productivity and crop transport distances.

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STUDY ON THE PROCESS OF ANAEROBE DIGESTION OF BIOGAS IN A BIOGAS PLANT

Mariana DUMITRU

Lucian Blaga University of Sibiu, 10 Victoriei Boulevard, 550024, Sibiu, Romania, Phone/Fax: +40-(269) 21.60.62, E-mail: mariana.dumitru@ulbsibiu.ro

Corresponding author: mariana.dumitru@ulbsibiu.ro

Abstract

The biomass resources existing all over the world can give us an idea of the global potential of biogas production, which is still not exploited to its full capacity, especially in our country. Biogas has proven in many countries its big potential as an alternative source of energy, being used on a large scale. In this study, we analysed the biochemical process of anaerobe digestion of biogas, because it is one of the most important processes which take place in a biogas plant. Agricultural biogas production provides agricultural, economic and environmental benefits and for this reason, the promoters of the biogas development in Europe, especially after the oil crisis, were the organic farmers, interested in anaerobe digestion, not only for renewable energy generation, but as a way to improve fertiliser quality of their animal manure.

Key words**:** *biogas, anaerobe digestion, anaerobe digestion parameters, digestate*

INTRODUCTION

In our days, using of alternative fuels is more and more a constant preoccupation of researchers all over the world, and within this trend, biogas proves that it is a reliable source of energy [11]. In Table 1 is presented the present and future ponder of alternative fuels in the world.

Table 1. Planned ponderance of alternative fuels

	2010	**2015**	**2020**
Biofuels	6 %	7 %	8 %
Natural gas	2 %	5 %	7 %
Hydrogen	0 %	2 %	5 %
TOTAL	8 %	14 %	20 %

Source: [7]

In a biogas plant, a very important process is that of anaerobe digestion, which is a microbiological process of decomposition of organic matter in absence of oxygen. The main products of this process are biogas and digestate. Biogas is a combustible gas, consisting mainly of methane and carbon dioxide. Digestate is the decomposed substrate, resulted from the production of biogas [5].
During anaerobe digestion, very little heat is generated in contrast to aerobic decomposition, in presence of oxygen, like it is the case of composting. The energy, which is chemically bounded in the substrate, remains mainly in the produced biogas, in form of methane.
The process of biogas formation is a result of linked process steps, in which the initial material is continuously broken down into smaller units. Specific groups of micro-organisms are involved in each individual step [3]. These organisms successively decompose the products of the previous steps.

MATERIALS AND METHODS

In this study, we analysed the biochemical process of anaerobe digestion of biogas in a biogas plant, observing the characteristics of all the main steps of this process.
The simplified diagram of the anaerobe digestion process, highlights the four main process steps: hydrolysis, acido-genesis, aceto-genesis, and methane-genesis [3]. The process steps quoted in Figure 1, run parallel in time and space, in the digester tank. The speed of the total decomposition process is determined by the slowest reaction of the chain. In the case of biogas plants, processing vegetable substrates containing cellulose,

hemi-cellulose and lignin, hydrolysis is the speed determining process. During hydrolysis, relatively small amounts of biogas are produced. Biogas production reaches its peak during methane –genesis [1].

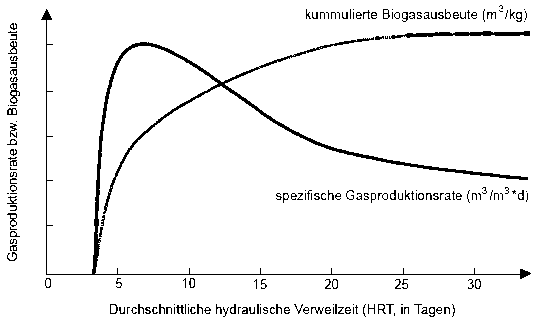

Fig. 1. Biogas production after addition of substrate – batch test
Source: [8]

Hydrolysis

Hydrolysis is the first step of anaerobe digestion, during which the complex organic matter is decomposed into smaller parts. During hydrolysis, polymers like carbohydrates, lipids, nucleic acids and proteins are converted into glucose, glycerol, purines and pyridines [4].

A variety of microorganisms is involved in hydrolysis, which is carried out by exo-enzymes, produced by those microorganisms which decompose the undissolved particulate material. The products resulted from hydrolysis are further decomposed by the microorganisms involved and used for their own metabolic processes.

Acidogenesis

During acidogenesis, the products of hydrolysis are converted by acidogenic (fermentative) bacteria into methanogenic substrates. Simple sugars, amino acids and fatty acids are digestioned into acetate, carbon dioxide and hydrogen (70%) as well as into volatile fatty acids) and alcohols (30%).

Acetogenesis

Products from acidogenesis, which can not be directly converted to methane by thanogenic bacteria, are converted into methanogenic substrates during acetogenesis. Volatile fatty acids and alcohols are oxidised into methanogenic substrates like acetate, hydrogen and carbon dioxide. Volatile fatty acids, with carbon chains longer than two units and alcohols, with carbon chains longer than one unit, are oxidized into acetate and hydrogen [3]. The production of hydrogen increases the hydrogen partial pressure. This can be regarded as a „waste product“ of acetogenesis and inhibits the metabolism of the acetogenic bacteria. During methanogenesis, hydrogen is converted into methane. Acetogenesis and methanogenesis usually run parallel, as symbiosis of two groups of organisms.

Methanogenesis

The production of methane and carbon dioxide from intermediate products is carried out by methanogenic bacteria. 70% of the formed methane originates from acetate, while the remaining 30% is produced from conversion of hydrogen (H) and carbon dioxide (CO_2), according to the following equations [3]:

$$\text{Acetic acid} \longrightarrow \text{Methane} + CO_2$$
$$H + CO_2 \longrightarrow \text{Methane} + \text{Water}$$

Methanogenesis is a critical step in the entire anaerobic digestion process, as it is the slowest biochemical reaction of the process. Methanogenesis is much influenced by operation conditions. For example, composition of feedstock, feeding rate, temperature, and pH are factors influencing the methanogenesis process. Also, factors as digester overloading, temperature changes or large entry of oxygen can result in termination of methane production.

RESULTS AND DISCUSSIONS

Anaerobe digestion parameters

The efficiency of anaerobe digestion is influenced by some critical parameters, thus it is very important that appropriate conditions for anaerobic microorganisms are provided. The growth and activity of anaerobic microorganisms is significantly influenced by conditions such as exclusion of oxygen, constant temperature, pH-value, nutrient supply, stirring intensity as well as presence and amount of inhibitors (e.g. ammonia). The methane bacteria are fastidious anaerobes, so

that the presence of oxygen into the digestion process must be strictly avoided.

Temperature

One of the most important parameter in the anaerobe digestion process is temperature, that is why measuring the temperature values in the different stages of the process is essential. The anaerobe digestion process can take place at different temperatures, divided into three temperature ranges: psychrophilic (below 25^0 C), mesophilic (25^0C –45^0C), and thermophilic (45^0C – 70^0 C). There is a direct relation between the process temperature and the Hydraulic retention time (Table 2).

Table 2. Thermal stage and typical retention times

Thermal stage	Process temperatures	Minimum retention time
Psychrophilic	< 25 °C	70 to 80 days
Mesophilic	30 to 42 °C	30 to 40 days
Thermophilic	43 to 55 °C	15 to 20 days

Source:[2]

The temperature stability is decisive for anaerobe digestion. In practice, the operation temperature is chosen with consideration to the feedstock used and the necessary process temperature is usually provided by floor or wall heating systems, inside the digester. Figure 2 shows the rates of relative biogas yields, depending on 2 factors: temperature and retention time.

Many modern biogas plants operate at thermophilic process temperatures , as the thermophilic process provides many advantages, compared to mesophilic and psychrophilic processes, such as:

-effective destruction of pathogens

-higher grow rate of methanogenic bacteria at higher temperature

-reduced retention time, making the process faster and more efficient

-improved digestibility and availability of substrates

-better degradation of solid substrates and better substrate utilisation

-better possibility for separating liquid and solid fractions.

The thermophilic process has also some disadvantages:

-larger degree of imbalance

-larger energy comsumption, due to high temperature

-higher risk of ammonia inhibition

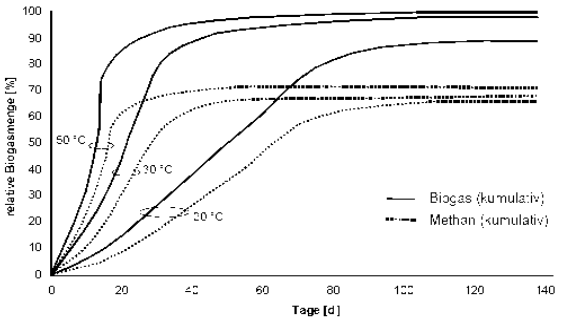

Fig. 2.Relative biogas yields, depending on temperature and retention time

Source: [8]

Table 3. Parameters for evaluation of a biogas plant

Parameter	Unit	Symbol	Determination
Temperature	T	°C	Measurement during operation
Operational pressure	P	mbar	Measurement during operation
Capacity, throughput	V	m3/d; t/d	Measurement
Reactor volume	VR	M^3	Determined by construction
Gas quantity	V per day/ year	m3/d; m3/a	Measurement during operation and conversion to Nm3
Retention time (hydraulic, minimum guaranteed)	HRT MG RT	d	Calculation from operating data
Organic anaerobe digestion		kg oTS / (m3 * d)	Calculation from operating data
Methane concentration in biogas	CH4	%	Measurement during operation
Specific biogas yield		%	Calculation from operating data
Specific biogas production		m3 / m3	Calculation from operating data
Plant efficiency	η	%	Net energy drawn from gross energy
Specific treatment costs		€/m3 Input; €/GV	Calculation

Source: [7]

CONCLUSIONS

After observations made on the anaerobe process which take place in biogas plant, we can conclude, among other, that operation temperature influences the toxicity of ammonia. Ammonia toxicity increases with increasing temperature, and can be relieved by decreasing the process temperature. However, when decreasing the temperature to 50°C or below, the growth rate of the

thermophilic microorganisms will drop drastically, and a risk of washout of the microbial population can occur, due to a growth rate lower than the actual hydraulic retention time. This means that a well functioning thermophilic digester can be loaded to a higher degree or operated at a lower Hydraulic retention time than an mesophilic one, because of the growth rates of thermophilic organisms (Fig. 3).

Experiences shows that at high loading or at low Hydraulic retention time, a thermophilic operated digester has higher gas yield and higher conversion rates than a mesophilic digester.

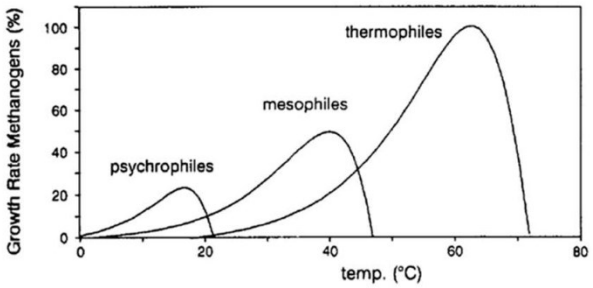

Fig. 3. Relative growth rates of methanogens
Source:[2]

Also, we may conclude that the viscosity of the anaerobe digestion substrate is inversely proportional to temperature. This means that the substrate is more liquid at high temperatures and the diffusion of dissolved material is thus facilitated. Thermophilic operation temperature results in faster chemical reaction rates, thus better efficiency of methane production, higher solubility and lower viscosity.

The higher demand for energy in the thermophilic process is justified by the higher biogas yield. It is important to keep a constant temperature during the digestion process, as temperature changes or fluctuations will affect the biogas production negatively. Thermophilic bacteria are more sensitive to temperature fluctuation of +/-1°C and require longer time to anaerobe digestion apt to a new temperature, in order to reach the maximum methane production. Mesophilic bacteria are less sensitive. Temperature fluctuations of +/-3°C are tolerated, without significant reductions in methane production.

These considerations are also usefull in waste management [9], which it is known to be an important source from which biogas results.

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EFFECT OF LIVELIHOOD DIVERSIFICATION ON FOOD SECURITY STATUS OF RURAL FARM HOUSEHOLDS IN ABIA STATE NIGERIA

Raphael Ndubuisi ECHEBIRI, Chigozirim Ndubuisi ONWUSIRIBE, Daniel Chinedu NWAOGU

Michael Okpara University of Agriculture Umudike, Abia state, Nigeria, Department of Agricultural Economics, Department of Agribusiness and Management, Phone: +2348063425721. Email: danielchinedu32@gmail.com

Corresponding author: danielchinedu32@gmail.com

Abstract

This paper examined livelihood diversification as a survival strategy and a means to escape food insecurity among rural farm households in Abia state. Although still of central importance, farming on its own is increasingly unable to provide a sufficient means of survival in rural areas thus necessitating the need for diversification. Food security condition was not much improved as about 67% of the households were unable to meet their daily food energy requirement with 8% of relative deficiency. The logit regression result showed that diversification was influenced by household size, amount of credit received, education of the household head, cooperative membership and monthly income while food security status was influenced by years of education of household head, credit access, monthly income, age of household head and household size. Rural farmers should be encourage to participate in varied income generating activities in both agriculture and nonagricultural ventures to enhance their income and break the vicious cycle of poverty and impoverishment. The provision of soft loans at reduced interest prices will catalyze involvement in non-farm income generating activities thereby creating a boost in household income and consequently, welfare.

Key words**:** *diversification, food security, livelihood, income, welfare*

INTRODUCTION

The prevalence of non-agricultural activities in rural Africa dates back in the literature as far as the 19th century [6] with studies over the past 15 years highlighting the increasing importance of non-agricultural sources of income to rural dwellers. The focus on livelihood diversification necessarily implies a process, a simple scope targeted at broadening of income and livelihood strategies away from purely crop and livestock production towards both farm and non-farm activities that are undertaken to generate additional income via the production of other agricultural and nonagricultural goods and services, the sale of waged labor or self-employment in small enterprises [14]. This clearly posits the economic grounds of livelihood diversification. Whilst much of the literature defines 'diversification' in terms of productive activities or income, the introduction of the concept of 'livelihoods' has broadened the debate to include "the process by which rural families construct a diverse portfolio of activities and social support capabilities in their struggle for survival and in order to improve their standard of living" [11]. Aside from the wider concept beyond income that includes both cash and in-kind income, social institutions and access to social and public services, the stress on process and thus dynamic change reflects the fluid and multi-faceted domain in which farm and non-farm based activities combine and compete.

The way a household copes with and withstands economic shocks depends on the options available in terms of capabilities, assets (including both material and social resources) and activities, i.e., on the household livelihood strategy [8, 11]. This implies that households will behave in dissimilar ways with respect to income generation and livelihood standards in entirety. In fact, households belonging to different socio-economic groups have different strategies to earn their own living

which, in turn, may ensure different levels of resilience to food insecurity. As a result, households belonging to different socioeconomic groups (for example, a farmer's household vs. a household whose main income source is public sector employment) require different interventions. Policymakers should tailor their national food security strategies in order to account for the different needs of the population. Comprehending the driving factors of each livelihood strategy is therefore crucial for improving the response mechanisms related to food insecurity and poverty in developing countries. This link provides a strong basis for judgment in conceptualizing the issues of livelihood diversification and food security especially in rural areas.

Traditionally, most research in the field of food security has focused on the development and refining of the methods of analysis chosen to predict more accurately the likelihood of experiencing future loss of adequate food, i.e., vulnerability to food security [14], more recently, a new concept has been proposed, i.e., resilience to food insecurity [2], that is the ability of the household to maintain a certain level of well-being (for example, food security) withstanding shocks and stresses, depending on the options available to the household to make a living and its ability to handle risks. Many studies have also found diversification to be increasing rapidly in some regions of the world. The conventional picture of the small farmer sustaining themselves off of their crops is no longer in accords with reality. Peasants are also traders, craftsmen, entrepreneurs, migrant workers, animal raisers and wage laborers. Some people pursue diversification activities to cope with insecurity and spread risks, while others are motivated by income accumulation. Whatever be the case, it becomes of great necessity to quantitatively link these economic variables with a functionality view of generating more potent and environment specific measures whose adoption can settle the ravaging effect of food insecurity in the study area. This interest in diversification in Nigeria (especially in Abia state illustrates not only the current reality that many rural households are engaged in a diverse set of livelihood activities, but also that despite the reliance on agriculture as the driving force of the rural economy, food security is yet to be achieved. In view of this dependency on agriculture and the concomitant level of rural poverty and food insecurity, investigations into the nature of livelihood diversification also clearly reflect the desire to understand better whether promoting diversification offers potentials for livelihood enhancement and poverty reduction or not.

MATERIALS AND METHODS

This research work was carried out in Abia State, Nigeria. The state lies between the latitude 50 03^{o}N to 50 07^{o} and longitude 70 17^{o}E to 70 24^{o}E and it is located in the tropical rainforest zone of Nigeria. Being close to the equator, the zone experiences almost no variation in temperature across the year. The climate is consistently hot with maxima typically being about 31^{o}C and minima around 24^{o}C with evenly distributed rainfall in moderate manner ranging from 2000mm to 2500mm annually [7]. The state covers a land area of 5,243.7 square kilometers. It has a total population of 2,845,380 comprising 1,430,298 males and 1,415,082 females [17]. The people are land resource dependent and produce crops like oil palm, melon, cocoa, maize, yam, cassava, okro, banana, plantain, etc. as well as livestock. Other livelihood option includes carpentry, gardening, wage services etc.

Data collection and analysis

Primary data were used for this work, generated with the use of questionnaires from 120 households. Simple descriptive tools like tables, means and frequencies as well as inferential tools like logit regression and FGT models were employed in the data analyses.

Model Specification

The logit model for factors affecting the choice of various livelihood strategies is given as:

$Li = Ln (Pi /1-Pi) = Zi = b_o + b_1x_1 + b_nx_n + e$

where:

Z = log of odds

Pi = Involvement in livelihood options other

than farming (1)
1-Pi = otherwise (0
X_1 = Age of household head (Years)
X_2 = Household size
X_3 = Credit volume accessed (₦)
X_4 = Years of education
X_5 = Cooperative membership
X_6= Income (₦)
b_1-b_6 = coefficients of parameters
e = error term

The data collected were subjected to descriptive statistics and econometric analyses such as Foster, Greer and Thorbeck index of food insecurity and binary logit regression. A separate food insecurity line was developed for the area. To achieve this, the cost of basic need method as proposed by Revalion and Bidani was used. This is mostly done through identifying the food insecure 50% of the sample population as a reference group with the assumption that in study area, the food insecure part of society is above 50%. The food consumption behaviour of the reference group is accessed to determine the average quantities in per adult equivalent of basic food items that makeup the reference food basket. In this case, the basket makes up of the mean consumption levels (purchase, remittance and food aid) of basic food items. The calorie value of each food items is constructed from the World Health Organization food nutrition table. The total calorie obtained from consumption of this basket of average quantity per adult by an individual is:

$$\sum_{i}^{qi} Ki = T^* \quad \text{.....(1)}$$

$T \approx T^*$, but $T \neq T^*$. Here T^* is total calorie obtained by individual adult from consuming the average quantities, qi is average quantity per adult of food item i consumed by individual, Ki the caloric value of the respective food item i consumed by individual adult and T is recommended consumed calorie per day per adult for Nigeria, i.e. 9,210 kJ = 2,200 kcal.

The average quantity per adult of each food item scales up and down by a constant value T/T^*
so as to provide total of 9,210 kJ = 2,200 kcal per adult per day before doing any activities.

Then, multiply each food items after scaling up and down by the median price and sum up to get a food insecurity line.

A household was then considered food secure or insecure if the daily recommended calorie was equal or above and below the food insecurity line respectively. The degree of food insecurity was estimated using the Foster, Greer and Thorbeck (FGT) equation shown as:

$$P\alpha = \frac{1}{N} \sum_{i=1}^{q} \left(\frac{z-y1}{z}\right)^{\alpha} \text{..... .....(2)}$$

where:
α is the degree of food insecurity with values of 0, 1 and 2 for headcount, short-fall and severity of food insecurity, respectively. Furthermore, N is total number of sample households, q the number of food insecure households, Z is the cutoff between food security and insecurity and yi is the measure of per adult equivalent food calorie intake of the ith household.

To examine the effect of demographic and socio economic characteristics on food insecurity and the probability of household being food insecure, the logit model will be adopted and specified as:

$$Li = \ln \frac{P(Yi = 1)}{1 - P(Yi = 1)} = Zi \text{ ....(3)}$$

$$Zi = b_1X_1 + b_1X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + u \text{ ....(4)}$$

where:
X_1 = Age of household head (Years)
X_2 = Household size
X_3 = Food aid (Kg)
X_4 = Years of education of household head
X_5 = Credit access (1=Yes, 0=No)
X_6= Assets' ownership (₦)
X_7 = Total number of earners in the household
X_8 = Monthly income (₦)
b_1 = b_8 = Coefficient of parameters
u = Error term

RESULTS AND DISCUSSIONS

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents are presented in Table 1 on such variables as age, sex, marital status, household size, level of education. The result in Table 1 indicates that majority of the respondents (68%) were between ages 45 and 64 comprising of middle and the aged. They may be limited to one livelihood means (farming) due to declining age. The study reveals that a greater proportion of the respondents (68%) in the study area were males while 32% were females. The married dominated involvement in income generating activities in the study area.

Table 1.Frequency Distribution of Respondents by socio-economic features

Age Range (Years)	**Frequency**	**Percentage**
25-34	10	8
35-44	22	18
45-54	30	25
55-64	38	32
65-74	17	14
75-84	3	3
Total	**120**	**100**
Gender		
Male	81	68
Female	39	32
Total	**120**	**100**
Marital Status		
Single	8	7
Married	94	78
Widow	18	15
Total	**120**	**100**
Level of Education		
No form. edu.	7	6
Pri. education	28	23
Sec. educ.	56	47
Tertiary educ.	29	24
Total	**120**	**100**
Experience (Years)		
1-5	47	39
6-10	56	47
11-15	8	7
16-20	7	6
21-25	2	1
Total	**120**	**100**

Source: Field Survey, 2017.

Such households are bound to enjoy the benefits of increased labour supply and supplementing the family's means of livelihood. Over 70% of the respondents in the study area were literate with diverse levels of formal education; from primary to tertiary. This implies a very high level of literacy (ability to read and write) abides in the study area which would enable the entrepreneurs to better utilize effectively and efficiently available resources as well as diversify livelihood.

Livelihood Diversification Strategies of the Rural Households

The different livelihood strategies engaged in by the rural households are presented in Table 2.

Table 2. Livelihood Diversification Strategies of the Rural Households

Livelihood Activities	**Frequency**	**Percentage (%)**
Crop Farming	50	42
Livestock raising	29	24
Agro-processing/marketing	15	13
Service sector	10	8
Commerce/trading	16	13
Total	**120**	**100**

Source: Field Survey, 2017.

The result of the various livelihood strategies adopted by the households shows that crop farming, livestock farming, agro-processing/marketing, service sector and commerce/trading were identified and accounted for 42%, 24%, 13%, 8% and 13%. Crop farming (42%) was the most prevalent livelihood strategy among the respondents. This was followed by livestock rearing. The result therefore indicates that the respondents are majorly agrarian rural dwellers. They depend mostly on the proceeds from their farms to survive and meet their daily food and other necessary requirements. The study also reveals that diversification is yet to be developed as the respondents still depend majorly on agriculture. This confirms previous finding that Agriculture is the bedrock of sustenance in the Nigerian society.

Analysis of factors affecting the choice of livelihood diversification

The effect of explanatory variables on the influence of rural households' decision to diversify their livelihood sources is analyzed using a binomial logistic regression.

The 2 log likelihood ratio test (-199.62) shows that the estimated model including a constant and the set of explanatory variables fit the data better compared with the model containing the constant only. The R^2 value, model Chi-Square and overall percentage of correct prediction also suggested that the estimated model has an excellent explanatory power. The result is presented in Table 3.

Table 3. Logit Regression Result for Determinants of Livelihood Diversification of Rural households in Abia State

Variables	Coeff.	S.E	Wald
Age of Household head	-.007	.632	-3.60***
Household size	.141	1401.26	3.122***
Amount of credit received	.047	411.12	2.132**
Education of household head	4.307	5048.35	2.453**
Cooperative membership	1.735	3220.87	-3.42***
Monthly income (₦)	.251	1106.89	1.984**
Constant	227.098	25566.7	.000***

*p<0.10; **p<0.05; ***p<0.01 Nagelkerke R^2 = .664; -2 log likelihood = 199.62
Source: Field Survey, 2017.

The result shows that the decision to diversify from agriculture to other livelihood means was positively influenced by household size, amount of credit received, education of the household head, cooperative membership and monthly income at 1%, 5%, 5%, 5% and 10% respectively and negatively influenced by age.
The coefficient of age is significant and negatively related to involvement in numerous livelihood activities implying that with advancement in age of household heads, their involvement in non-agricultural activities reduces. This finding agrees with *a priori* expectations though deviates from [9] firstly because experience increases with age and consequently, experienced persons have more prospects of getting jobs in the non-farm sector.
The coefficient of household size been positively signed implies that with an increase in the number of household members, households will seek for other livelihood means. An additional income source is expected to make available more money to meet the various demand of the increasing household membership.
The coefficient of credit use was found to be positively related to livelihood diversification. This implies that farmers with access to credit are likely to engage in other income generating activities. Since resource-base is very poor for most of the rural households, providing credit to households will improve their livelihood. Farmers engage in livelihood diversification to raise households' income portfolio. This is an indication that farmers who obtain credit are more likely to be livelihood means diversified. [9] agreed to this finding.
The coefficient of years of education of the household heads correlated positively with the probability event of involving in other source of livelihoods. The highly educated persons diversify their livelihood options through opting for salaried jobs, self-employment activities, etc., whereas low-educated and illiterate persons engage themselves in wage earning.
The finding also suggest that belonging to farmers organization would significantly influence farmers into livelihood diversification activities besides farming, because the experience of working and sharing ideas and common problems in groups would educate the farmers and also enable them to learn more about other opportunities which may exists outside his immediate engagement and environment.
The coefficient of monthly income correlated positively with livelihood activity. This could imply that rural dwellers who earn higher monthly income indulge in other livelihood activities (port- folio diversification) other than farming. This may be as results of having more money which can enable them invest in other livelihood activity other than farming.

Food security status

The food security status of the rural households is presented in Table 4.

Table 4. Households' Food Security status

Food Security	Frequency	Percentage (%)
Food secure	40	33
Food insecure	80	67
Total	**120**	**100**

Source: Field Survey, 2017.

The result shows that a greater proportion (67%) of the rural households were food insecure while 33% were food secured. This implies that 67% of the households were not able to meet their daily dietary requirements. The extent of the food insecurity is determined by the FGT results.

Table 5. FGT result

Variable	Index
Head count ratio	0.67
Short fall	0.32
Food insecurity severity	0.08

Source: Field Survey, 2017.

Table 5 shows that the headcount ratio, short-fall and severity of food insecurity were 67%, 32% and 8% respectively. This implies 67% of the sampled households could not meet the energy requirement recommended for subsistence. Each food insecure household needs 32% of the daily caloric requirement to bring them up to the recommended daily caloric requirement level. Besides, their per capita income and the relative deficiency among food insecure households is 8%.

Factors affecting food security status of the rural households

The results of the binary logistic regression are presented in Table 6.

According to the results, 5 variables are statistically significant. On the other hand, the values of Cox & Snell and Nagelkerke R^2 show that the model explains 40% and 50% variations in the data, respectively.

The result shows that food security status of the rural households was positively influenced by years of education of household head, credit access, farm size and monthly income respectively and negatively affected by age of household head and household size respectively. The coefficient of age of the household head had a negative relationship with food security. This implies that an increase in the age of household head reduces the chances of the family being food security. Younger heads are active, innovative and can efficiently cater for their households unlike older heads who are faced with the challenge of declining age, productivity and efficiency. However, [18] disagrees with this finding and states that a positive relationship is possible because as households acquire more experience in farming operations, non-farm businesses, accumulate wealth and use better planning, they have better chances to become food secure.

Table 6. Logit regression result for factors affecting food security status of rural households in Abia state

Variables	B	S.E.	Wald	Exp. (B)
Age	.809	0.83	2.92***	.445
Household size	-1.15	0.98	2.472**	.316
Farm size	.089	0.11	3.26***	1.141
Education	.013	0.10	3.01***	1.013
Credit access	2.549	1.30	3.81***	12.799
Diversification	1.477	0.96	2.362**	4.379
Monthly income	1.477	0.96	2.362**	4.379
Food aid	1.089	0.96	1.269	2.970
Constant	3.632	0.88	3.86***	

*p<0.10; **p<0.05; ***p<0.01 Nagelkerke R^2 = 0.50; Cox and Snell R^2 = 0.40; -2 log likelihood = 47.043
Source: Field Survey, 2017

Household size was statistically significant and exhibited a negative relationship with household food security similar to the hypothesized effect implying that the chances for being food secure decreases with an increasing household size. According to [15], large family size creates more pressure on household food security because more food and non-food expenditure is spent for them increases. This study is congruent with the previous studies of [16] and [19].

The coefficient of farm size cultivated by the household was found to have significant and positive relationship with food security status of households suggesting the larger the land size, the better food the security state of the household. The possible explanation is that the major source of food in the study area comes form own production, thus, household who have large size of cultivated land has better production which gives a better chance for the household to be food secure. This result is in agreement with the findings of [19, 1 and 15]. The study found that household

heads' level of education had a positive impact on household food security implying that at least, intermediate level of education is a necessary condition to assure household food security. Educational status of the household head is an important determinant of household food security because an educated household head is more sensitive to adopt technology to maximize the output he/she generated from farm activities. This study is in line with the previous studies of [3, 18].

The result of the logit model also showed that credit access had a significant and positive influence on food security in the study area suggesting that the use of credit increases the households' likelihood of being food secure in line with the hypothesized effect. Appropriate utilization of credit would build their capacity to produce more through purchase and use of agricultural inputs. [18] agrees with this posit and states that it would also be possible for the households to spend the credit on some other income generating activities so that the income from these could activities position households on a better status to escape vulnerability to food insecurity.

Income diversification was found to have a significant and positive relation with the food security status of the household indicating that farmers who engaged in other income generating activities other than farming have better chance to be food secure. It is certain that such households will be endowed with additional income and more likely to escape food insecurity. Household's monthly income is the total monthly income of the household from all sources. The positive coefficient of monthly income implies a positive relationship between food security and monthly income. An increase in monthly income of a household increases the chances of food security as agreed by [1].

Effect of livelihood diversification on the income and food security status of the households

A Pearson correlation analysis was carried out to examine how livelihood diversification affects households' income and food security as presented in Table 7.

Table 7. Correlations result: effect of livelihood diversification on income and food security (FS)

		(LD)	Income	FS (Z)
LD	Pearson Correlation	1	1.000**	.988**
	Sig. (2-tailed)		.000	.000
	N	120	120	120
Income (~~N~~)	Pearson Correlation	1.000**	1	.988**
	Sig. (2-tailed)	.000		.000
	N	120	120	120
Food Security (Z)	Pearson Correlation	.988**	.988**	1
	Sig. (2-tailed)	.000	.000	
	N	120	120	120

**. Correlation is sig. at the 0.01 level (2-tailed).
Source: Field survey, 2017.

A positive correlation at 1% was found to exist between livelihood diversification and income as well as food security. This implies that increasing the number of livelihood means engaged in by a household, her income level will increase with a consequent tendency towards food security. It is therefore worthy to note that livelihood diversified households are more income stable and food secured than the reverse households.

CONCLUSIONS

The result of this study has revealed that farmers' involvement in livelihood diversification activities is as a result of overwhelming need to increase households' income portfolio and to maintain livelihood. The quest for improved standard of living which has been sought after by rural dwellers and their sympathizers would be met with higher successes when rural people realize the potentiality and effectiveness of livelihood diversification in the overall scheme of rural poverty reduction especially in rural communities of low income countries. It is therefore, the general conclusion of this study that livelihood diversification is a positive undertaken and an antidote to the chronic menace of poverty and food insecurity ravaging rural areas. This is because it enables rural people increase their income portfolio and insures households from insufficiency of

food, thereby improving their food security status, while equally lessening their vulnerability to hunger, diseases and mortalities. Rural farmers should be given opportunity to participate in varied income generating activities in both agriculture and nonagricultural ventures and rural development programmes which would enhance their livelihood diversification activities and living standard be initiated and encouraged; the effect of education on household food insecurity cannot be over-emphasized therefore strengthening both formal and informal education and vocational or skill training should be promoted to reduce food insecurity in the study area. Access to credit can create an opportunity to be involved in economic activity that generates revenue to households. Development partners operating in the study area should implement provision of credit to eligible households using targeting criterion that reflects actual characteristics of food insecure households.

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HEALTH STATUS AND PRODUCTIVITY ANALYSIS OF RURAL FARMING HOUSEHOLDS IN ABIA STATE, NIGERIA

Raphael Ndubuisi ECHEBIRI[1], Daniel Chinedu NWAOGU[2]

Michael Okpara University of Agriculture, Umudike, Abia state, Nigeria. [1,2]Department of Agricultural Economics. Phone: +2348063425721. Email: danielchinedu32@gmail.com

Corresponding author: danielchinedu32@gmail.com

Abstract

This study analyzed the relationship between farmers' health status and their productivity levels in Abia state. A multi-stage sampling technique was adopted in collecting data for this research, thus, a total of 1080 farmers were selected. Simple descriptive statistics, the total factor productivity and ordinary least squares methods were employed in the data analysis. A mean productivity value of 1.895 implies that an average farmer made about 89 kobo for every one naira invested. Healthy farmers had a higher mean productivity (2.1246) than non-healthy farmers (1.9018). The regression model gave an R^2 of 0.594, 0.458 and 0.892 implying that 59.4%, 45.8% and 89.2% changes in the productivity of the three groups (pooled, healthy and non-healthy farmers) were accounted for by changes in the explanatory variables included in the model. The study showed that healthy farmers with access to appropriate inputs (including knowledge, land, tools, fertilizer, and seeds) had higher productivity and earned good incomes than non-healthy farmers, thus health improvement strategies granted to the farmers by government will allow them to thrive nutritionally, acquire more assets (including health), and become more resilient. It is also recommended that that land be made available to smaller farms to enhance increased overall production.

Key words**:** *health status, incomes, land, productivity*

INTRODUCTION

Changes in agribusiness systems and improvements in the agricultural sector of developing countries provide opportunities for smallholder farmers to commercialize agriculture [15]. However, rapid population growth, ongoing economic meltdown and unfavourable impacts of climate change might be accountable for the possible failure of progress in the agriculture sector. Agriculture has contributed significantly to the development of Nigeria's economy by providing the necessary raw materials required by agro-based industries that form the major support of the manufacturing sector. Agricultural development is still faced by the problem of food sufficiency. The food shortage problem is indicative of the high food import bills, consistent rise in domestic food price, high annual growth rates of food demand when compared with food supply and nutritional problems among others [7]. The problem of food shortages and insecurity is exacerbated when we consider the fact that food production in Nigeria is in the hands of small scale farmers who practice mixed cropping system and cultivate between 1-2 hectares of farm land which are usually scattered over a wide area [7, 17]. In addition, the productivity of these farmers is often affected by factors such as age, cropping patterns, years of farming experience, and lack of access to credit which tend to impact negatively on productivity and efficiency.

Empirical evidence that abound in economic literature on factors that affect productivity include technology, labour employment [20], education and training of farm operators [22], agro-environmental conditions [8], security of land ownership rights [6], land, labour, fertilizer and education [4] and funding which determines the maximal physical quantity of output that can be reached as well as the number and quantity of inputs required [10] while little has been done in the area of farmers' health and how it can affect their productivity. This implies that there is room for improvement in the area of farm productivity when farmers' health is given serious attention.

Health affects agricultural systems by

affecting the health of the farm principal operators. Poor health results in loss of work days or decreases workers capacity, decrease efficiency and ability to explore diverse farming practices and by such makes farmers to capitalize on farm specific knowledge. This makes the examination of the effect of farmers' health on farm productivity very important.

MATERIALS AND METHODS

Study area

Abia State is the study area and was carved out of Imo State on the 27th of August, 1991, [1]. Abia state situates east of Imo State with which it shares common boundary on its West, North and Northeast by Anambra, Ebonyi and Enugu states respectively. The state is bounded on the East and Southeast by Cross River and Akwa Iboms States respectively while it shares its southern borders with Rivers State.

Agriculture is the major occupation of the people of Abia State [1]. This is induced by the rich soil which stretches from the north to the southern parts of the State. There are three agricultural zones in the state namely Aba, Ohafia and Umuahia. Cash crops, such as oil-palm, cocoa and rubber are produced while food crops such as yam, cassava, plantain and maize are produced in large quantities.

Data collection and analysis

A multi-stage sampling technique was adopted in collecting data for this research. The first stage involved the selection of three LGAs from each of the three agricultural zones, precisely, Ikwuano LGA from Umuahia agricultural zone, Isiala Ngwa South LGA from Aba Agricultural zone and Bende LGA from Ohafia agricultural zone. In the second stage, six (6) autonomous communities were selected from each of the LGAs making a total of eighteen (18) autonomous communities. In the third stage, three (3) villages were selected from each of the selected autonomous communities making a total of fifty-four (54) villages. In the last stage, 20 farmers were selected from each of the villages to have a total of 1080 farmers.

The Total Factor Productivity (TFP) analysis was used to estimate the productivity of the arable crop farmers in the study area while the OLS regression method was used to analyze the effects of various factors (variables) on productivity. Total Factor Productivity (TFP) estimation following [12] and [23] can be measured as the inverse of unit variable cost. This is so since TFP is the ratio of the output to the Total Variable Cost (TVC) as shown in the formula (1).

$$TFP = \frac{Y}{\Sigma P_i X_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where,
Y = Value of crop in naira and
P = unit price of i^{th} variable input and
X_i = quantity of i^{th} variable input.

Total Factor Productivity ($\frac{total\ output}{total\ input}$) measured in naira ………………… ....(2)

The Ordinary Least Square regression method using diverse econometric specifications, namely, the linear, Cobb-Douglas, semi-log and the exponential functional forms analyzed. The model that gave the best fit was selected as the best equation. The model is described thus:

$$TFP = (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, \ldots\ldots) \quad (3)$$

where,
Y = Total Factor Productivity ($\frac{total\ output}{total\ input}$) measured in naira
X_1 = Age of the farmers (Years)
X_2 = Farmers' education (years)
X_3 = Number of extension contacts
X_4 = Household size
X_5 = Farm size (Hectare)
X_6 = Farming experience
X_7 = Labour cost (₦)
X_8 = Capital inputs (depreciation on fixed inputs, taxes, rent, interest and insurance measured in naira)
X_9 = Fertilizer (₦)

RESULTS AND DISCUSSIONS

Farmers' average socio-economic statistics

The socioeconomic characteristics of the farmers is summarized and presented in Table 1.

Table 1. Farmers' Average Socioeconomic statistics

Variable	Mean	Std. Dev.	Min.	Max.
Age	49	12.84	23	85
Household size	4	1.73	1	8
Education	9	4.44	1	28
Experience	17	10.27	2	50
Farm size	1.28	0.79	0.2	7
Days lost	18.00	4.68	.00	35.00
Male (%)	51			
Married (%)	56			
Farmer cooperators (%)	58			
Normal Body Mass Index (%)	44			

Source: Field survey, 2016.

The result shows that on the average, the farmers were about 49 years of age and as such expected to be strong, agile, and active and can participate adequately in farming activities. This finding is similar to that of [21] and [2] all things being equal that age relate to healthiness, farm productivity and technical efficiency. The study showed that 51% of the respondents are males.

This concurs with studies carried out in the south-eastern region of Nigeria where majority of farm households were male-headed [11]. Furthermore, 56% of the farmers were married. [16] opined that the stability created by marriage allows for efficient use of resources. The average household size was 4 persons implying that there is likely to be little contribution of household members to farm labour supply. According to the report of [19], there is a positive and significant relationship between household size and farmers' efficiency in production. The farmers spent an average of 9 years in school. Level of education will greatly influence the decision making and adoption of innovation by farmers, which may bring about increase in productivity and efficiency in resource allocation and management. A mean 17 years of farming experience was obtained for the farmers. This may give an indication of the practical knowledge a farmer has acquired on how he can overcome certain inherent farm production problems [16], thereby increasing farm efficiency. With 58% of the respondents participating in cooperative activities, they could have enjoyed the advantage of accessibility to micro-credit, input subsidy and cross-breeding of ideas and information. The mean farm size was 1.2 hectares of land. In general, these farmers operate on a small-scale level. Only about 44% of the farmers were healthy (using BMI) and it is therefore expected that they would be efficient and productive. On the average, the farmers lost about 18 days in a farming season due to incapacitation by diseases. This is expected to have a negative effect on farm efficiency and productivity.

Productivity of arable crop farmers in Abia state

The productivity of the farmers is their ratio of total output to total inputs used in the production process. Since various arable crops were studied, the monetary approach was adopted. In this case, the ratio of the output and inputs prices was determined respectively. The result is presented in Table 2.

Table 2. Productivity of arable crop farmers in Abia State

Productivity distribution	Pooled		Healthy farmers		Non-healthy farmers	
	Freq. (f)	(%)	Freq. (f)	(%)	Freq. (f)	(%)
0.17 – 0.99	144	13	54	8	90	22
1.00 – 1.82	210	19	105	16	105	26
1.83 – 2.65	237	22	138	20	99	24
2.66 – 3.47	180	17	150	22	30	7
3.48 – 4.29	107	11	60	9	57	14
4.30 – 5.11	192	18	165	25	27	7
Total	1080	100	675	100	405	100
Minimum	0.17		0.47		0.18	
Maximum	4.43		4.43		4.09	
Mean	1.8951		2.1246		1.9018	

Source: Field survey, 2016.

A mean value of 1.895 implies that an average farmer made about 89 kobo for every one naira invested. For the healthy farmers, a mean productivity of 2.1246 was higher than their unhealthy counterparts (1.9018) implying that an average healthy farmer made 22 kobo more than an average unhealthy farmer for every one naira invested.

Determinants of productivity of the arable crop farmers

The determinants of the farmers' productivity were analyzed using the multiple regression model and the results are presented in Tables 3, 4 and 5 respectively. Four functional forms of the multiple regression model were tried and the exponential, semi-log and double-log forms were chosen for the pooled farmers, healthy and unhealthy farmers respectively as the lead equations. The F-ratio was statistically significant at 1% indicating a high goodness of fit of the regression line. The R^2 of 0.594, 0.458 and 0.892 showed that 59.4%, 45.8% and 89.2% changes in the productivity of the three groups were accounted for by changes in the explanatory variables included in the model while 40.6%, 54.2% and 10.8% were accounted for by error. The result shows that age of the farmers had a positive relationship with productivity at 10%, 5% and 5% for the pooled sample,
healthy and unhealthy farmers respectively implying that as age increases, productivity also increases. This finding agrees with [5, 3, 13, 23] but contradicts the findings of [9, 18, and 14].

Education was positive for the pooled sample at 10%, negative for the healthy farmers at 5% and non-significant for the unhealthy farmers. As education level increases, the pooled farmers are expected to have increased productivity.

Table 3. Pooled productivity determinants of the arable crop farmers in Abia State

Variables	Linear	Semi-log	Exponential (+)	Double-log
(Constant)	1.838 (9.392)***	.427 (3.204)**	16.301 (9.107)***	7.311 (7.991)***
Age (Years)	.003 (1.093)	.002 (.772)	.190 (1.761)*	.080 (1.128)
Education (Years)	-.006 (-.717)	.000 (.061)	.102 (1.942)*	.090 (2.315)*
Extension contacts	.010 (.242)	-.005 (-.160)	.222 (1.797)*	.093 (1.472)
Household size	.024 (1.084)	.021 (1.425)	.027 (.364)	.013 (.336)
Farm size (Hectares)	.979 (13.798)***	.527 (10.923)***	1.742 (14.686)***	.897 (14.785)***
Experience (Years)	-.011 (-2.958)**	-.014 (-5.372)***	.077 (2.352)**	-.011 (-.324)
Labour cost (₦)	-2.465E-005 (-4.667)***	-5.391E-006 (-1.500)	-.394 (-2.609)**	.001 (.018)
Depreciation (₦)	.000 (-10.449)***	-7.462E-005 (-9.379)***	-.626 (-8.268)***	-.406 (-10.507)***
Fertilizer (₦)	1.732E-005 (1.973)*	9.360E-006 (1.567)	.737 (6.089)***	-.441 (-7.130)***
R^2	0.403	0.368	0.594	0.650
Ad.R^2	0.387	0.352	0.576	0.634
F-ratio	25.990***	22.455***	35.059***	41.821***

Source: Field survey, 2016.

Extension contact was positive for the pooled sample and unhealthy farmers at 10% and 5% respectively and insignificant for healthy farmers. This is expected as extension contacts serve as a medium of advancing new ideas and technologies to the farmers. Increased extension contacts would lead to more knowledge on improved crop technologies which have a strong influence on increased productivity.

Household size was not significant for the pooled sample but negative for the healthy and unhealthy farmers at 1% and 10% significant level respectively. Farmers with large household sizes tend to dissipate most of their resources on the upbringing and education of their children [23, 18]. For every 1% increase in household size, productivity will reduce by 0.007% and 0.082% for healthy and unhealthy farmers respectively, thus for 1% increase in household size, healthy farmers are more productive than their unhealthy counterparts by 0.075%.

Farm size was positive for the pooled, healthy and unhealthy farmers at 1%, 5% and 1% significant levels respectively. This implies that the larger the farm size, the higher the level of productivity. However, unhealthy farmers had more productivity (1.18%) than the healthy farmers (0.039%) with increase a 1% increase in land size. Unhealthy farmers may practice more land-use intensification per unit area cultivated than their healthy counterparts.

Table 4. Productivity determinants for healthy arable crop farmers

Variables	Linear	Semi-log (+)	Exponential	Double-log
(Constant)	2.236 (7.801)***	.670 (4.441)***	9.327 (4.071)***	4.035 (3.905)***
Age (Years)	.003 (.716)	.002 (2.622)**	.144 (.451)	.068 (.471)
Education (Years)	-.016 (-1.467)	-.010 (-1.716)*	-.138 (-.737)	-.063 (-.753)
Extension contacts	-.089 (-1.450)	-.038 (-1.180)	.288 (1.120)	.134 (2.151)**
Household size	-.010 (-.299)	-.007 (-4.377)***	.138 (1.099)	.062 (1.090)
Farm size (Hectares)	.069 (.995)	.039 (3.025)**	.131 (1.908)*	.072 (1.105)
Experience (Years)	.004 (.574)	.003 (3.789)***	-.069 (-.425)	-.024 (-.332)
Labour cost (₦)	7.893E-006 (1.141)	.006 (1.849)*	.258 (.821)	.118 (.834)
Depreciation (₦)	.000 (-6.248)***	-.760 (-6.984)***	-.427 (-2.820)**	-.200 (-2.929)**
Fertilizer (₦)	3.604E-005 (2.537)**	.238 (3.187)**	-.739 (-2.658)**	-.341 (-2.721)**
R^2	0.518	0.458	0.652	0.464
Ad.R^2	0.185	0.226	0.489	0.204
F-ratio	6.569***	8.182***	4.012***	4.295***

Source: Field survey, 2016.
Significant at * = 10%, Significant at ** =5%, Significant*** = 1% $^{+}$=lead equation

Farming experience was positive for pooled and healthy farmers at 5% and 1% respectively and negative for unhealthy farmers at 10%. Increased experience have important roles to play in farming activities in that it makes farmers receptive to new ideas and as a result of that, they are expected to be more productive. The result further showed that labour cost was negative for the pooled and unhealthy farmers and positive for the healthy farmers at 5%, 10% and 5% levels of significance. This result implies that as labour cost increases, the pooled and unhealthy farmers will experience decline in productivity and otherwise for the healthy farmers. In essence, this finding does not follow *a priori* for the healthy farmers. This may be a case where the marginal productivity of labour (an increase in productivity due to additional unit of labour) exceeds the marginal cost of labour (the cost of adding an extra unit of labour).

Depreciation cost was negative for all the farmers at 1% significant level implying that as depreciation costs increase, productivity. This is expected since costs are leakages from

farmers stock of resources.

Fertilizer was positive for pooled and healthy farmers at 1% and 5% and negative for unhealthy farmers at 1% significant level. This result agrees with *a priori* for the pooled and healthy farmers and otherwise for the unhealthy farmers respectively implying that increase in the use of fertilizer will increase the productivity levels of the farmers.

Table 5. Productivity determinants for non-healthy arable crop farmers

Variables	Linear	Semi-log	Exponential	Double-log (+)
(Constant)	1.482 (4.581)***	.218 (.830)	18.996 (7.388)***	8.604 (8.320)***
Age (Years)	.013 (2.343)*	.007 (1.448)	.435 (2.015)*	.237 (2.737)**
Education (Years)	-.032 (-1.781)*	-.008 (-.564)	.171 (1.017)	.015 (.217)
Extension contacts	.248 (3.590)***	.160 (2.857)**	.480 (2.555)**	.221 (2.920)**
Household size	-.026 (-.705)	.003 (.090)	-.109 (-.933)	-.082 (-1.745)*
Farm size (Hectares)	1.238 (10.725)***	.637 (6.790)***	2.291 (13.727)***	1.118 (16.654)***
Experience (Years)	-.025 (-3.240)**	-.021 (-3.408)**	.010 (.091)	-.078 (-1.783)*
Labour cost (₦)	-1.150E-005 (-1.198)	-3.304E-007 (-.042)	-.387 (-1.878)*	-.520 (-3.241)**
Depreciation (₦)	.000 (-7.620)***	-9.513E-005 (-5.192)***	-.463 (-3.325)**	-1.410 (-7.316)***
Fertilizer (₦)	-2.962E-006 (-.211)	-1.055E-005 (-.923)	-1.286 (-6.475)***	-.574 (-7.188)***
R^2	0.618	0.480	0.832	0.892
Ad.R^2	0.591	0.443	0.811	0.879
F-ratio	22.496***	12.845***	39.165***	65.290***

Source: Field survey, 2016**.**

Significant at * = 10%, Significant at ** =5%, Significant*** = 1% $^{+}$=lead equation

CONCLUSIONS

This study analyzed the relationship between farmers' health status and their productivity levels in Abia state. A multi-stage sampling technique was adopted in collecting data for this research, thus, a total of 1080 farmers were selected. Simple descriptive statistics, the total factor productivity and ordinary least squares methods were employed in the data analysis. The result shows that on the average, the farmers were about 49 years of age, predominantly male, married with an average of 9 years of education and 17 years of farming experience with a mean farm size of 1.2 hectares. Only about 44% of the farmers were healthy (using BMI) and it is therefore expected that they would be efficient and productive. A mean productivity value of 1.895 implies that an average farmer made about 89 kobo for every one naira invested. For the healthy farmers, a mean productivity of 2.1246 was higher than their unhealthy counterparts (1.9018) implying that an average healthy farmer made 22 kobo more than an average unhealthy farmer for every one naira invested. The regression model gave an R^2 of 0.594, 0.458 and 0.892 implying that 59.4%, 45.8% and 89.2% changes in the productivity of the three groups (pooled, healthy and non-healthy farmers) were accounted for by changes in the explanatory variables included in the model while 40.6%, 54.2% and 10.8% were accounted for by error. The result shows that age of the farmers had a positive relationship with productivity at 10%, 5% and 5% for the pooled sample, healthy and unhealthy farmers respectively implying that as age increases, productivity also increases. Education was positive for the pooled sample at 10%, negative for the healthy farmers at 5% and non-significant for

the unhealthy farmers. As education level increases, the pooled farmers are expected to have increased productivity. Extension contact was positive for the pooled sample and unhealthy farmers at 10% and 5% respectively and insignificant for healthy farmers. Increased extension contacts would lead to more knowledge on improved crop technologies which have a strong influence on increased productivity. Farm size was positive for the pooled, healthy and unhealthy farmers at 1%, 5% and 1% significant levels respectively. Farming experience was positive for pooled and healthy farmers at 5% and 1% respectively and negative for unhealthy farmers at 10%. Labour cost and depreciation were negative for the pooled and unhealthy farmers and positive for the healthy farmers at 5%, 10% and 5% levels of significance.. Fertilizer was positive for pooled and healthy farmers at 1% and 5% and negative for unhealthy farmers at 1% significant level. The study showed that healthy farmers with access to appropriate inputs (including knowledge, land, tools, fertilizer, and seeds) had higher productivity and earned good incomes than non-healthy farmers, thus health improvement strategies granted to the farmers by government will allow them to thrive nutritionally, acquire more assets (including health), and become more resilient. It is also recommended that land be made available to farmers to enhance increased overall production, as well as improve the welfare of the small and landless peasantry since the bulk of agricultural food production is dominated by the small-holder farmers.

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LABOUR-TIME-USE PATTERNS AND MAJOR DISEASES AFFECTING FARM ACTIVITIES IN ABIA STATE, NIGERIA

Raphael Ndubuisi ECHEBIRI, Oscar Igwe OBASI, Daniel Chinedu NWAOGU

Michael Okpara University of Agriculture Umudike, Abia state, Nigeria. Department of Agricultural Economics. Phone: +2348063425721. Email: danielchinedu32@gmail.com

Corresponding author: danielchinedu32@gmail.com

Abstract

This study examined the major diseases affecting agricultural production in Abia state in line with the various time allocation and labour-use patterns in the study area. The Body Mass Index (BMI) was used as a classification criterion to categorize farmers as healthy and non-healthy. 1080 farming households were selected from Abia state through a multi-stage sampling technique. The anthropometric result (using BMI) showed that only about 44% of the farmers were healthy. There was a marked difference for labour and time-use patterns (considering the energy demands of the various activities) for both healthy and non-healthy farmers. Healthy households utilized family labour as their main source of labour while hired labour was mainly used by non-healthy households. Arthritis, rheumatism, malaria/typhoid and asthma were the major diseases that affected the farmers during different cultural activities. These farm activities are usually energy-sapping and have the tendency to increase the likelihood event for farmers to take ill. The study recommends that effective extension services geared towards educating farmers on preventive measures to avoid undue exposure to harsh environmental conditions so as to improve agricultural productivity. The operation of action programs to combat these health challenges by all stakeholders as well as the availability of inputs at subsidized prices will provide a pathway for improved healthiness and welfare by reducing the financial burdens faced by these poor, sick households.

Key words**:** *diseases, labour-use, cultural activities, productivity, healthiness*

INTRODUCTION

There is a strong argument that agriculture continues to be one of the most important drivers of poverty reduction and the bedrock for economic growth, especially for the billions of people in developing countries [4]. This argument has gained momentum over the years owing to the fact that in agriculture-based countries, the sector generates, on average, 29% of the gross domestic product (GDP) and employs 65% of the labor force [14]. Farm households can use savings from sales of agricultural proceeds for improved access to health products and services. Similarly, agriculture provides food and nutrients for energy and maintenance of good health.

The role of agriculture in human livelihood also means that agricultural development has strong linkages with other fields of development practice and research, including health and nutrition [4]. These linkages are causal in nature and imply that there is a strong interdependence across them. In a nut shell, the success of agricultural livelihoods depends on the health of its workforce. At the same time, different agricultural production systems have different impacts on health, nutrition, and well-being of the people. Based on this premise, farm-related infections and diseases could pose serious challenges to farmers' health and can thus be isolated to be detrimental. By these interactions, it can be said that agriculture and health are closely related and their consequences will be useful in planning development programs in agriculture and health.

Agricultural productivity will continue to experience decline owing to illness and consequent loss of productive adults' knowledge, assets to cope with illness and human capital through death as a result of HIV/AIDS, malaria, tuberculosis and other diseases [14]. These health threatening diseases such as malaria fever, HIV/AIDS, farm injuries, cholera fever, schistosomiasis, diarrhoea, respiratory diseases and skin

disorders are on the alarming increase [6,7,5]. A closer look at existing literatures show alarming rate of productivity decline through labour losses during various farm activities giving rise to trade-offs between the cost of care-giving (for the sick) and labour productivity. For example, when a household member gets sick, arrangements are made to take care of the person and this may further aggravate the household labor situation. In Northern Zambia, AIDS-affected households, particularly those headed by women, reduced the total area under cultivation due to labor shortages [8]. A Tanzanian study by [11] reported that women spent 60% less time on farming activities taking care of their husbands suffering from AIDS. Available healthy time has often times been reduced due to incapacitations. In line with this, a study showed that Ethiopian women were found to spend about 100 hours a week which is equivalent to about 4 days nursing AIDS-affected household members, largely at the expense of their children and their farms [9]. Nigerian subsistence farmers spend as much as 13% of total household expenditure on treatment of malaria alone [2], thus lending credence to the fact that cost of combating diseases and health problems by farmers is quite enormous, considering the frequency and prevalence of diseases among Nigerian farmers. This study is carried out in an attempt to cross-examine the major diseases affecting farm activities and practices in Abia state, Nigeria.

MATERIALS AND METHODS

Study area

Abia State is the study area and was carved out of Imo State on the 27th of August, 1991, [1]. Abia state situates east of Imo State with which it shares common boundary on its West, North and Northeast by Anambra, Ebonyi and Enugu states respectively. The state is bounded on the East and Southeast by Cross River and Akwa Iboms States respectively while it shares its southern borders with Rivers State. Agriculture is the major occupation of the people of Abia State [1]. This is induced by the rich soil which stretches from the north to the southern parts of the State. There are three agricultural zones in the state namely Aba, Ohafia and Umuahia. Cash crops, such as oil-palm, cocoa and rubber are produced while food crops such as yam, cassava, plantain and maize are produced in large quantities.

Data collection and analysis

A multi-stage sampling technique was adopted in collecting data for this research. The first stage involved the selection of three LGAs from each of the three agricultural zones, precisely, Ikwuano LGA from Umuahia agricultural zone, Isiala Ngwa South LGA from Aba Agricultural zone and Bende LGA from Ohafia agricultural zone. In the second stage, six (6) autonomous communities were selected from each of the LGAs making a total of eighteen (18) autonomous communities. In the third stage, three (3) villages were selected from each of the selected autonomous communities making a total of fifty-four (54) villages. In the last stage, 20 farmers were selected from each of the villages to have a total of 1080 farmers. The Body Mass Index (BMI) which was derived from [15] was used to classify farmers as healthy and non-healthy. The BMI is derived by dividing the height (in Centimeter) of a respondent by the weight (in Kg).

RESULTS AND DISCUSSIONS

Body Mass Index

This study adopted BMI as the major measurement of farmers' health status. The BMI classification as well as BMI status of the farmers is presented in the Table 1 and Figure 1. The BMI classification used in this study was adopted from the World Health Organization records in [16].

Table 1.BMI classification

BMI (kg/m^2)	Description
Less than 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30 – 39.9	Obese
40 and above	Morbidly obese

Source: WHO, 2013.

The BMI result shows that while none of the

farmers was morbidly overweight, 5%, 18%, 33% and 44% were obese, overweight, underweight and normal respectively. This implies that about 66% of the respondents were not healthy.

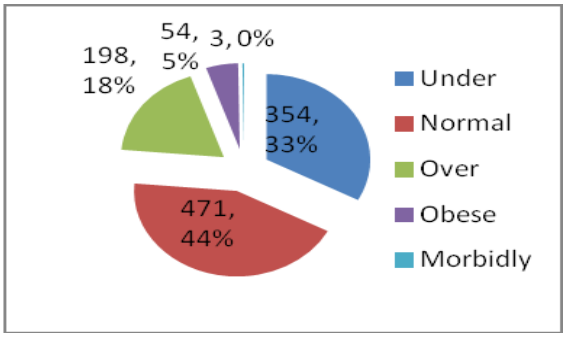

Fig. 1. BMI of the farmers
Source: Field survey, 2016.

This situation requires urgent policy interventions. Clearly, BMI is related to energy intake, net of output; it has also been shown to be related to maximum oxygen uptake during physical work, which is, in turn, related to aerobic capacity and endurance, independent of energy intake [12, 10] in [3]. Given this scenario, it is therefore expected that these farmers would be inefficient and less productive.

Sex-number of days lost due to incapacitation distribution of the farmers

Table 2 shows the distribution of the number of days lost due to incapacitation in relation to the sex of the farmers. The result in Table 2 shows that all the farmers lost more than 5 days due to disease incapacitation. However, the greatest percentage (43%) of the male farmers lost between 16 and 20 days while only 2% lost about 31 – 35 days. On the other hand, more than half (52%) of the female farmers lost about 16 – 20 days while 2% lost about 1 – 5 days. In general, female farmers lost an average of 19 days in a season while male farmers lost about 16.8 days. From intuition, women are more resilient than men and as such could be more stress-resistant. However, the higher number of days lost by female compared to male farmers may be as a result of the excessive exposure to farming operations.

Time and labour-use patterns for various farm activities

The time allocated to various farming activities as well as the use of family and or hired labour is expected to differ across the farm households given their health conditions. This result is presented in Tables 3 and 4.

Table 2. Distribution of farmers by Sex and number of days lost due to incapacitation

Number of days lost	Male		Female		Agregate	
	(f)	(%)	(f)	(%)	(f)	(%)
1 – 5	0	0	9	1	9	1
6 – 10	9	1	9	1	18	2
11 – 15	180	17	90	8	270	25
16 – 20	234	21	279	26	513	47
21 – 25	90	8	108	10	198	18
26 – 30	27	2	36	3	63	5
31 – 35	9	1	0	0	9	1
Total	**549**	**51**	**531**	**49**	**1080**	**100**
Mean	**16.8 days**		**19 days**			

Source: Field data survey, 2016.

The result showed that healthy households utilized family labour as their main source of labour supply for all their farm activities except for harvesting where 56% of them used hired labour. However for the non-healthy households, this was not so. Hired labour was used majorly for land clearing and burning, land cultivation and harvesting while they utilized family labour in the other activities. The implication of this is that they could not cope with the energy demands of the aforementioned activities but could manage themselves in the case of lesser energy-demanding activities.

The time use pattern result shows that on the average for all the farm activities, healthy farmers spent more time than non-healthy farmers.

There is a marked difference for time utilization considering the energy demands of

the various activities.

Table 3. Labour-use patterns

Labour used	Healthy		Non-healthy	
	Frequency	Percentage	Frequency	Percentage
Land clearing/burning				
Family labour	450	67	180	44
Hired labour	225	33	225	56
Land cultivation				
Family labour	390	58	135	33
Hired labour	285	42	270	67
Planting				
Family labour	675	100	360	89
Hired labour	0	0	45	11
Thinning/supplying				
Family labour	675	100	315	78
Hired labour	0	0	90	22
Weeding				
Family labour	525	78	270	67
Hired labour	150	22	135	33
Fertilizer application				
Family labour	480	71	261	64
Hired labour	195	29	144	36
Harvesting				
Family labour	300	44	117	29
Hired labour	375	56	288	71

Source: Field survey, 2016.

Table 4. Time use patterns for various farm activities

Time use (No. of hours)	Healthy		Unhealthy	
	Frequency	Percentage	Frequency	Percentage
Land clearing and burning				
< 2	0	0	180	44
2.0 – 3.9	270	40	225	56
4.0 – 5.9	345	51	-	-
6.0 – 7.9	60	9	-	-
Mean	3.77		1.8	
Land cultivation				
< 2	-	-	-	-
2.0 – 3.9	150	22	333	82
4.0 – 5.9	345	51	72	18
6.0 – 7.9	180	27	-	-
Mean	4.52		2.75	
Planting				
< 2	-	-	171	42
2.0 – 3.9	450	-	171	42
4.0 – 5.9	225	67	63	16
6.0 – 7.9	-	33	-	-
Mean	3.2		2.02	
Thinning/supplying				
< 2	-	-	207	51
2.0 – 3.9	420		198	49
4.0 – 5.9	255		-	-
6.0 – 7.9	-		-	-
Mean	3.2		1.64	
Weeding				
< 2	-	-	-	-
2.0 – 3.9	150	22	342	84
4.0 – 5.9	465	69	63	16
6.0 – 7.9	-	9	-	-
Mean	4.20	2.62		
Fertilizer application				
< 2	-	-	243	60
2.0 – 3.9	495	73	162	40
4.0 – 5.9	180	27	-	-
6.0 – 7.9	-	-	-	-
Mean	3.00		1.53	
Harvesting				
< 2	-	-	99	24
2.0 – 3.9	225	33	252	63
4.0 – 5.9	390	58	54	13
6.0 – 7.9	60	9	-	-
Mean	3.90		2.31	

Source: Field survey, 2016

For instance, land clearing and burning which are energy sapping activities had healthy farmers spending about 4 hours while non-healthy farmers could barely manage 2 hours. For land cultivation, the difference is also obvious. Summarily, since time is a human capital that determines the amount of labour supplied to agricultural activities, its depletion through disease incapacitations is sure to affect productivity both at short and long runs production cycles.

Major diseases affecting the farmers in the study area

This section presents the major identified diseases affecting the farmers. Only respondents who approached medical experts for diagnosis of specific diseases were studied. The diseases identified include common fevers/colds, malaria/typhoid, tuberculosis, hypertension, hepatitis, asthma, pneumonia, diabetes, arthritis and rheumatism. These diseases affected the various farm operations including land clearing/burning, land cultivation, planting, thinning/supplying, weeding, fertilizer application and harvesting. The results are presented in the Figures 2 to 7

Major diseases affecting land clearing and burning

The major diseases affecting land clearing and burning are shown in Figure 2.

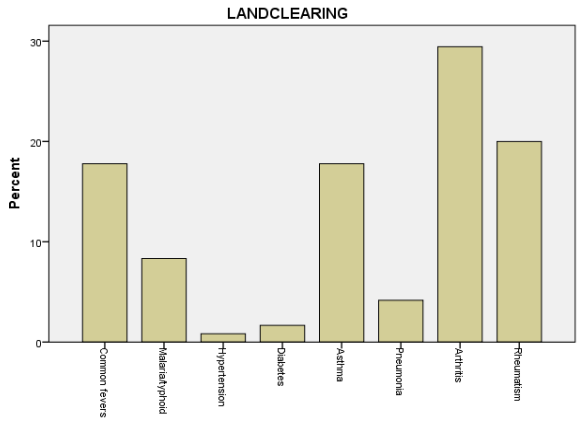

Fig. 2. Major diseases affecting land clearing and burning
Source: Field survey, 2016

The information on Figure 2 shows that arthritis, rheumatism, asthma and common fevers were the ill-health conditions that affected the farmers during land clearing and burning. Arthritis and rheumatism accounted for about 29% and 20% incapacitation of the farmers during this operation. Land clearing is one of the most tedious farm activities usually carried around late January and early March and requires a lot of energy to carry out. Although arthritis is expected to be most prevalent among the aged population, it affected majority of the farmers (who were middle-aged) during a number of farm operations including land clearing and burning. It showed a high correlation with rheumatism showing that they were aggravated by similar work operations and conditions. As expected, 18% of the farmers were affected by asthma during this period, especially because of burning. The spoke from the burnt bio-masses would have aggravated asthma in the farmers.

Major diseases affecting land cultivation

The major diseases affecting land cultivation are presented in Figure 3.

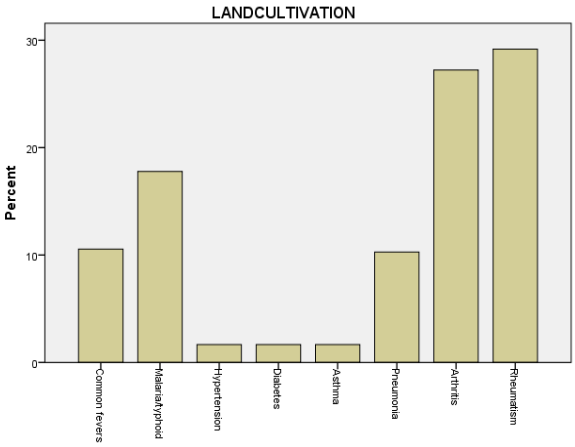

Fig. 3. Major diseases affecting land cultivation
Source: Field survey, 2016

The diseases affecting farmers during land cultivation in is presented in Figure 3 and shows that rheumatism, arthritis and malaria/typhoid were the most severe such that 29%, 27% and 18% of the farmers were affected respectively with an appreciable increase in the level of malaria infestation within this period. While malaria has remained a major killer in this region of the world, its morbidity is expected to rise with more of the rains. This study shows that

malaria episodes were higher in successive farm operations. A rise in pneumonia occurrence at this point more than at the period of land clearing lays more claims to the fact that majority of these diseases are responsive to climatic and weather changes. Land cultivation is usually carried out during early rains in March.

Major diseases affecting planting operation

The major diseases affecting planting are presented in Figure 4.

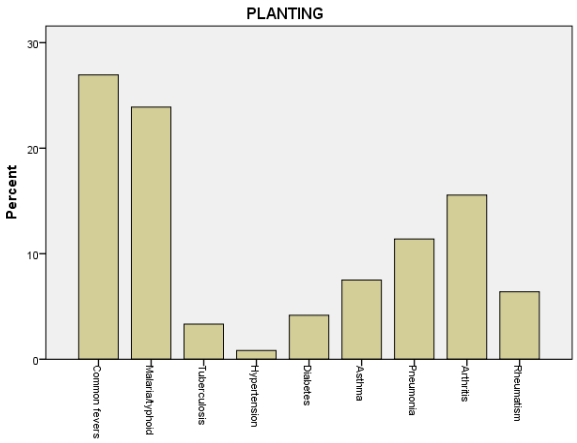

Fig. 4. Major diseases affecting planting operation
Source: Field survey, 2016

The information contained in Figure 4 shows that common fevers, malaria/typhoid and arthritis contributed to about 26%, 23% and 16% of the major diseases affecting planting operation respectively. Planting is usually done immediately after land cultivation in March and early April. It is less energy-intensive and may be majorly affected by common fevers. This explains why there was a marked decrease in the severity of arthritis and rheumatism in comparison to the previous farm operations. There was a slight increase in such diseases as tuberculosis (which is weather sensitive) as compared to land cultivation implying that there could have been more of rains and that the farmers might have been exposed to rains in the course of planting. With an increase in the volume of rainfall, mosquitoes tend to multiply. With mosquito bites, malaria infestation is sure to increase. This could be the reason for a rise in malaria occurrence.

Major diseases affecting thinning and supplying

The major diseases affecting thinning and supplying are shown in Figure 5.

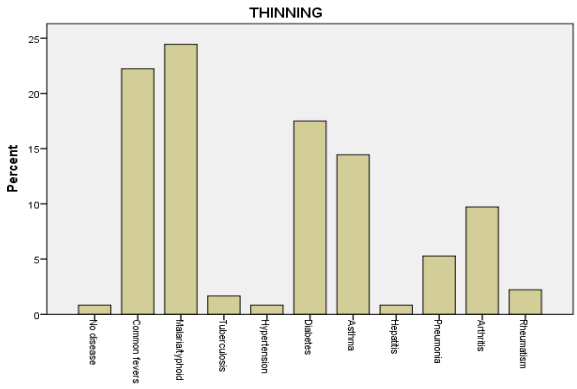

Fig. 5. Major diseases affecting thinning and supplying
Source: Field survey, 2016

As contained in Figure 5, thinning and supplying are usually done two to three weeks after planting, especially around mid-May. This period is usually marked by heavy rains explaining why farmers showed appreciable signs of diabetes and asthma during this period. Common knowledge holds that diabetic patients are unfriendly to heavy rains. There was also a decrease in the level of arthritis and rheumatism in this operation showing that since thinning and supplying are basically none-labour intensive, the principal operators may find it necessary to rest and free the mind of farm-related stress.

Major diseases affecting weeding operation

The major diseases affecting weeding operation are presented in Figure 6.

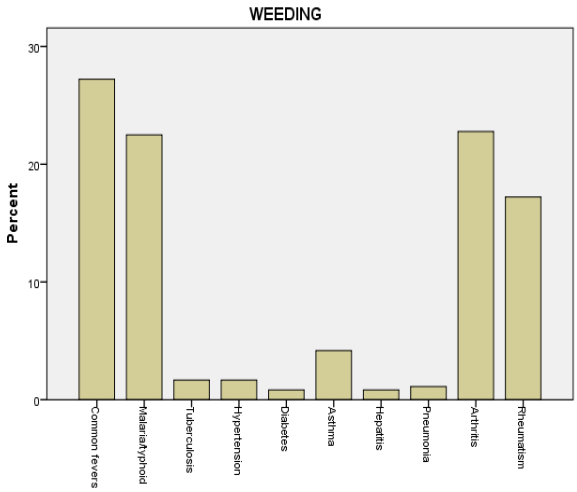

Fig. 6. Major diseases affecting weeding
Source: Field survey, 2016

The result in Figure 6 shows that about 27%, 23% and 22% of the farmers were affected by common fevers, arthritis and malaria respectively. This result is expected to have a strong link with thinning and supplying because these activities usually overlap and in most cases, these operations are carried out together and similar diseases may be prevalent. Depending on the nature of weed and growth, weeding is usually carried out simultaneously with fertilizer application, especially, around early June.

Major diseases affecting fertilizer application

The major diseases affecting fertilizer application are presented in Figure 7.

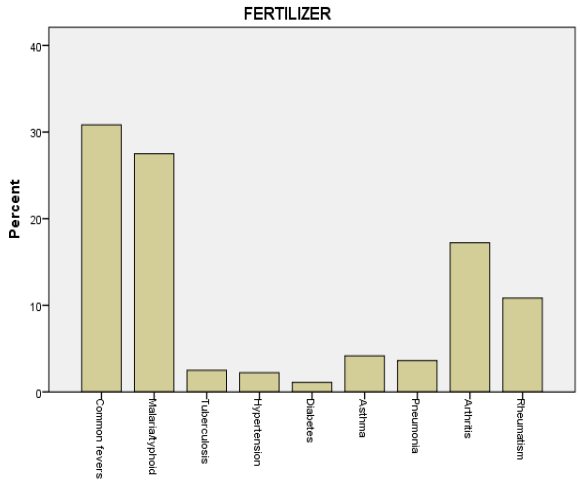

Fig. 7. Major diseases affecting fertilizer application
Source: Field survey, 2016

The result in Figure 7 on fertilizer application is similar to other farm operations. Common fevers, malaria and arthritis were the major health challenges faced by farmers during fertilizer application. Tuberculosis, asthma and pneumonia also showed appreciable increase during this period.

Major diseases affecting crop harvesting

The major diseases affecting crop harvesting are presented in Figure 8.

According to the result on crop harvesting, malaria was at its peak, followed by common fevers. Arthritis was low in comparison to other farm operations. Early harvesting starts usually in June.

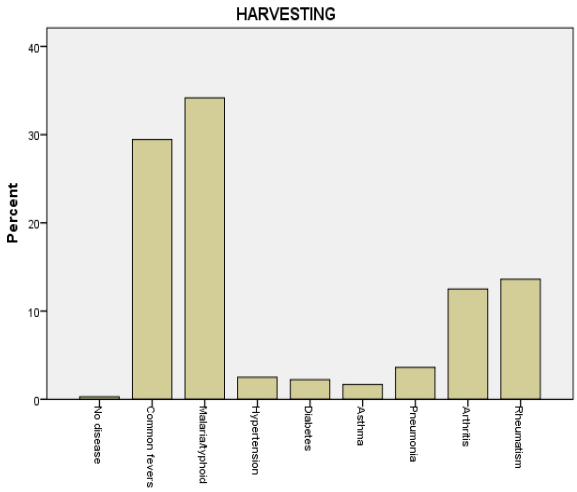

Fig. 8. Major diseases affecting harvesting
Source: Field survey, 2016

Number of days lost due to incapacitation in the various farming activities

The farmers were incapacitated and could not go to their farms due to the infestation of certain diseases. Some days were lost due to this incapacitation. This result is presented in the pie-chart below.

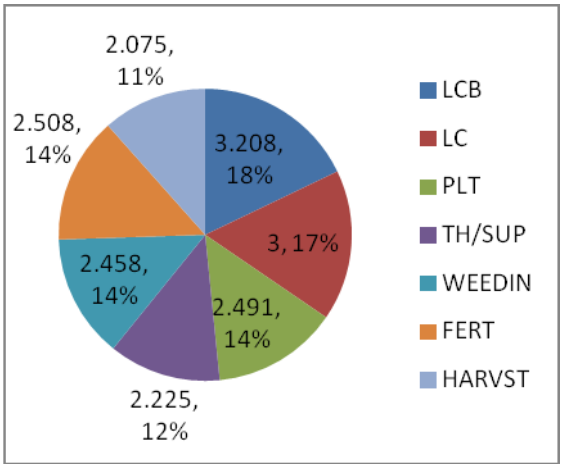

Fig. 9.Number of labour days lost due to incapacitation during farm operations
Source: Field data survey, 2016.

The result above shows that a total of 18%, 17%, 14%, 14%, 14%, 12% and 11% of labour days were lost due to the infestation of diseases in land clearing/bush burning, land cultivation, planting, weeding, fertilizer application, thinning/supplying and harvesting respectively. This finding is similar to [13] who found out that number of days lost to farming due to illness was most during land preparation, weeding (hoeing) and fertilizer application. These activities are usually

energy-sapping and have the tendency to increase the likelihood event for farmers to break down. Given the existent poor labour substitution, productivity is directly affected.

CONCLUSIONS

This study examined the major diseases affecting agricultural production in Abia state in line with the various time and prevalent labour-use patterns in the study area. The Body Mass Index (BMI) was used as a classification criterion to categorize farmers as healthy and non-healthy. The result showed an active farm population, relatively educated with limited land holdings. The anthropometric result showed that only about 44% of the farmers were healthy (using BMI) and it is therefore expected that they would be efficient and productive. On the average, the farmers lost about 18 days in a farming season due to incapacitation by diseases.

The labour-use pattern result showed that healthy households utilized family labour as their main source of labour supply for all their farm activities while hired labour was used majorly used for land clearing and burning, land cultivation and harvesting for non-healthy households. Similarly, the time use pattern result shows that on the average for all the farm activities, healthy farmers spent more time than non-healthy farmers. There is a marked difference for time utilization considering the energy demands of the various activities.

Arthritis, rheumatism, malaria/typhoid and asthma were the major diseases that affected the farmers during different cultural activities. The first two were the most severe for land clearing. Malaria was more severe as more rains fell. These farm activities are usually energy-sapping and have the tendency to increase the likelihood event for farmers to take ill. The study recommends that farmers adopt preventive measures to avoid undue exposure to harsh environmental conditions. This may involve the use of rain coats, rain boats, sunshades etc. An effective policy strategy with emphasis on health development by the government will be a welcome idea. To this effect, health education seminars on the impact of good health on agricultural productivity will be ideal. Arthritis, rheumatism and malaria were major ailments identified to affect farmers. Action programs to combat these health challenges by the government and non-government agencies is highly recommended. Provision of inputs at subsidized prices will go a long way in reducing the financial burdens faced by these poor households. As such, inputs market development with preference to rural based farmers would go a long way in achieving the goal of improved health condition, food production efficiency, sufficiency, security and general living standard.

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ANALYSIS OF ADHERENCE TO DOSAGE RECOMMENDATIONS FOR USE OF PESTICIDES BY ARABLE CROP FARMERS IN NJABA LOCAL GOVERNMENT AREA OF IMO STATE, NIGERIA

Christopher Ogbonna EMEROLE, Nnenna Eberechi CHIKEZIE, Alozie ANYIM, Darlington UGBOAJA

[1]Abia State University, Department of Agricultural Economics and Extension, Uturu Umuahia campus, Nigeria P.M.B. 7010 Umuahia, Phone: +234 805 3289 183, E-mail: emerolechriso@yahoo.co.uk
[2]Abia State Ministry of Women Affairs, Umuahia, Phone +234 806 6783 944, E-mail nenechikezie@yahoo.com
[3]Pest Control Unit, Abia State Ministry of Agriculture Umuahia, Phone +234 803 3396 960, E-mail: anyimalozie@gmail.com

Corresponding author: emerolechriso@yahoo.co.uk

Abstract

Modern practices in crop farming in areas prone to attacks of pests is recently attracting increasing use of chemicals in checking incidences of weeds, insects, birds and rodents not only in farms, gardens but in food and product stores. Many factors have influenced these practices including socio-economic variables which either encourage or discourage the pesticides use. This investigation involved a survey of eighty (80) arable crop farmers' selected using multi-stage random sampling technique in Njaba local Government Area of Imo State of Nigeria. Result reveals that farm size, farming experience, number of times in contact with extension agents in a month, level of educational attainment, and cost of pesticides were factors that influenced use and adherence to recommended dosage of pesticides by farmers. Pesticides when properly applied in the right dosage, under dry weather condition gave good results especially in the short run. Extension outfit should encourage the farmers to process and store their products even for a short period of time. This will enable them be much aware of storage pesticides and help them fetch better prices for their products. Farmers were reminded to recognize and heed the three principles of threshold, interdependence, and complexity in their practice of using most pesticides.

Key words**:** *adherence, control, farm modernization, pesticides*

INTRODUCTION

Pests are plants and animals that are growing in off locations especially where crops and/or livestock are nurtured such that their presence constitutes nuisance and demand to be removed. Pests constitute problems in crop and livestock management. One easy way of exterminating pests and protecting crops is through use of some chemical formulations called pesticides. The use of pesticides in farms truly demands understanding the nexus of ecological interrelatedness and wilful application of guiding policies for protectionist results [7]. Arable crop farms in many parts of south eastern Nigeria are attacked by insects such as leafhoppers, termites, aphids, weevils, cutworms, stem borers, millipedes, beetles, bollworms, black ants, mites and bugs. Other pests' are birds (weaver birds, sun birds, quails) and rodents (squirrels, grass cutters, and cane rats). Farms are attacked by weeds to which most times farmers accommodate the drudgery and culturally check the weeds using hoes, cutlasses and hand rogueing that have little or no adverse environmental effects. In line with principles of agricultural modernization, farmers are now checking weeds using recommended doses of herbicides such as Primextra, paraquat, Dopax, Sencor, Lasso and Diuron with effects lasting for up to a month or two as they kill their target organisms indiscriminately.

Some pesticides like the organo-phosphates malathion and parathion are highly toxic and short-lived in their action while others like the chlorinated hydrocarbons (DDT, dieldrin and

endrin accumulate along the food chains over time in increasingly concentrated forms with varying effects on their target preys and environment [6, 2]. In advanced economies, famers use a mixture of technologies relating to farm level conservation practices, association between disease and insect resistant varieties, spot spraying, rotating pesticide classes, the use of different varieties in different fields, the treatment of seeds, crop rotation and adjustments to the time of operations. This mix of technologies suggests that some farmers are combining chemical use with crop management in a way that preserves pesticides from biological resistance [5]. The accumulation effects of pesticides along the food chains require that farmers be investigated of their reasons for choice of chemical pesticides use, their awareness of adherence to recommended dosage, types and sources of pesticides used and determinants of their decisions to adhere to recommended dosages to be environment friendly. This study therefore investigates (i) types and sources of the pesticides used; (ii) farmers' level of awareness of recommended dosage of pesticides at the time of use; and (iii) factors that influence their decisions to adhere to pesticides recommended dosages.

MATERIALS AND METHODS

This study involved a survey of Njaba Local Government Area of Imo state in Nigeria. Njaba LGA shares boundaries in the East with Isu and Nkwere LGAs, in the west with Oru East, in the North with Orlu and in the south with Mbaitoli LGAs all in Imo State This is a geographical region that encapsulates fourteen autonomous communities with its headquarters in Nnenasa along Orlu-Owerri Federal highway in south eastern Nigeria. The communities are Amazano, Umuaka, Isiozi Akah, Ugbelle Akah, Amakor, Ihebina Owerre, Ebeise, Okponakuma, Ibelle, Okwudor, Nkume, Attah, Amucha, and Egwedu. The area derives its name from Njaba River that rises from Isunjaba and drains through Oguta to the Niger Delta area and lies within Latitudes 4^0 $10^/$ N and 5^0 $01^/$N of the Equator and between Longitudes 6^0 $29^/$E and 6^0 $47^/$E of the Greenwich Meridian. The 2006 Nigeria's National population census enumerated the area to comprise of 145,110 inhabitants [3]. The area is truly agrarian as food crops such as yam, cassava, rice, cocoyam, maize, plantain, banana, fluted pumpkin, and sweet potatoes are widely grown. Cash crops grown in the area include oil palm, cashew, cocoa, rubber, and ginger. Livestock such as poultry, sheep, goat, pigs, and N'dama/muturu cattle are reared. Smallholder farmers are in predominance in the area cultivating multiples of small plots with crops grown in mixtures (multiple cropping) and livestock reared both in extensive and intensive care systems.

The study adopted a multi-stage random sampling technique. In the first stage, four autonomous communities were selected following a simple random process. The communities chosen at this stage were Umuaka, Nkume, Egwedu and Isiozi Akah. In the second stage, two villages were also randomly chosen from each of the four chosen communities. This gave a total of eight (8) villages involved in this study. From each chosen village, ten (10) arable crop farmers identified by the Agricultural Extension Agents (EAs) to have adopted use of pesticides in farming in the communities were selected and approached for information. A total eighty (80) such arable crop famers were involved in this study.

Information was gathered from the farmers by personal interview method with a semi-structured questionnaire on issues of challenges in the use of pesticides and adherence to dosages of pesticides both in their farms and post-harvest storage. These among others included socioeconomic information on age, gender, marital status, farm size, farming experience, farm income, level of education of farm owner, number of contact times with extension personnel, distance of farm to pesticide market/source, market cost of pesticides, and ownership/hire of spraying implement (knapsacks).

Descriptive statistics of frequency tables, percentages and mean of observations were used in analysing information of farm household socioeconomic, source and type of

pesticides used, and reasons for adopting pesticide use and challenges. The farmers' level of awareness of deleterious effects of pesticides was done with a rating scale analysis hinged on a five-point Likert scale. The determinants of adherence of farmers to recommend dosages of pesticides were achieved with Probit multiple regression technique where a farmer either adheres (1) or does not adhere (0).

Farmers' level of awareness of recommended dosages of pesticides on a five-point Likert scale type and nominal score value of Unaware (0); Least Aware (1); Aware (2); Much Aware (3) and Very much Aware (4). The mean awareness level was determined thus:

$$\bar{X} = \frac{\sum X}{N}$$

$$\bar{X} = \frac{0 + 1 + 2 + 3 + 4}{5} = 2.0$$

For each pesticide, the Xs was determined by multiplying the frequency of response to each with its appropriate nominal score value and dividing the sum with the number of farmers aware of recommended dosage of the pesticide. Thus

$$\bar{X}s = \frac{\sum fx}{nr}$$

Where:

$\bar{X}s$ = mean score; $\sum$ = summation; f= frequency or number of specifically observed farmers in each level; nr = number of farmers aware of dosage of each pesticide; x = awareness nominal value score. Thus:

$$\bar{X}s = \frac{0(X1) + 1(X2) + 2(X3) + 3(X4) + 4(X5)}{nr}$$

Decision rule:

Less than 1.0 = Unaware level;
1.10 – 1.61 = Least Aware;
1.62 – 2.00 = Aware;
2.10- 2.63 = Much Aware;
2.64 – 3.14 = Very much Aware.

The threshold score of 2.0 and above indicates famers' perceived level of awareness of pesticide dosage while using it.

The Probit regression model for determining factors influencing use and adherence was framed as follows:

$$Y_{ij} = \alpha_j + \beta_j \sum_{k=1} H_{ijs} + \varepsilon_{ij} \quad \ldots (1)$$

Where the H_{ijs} are vectors of s explanatory variables of the j^{th} household using pesticides; Y_{ij} is a vector of binary variables such that Y_{ij} =1 if the j^{th} household using pesticide adheres to recommended dosages of pesticides, and 0 otherwise. Since Y_{ij} can only assume two different values for the decision yes or no, represented by 1 or 0, the expected probability can be defined as follows:

$$E(Y_{ij}) = E\left[\alpha_j + \beta j \sum_{k=1}^{s} H_{ijs} + \varepsilon_{ij}\right]$$

$$= \alpha_j + \beta_j \sum_{k=1}^{s} H_{ij}\, E(H_{ij}) \quad \ldots(2)$$

Equation (4) defines the proportion of households with characteristics (H_{ij}) likely to adhere to dosage specifications. The empirical model was specified thus:

$$EXP\ Y_{ij} = \beta_0 + \beta_1 \ln(ED_{ij}) + \beta 2 \ln(EC_{ij}) + \beta 3 \ln(MD_{ij}) + \beta 4 \ln(CP_{ij}) + \beta 5 \ln(SE_{ij})$$

$$+\beta 6 \ln(FS_{ij}) + \beta 7 \ln(WR_{ij}) + \beta 8 \ln(FE_{ij}) + \beta 9 \ln(FY_{ij}) + \varepsilon_{ij} \quad \ldots (3)$$

Where:

The dependent variable EXP Y_{ij} is a farmer's decision to use and adhere to pesticide recommendations as defined in equation (1);
ED = Level of Education of the farm owner (Years);
EC = Number of contacts with extension in a month;
MD = Distance of source/market for pesticide (Km);
CP = Cost of pesticides used (₦);
SE =Ownership of spraying equipment (yes/No);
FS = Farm size (Ha);
WR = Farm wage rate (₦);
FE = Farming experience (years);
FY= Annual Farm income (₦);
ei = Stochastic error term.

The explanatory variables were both the continuous and binary/nominal types.

RESULTS AND DISCUSSIONS

Table 1 showed that slightly more than one third (33.75%) of the farmers using pesticides in their operations were aged between 41 and 50 years. Cumulatively, farmers aged at most 50 years accounted for 61.58% of those relying on pesticides in plying their trade.

Table 1. Socio-economic of Arable crop Farmers in Njaba LGA of Imo State, Nigeria

Socio-economic variable	Category	No. of farmers	Percentage (%)
Age (years)	Below 41	23	28.73
	41-50	27	33.75
	51-60	21	26.25
	61 and above	9	11.25
	Total	80	100.00
Marital Status	Single	3	3.75
	Married	62	77.5
	Widowed/ Widower	15	18.75
	Total	80	100.00
Level of Education (years)	No formal Education	12	15.00
	Primary school	52	55.00
	Secondary school	15	18.75
	Tertiary school	1	1.25
	Total	80	100.00
Farm Size (Hectare)	0.1- 1.0	8	10.00
	1.1 – 2.0	50	62.50
	2.1 - 3.0	16	20.00
	3.0 and above	6	7.50
	Total	80	100.00
Annual Farm Income (₦)	Below 50,000.00	28	35.00
	51,000-100.000.00	27	33.75
	101,000-150,000	10	12.50
	Above 150,000.00	15	18.75
	Total	80	100.00
Farming Experience (Years)	Below 6 years	11	13.75
	6 -10	36	45.00
	11 -15	14	17.50
	16 - 20	13	16.25
	21 - 25	6	7.50
	Total	80	100.00

This age is one when most the farmers are saddled with the responsibility of providing basic household assets and paying school fees for their children and therefore do the needful in ensuring reliable means of earning personal and farm income. Use of pesticides prevents avoidable losses that arise from attacks of organisms on crops in the field as well as in the store rooms. On marital status, the Table revealed that only 3.75% of the farmers were single with the rest either married (77.5%) or widowed/widower (18.75%). This goes to confirm a strong linkage between modernizations of income generating operations with ties on household's responsibilities [1] which marriage enshrines.

In terms of level of education, Table 1.0 also revealed that only 15.0% of the farmers had no formal education meaning that as high as 85.0% of them had various levels of formal education. More than half (55.0%) of the pesticides using farmers in the area had at most primary education with 18.75% of them having at least secondary education. Possession of formal education to a large extent enabled the farmers appreciate and ensured commitment to their use of modern innovations including pesticides. The size of farm holdings by the farmers showed that they could best be described as small scale farmers. Considering the size of lands under cultivation of their arable crops, more than half (62.5%) of them cultivated between 1.1 and 2.0 hectares of land with a cumulative of 27.0% of their number cultivating at least 2.1 hectares of land. These indeed were small-scale farmers with incomes that relatively were low as 35.0% of them earned below ₦50,000.00 and only 18.75% of them earned above ₦150,000.00 as annual farm income. The farmers had many years of farming experience as the least experienced of them (13.75%) had less than six years' experience in farming. Years of experience in farming could guide wise decisions including their adoption of modern technologies meant to facilitate practices in a developing economy [4]. Experience truly informs a farmer that pesticides when properly applied in the right dosage, under dry condition give good results especially in the short run.

Pesticide Types and Sources to Farmers

Farmers in Njaba area of Imo State sourced pesticides used in their operations from available markets and the agricultural extension personnel of Imo State Agricultural Development Programme (IMADP) attached to different cells and blocks. Table 2.0

showed different types of pesticides used by the farmers and the places they reported to have sourced them.

Table 2. Distribution of Farmers by Pesticides Used and Sources in Njaba LGA of Imo State, Nigeria

Pesticide	Source		
	Local Market	Urban Market (Owerri)	IMO ADP Extension
Primagram	28 (35.00)	15 (18.75)	37 (46.25)
Furadan	22 (27.50)	16 (20.00)	42 (52.50)
Gesaprim 500 FW	36 (45.00)	14 (17.50)	30 (37.50)
Uproot	22 (27.50)	16 (20.00)	42 (52.50)
Paraforce	13 (16.25)	15(18.75)	52(65.00)
Ridene	20 (25.00)	20 (25.00)	40 (50.00)
Phostoxin	18 (22.50)	22 (27.50)	40(50.00)
Action 40	10 (12.50)	35 (43.75)	35 (43.75)
Aldrin Dust	28 (35.00)	16 (20.00)	36 (45.00)
Primextra	19 (23.75)	21 (26.25)	40(50.00)
Mean	22 (27.50)	19 (23.75)	39 (48.75)

Note: Figures in parentheses are percentages**.**

Table 2 showed on the average that about half of the arable crop farmers (48.75%) sourced the pesticides they used from the Imo State Agricultural Development Extension personnel while 27.0% and 23.75% of them sourced their own used pesticides from local markets and the urban markets respectively. This suggests a confirmation of interdependence principle in farming as applied to sourcing and use of pesticides. The distribution further shows that use of high input resources such as pesticides in farming is facilitated more by agricultural extension agency than does the farmers on their own patronizing each segment of the distributive market considered in isolation.

Awareness of Pesticides Use Dosage

Pesticides and other chemicals used as insecticides, herbicides and drugs become effective and objectively used when their correct measures under specified conditions are used on their target organisms. The user therefore has to be aware of the correct dosage to use especially the threshold quantity and under what other conditions as recommended by the formulator. The level of awareness of pesticides dosage as perceived by the farmers is presented as Table 3.

Table 3. Farmers' level of Awareness of Recommended Dosage of Pesticides Used in Njaba LGA of State, Nigeria

Pesticide	Pesticide Dosage Awareness Level			
	Very much aware (4)	Much aware (3)	Aware (2)	Least aware (1)
Primagram	13(52)	5(15)	25(50)	30(30)
Furadan	16(64)	8(24)	20(40)	35(35)
Gesaprim 500 FW	9(36)	11(33)	12(24)	20(20)
Uproot	7(28)	9(27)	9(18)	12(12)
Paraforce	5(20)	7(21)	7(14)	10(10)
Ridene	5(20)	3(9)	8(16)	8(8)
Phostoxin	0(0)	0(0)	1(2)	1(1)
Action 40	6(24)	8(24)	6(12)	4(4)
Aldrin Dust	16(64)	6(18)	20(40)	25(25)
Primextra	9(36)	7(21)	9(18)	12(12)

Table 3 revealed that the farmers were much aware of the dosage recommendations of pesticides such as premextra, Action 40, Ridene, Paraforce, Uproot, and Gesaprim 500 FW. In like manner, they were aware of the dosage recommendations for Primagram, Furadan and Aldrin Dust. However, they were least aware of phosphotxin insecticide. This was not surprising considering that their small scale of production could not leave them with bountiful grains for storage, hence the least awareness of the use of phosphotoxin.

Determinants of Decisions to Adhere to Recommended Pesticide Dosages.

Farmers decided either to adhere to recommended dosage of use of pesticides or simply refused to do so. Some factors influenced such decisions as revealed by probit regression estimates in Table 4.

Table 4.0 showed that the decision of the farmers to adhere strictly to recommendations of the makers of pesticides at the time of use was positively influenced by number of contact with Agricultural Extension agents in a month, level of educational attainment, annual farm income, farm size and cost of pesticides. This meant that as these factors increased the farmers adhered more to makers' recommendations on measures and conditions for using the pesticides. However, the farmers decision to this adherence was significantly but negatively influenced by years of farming experience of the farmers.

Table 4. Maximum Likelihood of First-Stage Probit Estimates of Factors influencing Small Farmers Decision to Adhere to Recommended Pesticide Dosages in Njaba, Nigeria

Variable	Coefficient	Std. Error	t-ratio
Constant	1.175***	0.74	6.58
Number of contact with Extension Agents in a month	0.048**	0.18	1.99
Education Level	1.272**	1.54	2.31
Distance of pesticide source/market	-0.036	0.36	-0.24
Cost of Pesticides	4.321*	2.71	1.45
Ownership of Spraying equipment/Knapsack	2.226	0.775	0.064
Annual Farm income	0.167**	1.105	3.42
Farm size	0.212***	1.227	3.81
Farming Experience	-0.049**	0.213	2.97
Farm wage rate	-1.084	0.612	1.11
Likelihood ratio Test	71.32***		
R-Squared	0.762***		

*Significant at 10.0%; ***significant at 1.0% alpha level.

This was plausible that as farmers had more years of experience in farming, they got used to guess or estimates (threshold quantities) for use of the pesticides than on strict compliance to pesticide recommendations. The interplay of factors positively was influencing and others negatively influencing adherence to dosage recommendations showed complexity of reasoning in making the decision to adhere or not adhere to formulators' recommendations in application of pesticides.

CONCLUSIONS

Use of pesticides has formed part of modern practices in farming adopted by small farmers to enhance their operations. Local and urban markets complemented the state agricultural extension outfit (IMADP) in providing farmers with their needed pesticides in Njaba local government area of Imo State, Nigeria. The small farmers were at different levels in their perceived awareness on adherence to chemical dosages recommended by formulators of pesticides at the time of use. They were more aware of adhering to dosages on pesticides used in their field to control insects, birds, rodent pests, and weeds than they were of the ones used in controlling pests on products in their stores.

Many factors influenced farmers' adherence to dosages recommended on pesticides and included farm size, farming experience, number of times in contact with extension agents in a month, level of educational attainment, and cost of pesticides. Pesticides when properly applied in the right dosage, under dry weather condition gave good results especially in the short run. Extension outfit should encourage the farmers to process and store their products even for a short period of time. This will enable them be much aware of storage pesticides and fetch better prices for their products. Farmers should recognize and heed the three principles of threshold, interdependence, and complexity in their practice of using most pesticides.

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COLLECTION AND USE OF BIRCH SAP, A LESS KNOWN NON-WOOD FOREST PRODUCT IN ROMANIA

Cristian Mihai ENESCU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, Department of Soil Sciences, 59 Mărăşti Boulevard, 1st District, Bucharest-011464, Romania, Email: mihaienescu@agro-bucuresti.ro

Corresponding author: mihaienescu@agro-bucuresti.ro

Abstract

Silver birch (Betula pendula Roth.) is generally recognized as a useful tree species across its wide natural distribution range. In Romania, even if the presence of this species especially in mountainous and hilly regions is quite common, little is known about the uses of its sap, a special category of non-wood forest products. The aim of this paper was to test different methodologies for sap harvesting and syrup and alcoholic beverage production. Forty mature birch trees were sampled. During two days of spring, more than 70 liters of sap were collected. Syrup and alcoholic beverage were also obtained. At a small-scale, birch syrup and alcoholic beverage production could become an important source of income for birch forest owners.

Key words**:** *birch sap, Betula pendula, non-wood forest product*

INTRODUCTION

Tree sap contains a range of diverse chemical elements (e.g. Calcium, Magnesium), enzymes, plant hormones, carbohydrate, lipid products, organic acids, amino acids and other biochemicals, C vitamin and vitamins from B complex, considered to be an important source of this kind of elements for human consumption [7], [8], [10], [11].

The sap can be consumed fresh and can be stored in the refrigerator for a limited term (about a week), or may be boiled and transformed in syrup, or alcoholic beverage by fermentation with yeast, sugar and other aromatics [5], [9], [12]. Recently, the consumption of tree saps has been increasing significantly [2].

In countries with a tradition in extracting and valuing the sap of trees, such as Canada, United States of America, Russian Federation, China, Northern European countries (e.g. Estonia, Latvia, Lithuania, Belarus), the most commonly used species are maples (Genus *Acer* L.) and birches (Genus *Betula* L.). The concentration of maple sap in sugars is between 2-4%, being double than in the case of birches [3], [4], [12], [14].

In Europe, the most common birch species are the Silver birch (*Betula pendula* Roth.) and downy birch (*B. pubescens* Ehrh.) that occur particularly in northern regions [1]. For example, in Lithuania several state forestry divisions and private forest owners obtain profits by collecting and marketing the birch sap [13].

In Romania, one of the species of interest for the extraction of sap is the Silver birch, until now few studies addressing this topic being conducted. According to pollen analysis, at the onset of Holocene, on the current territory of Romania, the first species that appeared were the elms and the birches [16]. Birch trees are among the species of sanogenous interest in our country, being mostly present in mountain and hilly regions. In addition to sap (*Betulae limfa* or succus), also the bark, buds or leaves of *B. pendula* can be use for several medicinal purposes [6], [15].

The aim of this paper was to test different methodologies for sap harvesting and syrup and alcoholic beverage production.

MATERIALS AND METHODS

The study site was located in parcel 1A (45°19′47.0′′ N latitude, 25°58′37.7′′ E longitude, 630 m elevation) of Crasna

Production Unit, administrated by Măneciu Forest District (Prahova County). Within this stand, the Silver birch accounts for more than 80%, the average age of the trees was 70 years, the average diameter was 26 cm and the average height was 17 m. Forty trees, with different diameters and height, were sampled.

The working method consisted of extracting the sap from each tree by making a single hole per tree, recording the time and the volume of the sap harvested.

The necessary tools were: drills (diameter 12 or 16 mm), drill with batteries, transparent and flexible hoses (diameter 14 or 16 mm), compass, forest caliper, time counter, rope, scissors, hammer, saw, plastic containers with capacities between 0.5 and 2 l and writing instruments.

After the trees were sampled and numbered by using permanent markers, the methodology for extraction of sap consisted in: a) drilling a hole, with an inclination of 15-20 degrees, depending on the desired exposure (10 trees per each cardinal point); two types of drills, 16 mm (17 trees), and 12 mm (23 trees) were used, and the hole depth was between 1.5 and 2.5 cm; b) putting into the holes the transparent hoses with diameters of 16 mm (for the holes with the same diameter) or 14 mm (for holes with diameter of 12 mm); the time (hour and minute) was recorded; c) positioning the bottles with capacities of 0.5 to 2 liters on the trees by using the rope (Figure 1). After completion of the extraction, the holes were sealed with plugs made of wood, which were subsequently severed from the trunk by means of the saw. In parallel, the diameter was assessed.

The sap was collected between 4th and 5th of April 2015, and the following variables were assessed: diameter at breast height ($D_{1.30}$), hole diameter (H_d), hole exposition (H_e), quantity of collected sap per tree (Q), time length of extraction (T) and sap flow (F).

Birch syrup was obtained by boiling raw sap content immediately after extraction, on a stove. The boiling was done until the quantity decreased in a proportion of 7:1, *i.e.* from 7 liters of raw sap 1 liter of syrup was obtained.

a) Realization of the hole

b) Introduction into the holes the transparent hoses

c) Positioning the bottles on the trees

Fig.1. Methodology for sap extraction

The recipe for obtaining the alcoholic beverage consisted in the following steps: i) in a container of 10 liters, 5 liters of raw sap were placed and 1 kg of sugar, 4 cubes of yeast of 5 grams each, the juice of four lemons and half of kg of raisins were added; ii) the composite was maintained for 24 hours, time during which the fermentation process began; iii) after the 24 hours, the composite has been added to another 20 liters of raw sap and 4 kg of sugar in a demijohn with a capacity of 50 liters, fitted with kettle, and placed in a cellar.

Data were centralized and the calculations were performed with STATISTICA software.

RESULTS AND DISCUSSIONS

Results regarding sap collection

In the first day, the total amount of sap extracted in the time frame 9:30-17:00 was 29.55 liters. The smallest quantity was recorded in the case of tree no. 1 (0.1 l) and the largest amount in the case of tree no. 24 (2.85 l). The sap flow rate per tree ranged from 0.7 ml/min to 8.7 ml/min, the average value being 3.0 ml/min (180 ml per hour).

In the second day, the total amount of sap extracted between 10:00 and 15:00 o'clock was 26.65 liters. As in previous day, trees no. 1 and 24 recorded the lowest, and the largest quantities, respectively. The flow rate per tree ranged from 0.5 ml/min to 8.9 ml/min, the average value being 2.7 ml/min.

Between April 4, 17:00 o'clock and April 5, 10:00 o'clock the collection containers (plastic bottles with capacities of 0.5 liters and 2 liters) were maintained on the trees, collecting a quantity of 17 liters. Therefore, the total sap extracted from the 40 trees in two days was 73.2 liters.

Regarding the hypothesis according to which the average sap flow is higher on the north-south orientated holes compared with the ones orientated on east-west, the obtained results confirm it. The highest quantity of sap collected and the highest flow rate were recorder for the holes facing north, while the lowest values were recorded in the case of the holes facing east

The diameter of the 40 trees, measured at a height of 1.30 m above the ground, varied between 15 cm and 40 cm, and the mean diameter was 27.7 cm. The correlation coefficient between $D_{1.30}$ and Q was 0.10.

Results regarding the obtained syrup and alcoholic beverage

Fresh birch sap was colorless, odorless and had a sweet taste. Stored in a refrigerator at 4-5° C temperatures, the sap retained its qualities for about a week. After this deadline, the sap presented a "muddy" look and a sour taste.

After the first 30 minutes of boiling, at the surface of the liquid, colorless foam formed which was immediately removed. At 60 minutes after the start of the boiling process, the liquid began to be colored in a shade of light brown. After 90 minutes, the liquid became browner (Figure 2). The ratio of 7:1 was achieved in 5 hours of boiling, resulting a final product with sweet taste and brown shades.

Fig.2. The aspect of sap after 90 minutes of boiling

After the completion of boiling, the fresh syrup obtained (hot) was stored in glass bottles, left to cool in ambient temperature for 24 hours, after which it was stored in a refrigerator at 4-5° C. Without further treatment and stored in such conditions, the syrup kept its qualities (taste and color) for about three weeks after which a sour taste and some deposits were observed.

Regarding the alcoholic beverage, the fermentation lasted for three months.

The study confirmed the results of similar research carried out in Romania [1], according to which the amount of sap extracted is directly proportional to the diameter of trees. Also, the largest amounts of sap were extracted from the holes facing north.

Even if the guidelines described in other studies regarding the ration between the raw sap and the syrup obtained were not followed, a flavored syrup with caramel taste, which has maintained its qualities for nearly one month, was obtained.

CONCLUSIONS

Regarding the method for sap extracting, the best results were obtained by using a drill with a diameter of 12 mm and a hose with a

diameter of 14 mm. It is also preferable to use the bottles of 0.5 liters for harvesting sap in order not to exercise a tension too high in the rope, causing tearing, on the one hand, and to increase the stability of the bottles especially when strong currents appear, on another hand.
When working in a team with two members and using the methodology proposed in this study, it is recommended not to exceed the number of 40-50 trees from which sap is extracted in order to track and collect the sap in an optimally way, without loss.
Future research should be conducted in partnership with experts from the food industry in order to increase the quality of the obtained derived products from sap.
Even if the birch sap is considered to be an exclusive non-wood forest product, in some regions across Romania the potential for collecting and marketing of the birch syrup and alcoholic beverage is high. At a small-scale, birch syrup and alcoholic beverage production could become an important source of income for birch forest owners.

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TRENDS AND DETERMINANTS OF PRICE IN THE POULTRY SUB-SECTOR OF NIGERIA

Joseph Evo EWA, Chigozirim Ndubuisi ONWUSIRIBE, Felix Chibueze NZEAKOR

Michael Okpara University of Agriculture Umudike, University Farm Centre, Department of Agribusiness and Management, Department of Rural Sociology &Extension, Abia State, Nigeria, Phone: +2348063724608, Email: ndubuisichigo@gmail.com

Corresponding author: ndubuisichigo@gmail.com

Abstract

This study analyzed the trends and determinants of price in the poultry sub-sector of Nigeria. A time series data, from the period of 1961-2014 were collected from the Food and Agricultural Organization database and other sources. Trend analysis, ADF unit root test, cointegration test error correction model, and impulse response were used to analyze the data. The unit root test using Augmented Dickey Fuller test (ADF) shows that all the variables have constant mean suggesting the presence of a long-term relationship. The Johansen cointegration test indicates the presence of two cointegrating equations suggesting the likelihood of long-run relationships between the variables. The error correction term (ECM) coefficient of 87.2 % indicates that the speed of adjustment of the dependent variable from the short run to the long run was high. Imports of poultry products, capital, inflation, interest rate and tariff rate were the significant variables affecting the domestic poultry product prices in the long run. We, therefore, recommend that a well-articulated import control measures should be adopted and not necessarily tariff increase. An outright ban and border control will go along to help stabilize domestic poultry prices.

Key words**:** *determinants, price, poultry, trends*

INTRODUCTION

The poultry sub-sector globally is highly dynamic and it is been challenged by the increasing cost of inputs which translates to the increasing price of poultry products. In developing countries, poultry production is evolving in response to rapidly increasing demand for poultry products with the attendant shortfall in supply leading to increasing level of imports. In developed countries, demand for poultry products is stagnating, while many production systems are increasing their efficiency. Historical changes in the demand for poultry products have been largely driven by human population growth, income growth and urbanization [1]. The poultry sub-sector is an important component of the Nigerian Agricultural Economy. Its importance derives from the fact that it is one of the key employers of labor as there are many poultry enterprises springing up.

Poultry is generally considered as a collective name to domesticated fowls kept primarily for meat, eggs and in some cases as ornamental. These include chicken, turkey, Guinea fowls, pigeons, Ostriches, Pheasant, Quails, Peafowl's, and swimming birds such as ducks, Geese, and Swans. They are domesticated birds kept for egg or meat production which include chickens (domestic fowls) turkeys, ducks and geese [8]. Poultry is the quickest source of meat and its production process involves the least hazardous and arduous in relation to another livestock enterprise. Hence, increased poultry production is one of the surest and quickest ways of increasing income and poverty alleviation.

In Nigeria, poultry production can be divided into three main sections name small, medium and large-scale production with 25% being provided by commercial farms, 15% semi-commercial and 60% from the backyard [1]. The two major events that have been recorded in the industry has been the ban on the importation of frozen poultry product which was introduced in 2003 and deepen the market for poultry product in Nigeria and the Avian

Influenza of 2007 which affected the industry on a negative note. The ban according to on the importation of frozen chicken into Nigeria has not only created jobs in the poultry industry but encouraged investments in poultry production. It is recorded that the poultry industry contributes about 25% of the country's Agricultural GDP.

Consequently, local supplies have been inadequate with an estimated 30% of the livestock slaughter imported from neighboring countries. In addition, inability to comply with international sanitary and photo-sanitary standard requirements has made it challenging for Nigeria to be a net exporter of live animals and livestock products internationally. Although the potential poverty-reducing and food security promoting opportunities of livestock development have not been fully tapped into in Nigeria, the role of livestock in food security and poverty reducing could be enhanced through research, extension, and training.

There has been a steady increase in population, urbanization, disposable income and export drive. Unfortunately, the poultry industry is beset by quite a number of challenges. These challenges range from the high cost of feed, poor quality chicks and pouts, inadequate basic infrastructures such as road, power and water supply to inaccessibility of veterinary services, credit facilities and inadequate investment by both the public and the private sectors.

The increasing rate of urbanization in Nigeria, and the subsequent soaring amount of wastes being generated in the poultry industry and the resultant human population explosion, and their human wastes present greater challenges for waste disposal and management, especially in the urban areas of this country. Of great concerns are the environmental pollutions resulting from poultry industry activities. One major challenge of commercial poultry is waste management from feed mills to the meat processing unit of the poultry industry. A Large quantity of poultry waste is inevitably generated on a continuous basis in commercial production to the extent of the intensity of operations. The waste if not managed properly, can be inimical to human health and the water quality. Repugnant odors from commercial poultry operations, especially when the wastes are not properly managed, has often been found to be a major source of conflicts within communities in cases where the enterprise is located near Residential areas. Nigeria has the highest number of poultry farms in Africa. Poultry meat and eggs are the most consumed animal protein; unrestricted by any religion or culture in Nigeria.

MATERIALS AND METHODS

Nigeria is a country located in West Africa along the Atlantic Ocean's Gulf of Guinea, its land borders are with Benin to the West Cameroon and Chad to the East and Niger to the North. It is between latitudes 4^0N and 14^0N and longitudes 3^0E and 15^0E Meridian. Nigeria's equatorial position gives its tropical climate but this does not mean a single environment. Nigerian are predominantly farmer producing and importing poultry products to meet their protein needs.

This study will adopt principally secondary data obtained from the Central Bank of Nigeria statistical bulletin, National Bureau of Statistics (NBS), State Agricultural Development Programmes (ADPs), Food and Agriculture Organization database, World Bank Statistical Bulletin, United Nations Development Programme (UNDP) statistical reports and other sources for a period of 1961-2014.

Unit Root Test using the ADF test and Philip-Perron technique to test if the time series data is stationary and descriptive statistics. The Johansen's Cointegration Test and Error correction estimate which shows the short run and long run relationship between the specified variables

Model Specifications

Growth rate analysis

The growth rates in poultry are computed using the following least squares method of fitting the semi-logarithmic function:

$$y = ab^t e_t \quad \text{.....(1)}$$

where, Y = dependent variable (production,)
a = intercept term,
b = (1+r) and r is the compound growth rate
t = time period (t = 1, 2, 3…………n)
et = error term
Where the coefficients are obtained using OLS procedure and the compound growth rate is (Antilog of logb-1) *100, i.e. the percentage of growth rate [9].

Unit Root Test: Augmented Dickey-Fuller (ADF) Test (for stationary test)

The ADF test consist of estimating the following regression

$\Delta Y_t = \beta_1 + \beta_1 + \delta Y_{t}- + \Sigma^m{}_t=1 \propto_i \Delta Y_t-1 + e_t$…………………………….....................(2)

where y is the series t is trend factor, e_t is the stochastic error term t-1 is the lag length. It is a one-sided test whose null hypothesis is δ=0 versus δ<o (hence large negative values of the test statistics lead to the rejection of the null) and Δ is the difference operator. Under the null, Y_t must be differenced to achieve stationarity; under the alternative, Y_t is already stationary and no differencing is required. The Augmented Dickey-Fuller (ADF) unit root test is employed to test the integration level and the possible integration of the variables. If the data set indicates integration property for the employed variables, there we proceed to test for cointegration among the variables employing [4,5] test techniques.

Cointegration Test

According to [6] two variables are said to be cointegrated if they have a long-term, or long run equilibrium, relationship between them. If two variables, dependent and an independent, are individually non-stationary but their residual (combination) is stationary, those variables are co-integrated on the long run. The researchers used the Johansen co-integration test to test co-integration since it is the only test which can estimate more than one co-integration relationship if the data set contains two or more time series as well as gives the maximum rank of co-integration [10].

According to [3] the Johansen's methodology takes its starting point in the vector autoregression (VAR) of p order by:

$Y_t = \mu + {}^{A}{}_1 y_t-1 + \ldots + A_p y_t + {}^{\Sigma}{}_t$……………..(3)

where y_t is an n 1 vector of variables that are integrated of order one or two, commonly denoted by 1(1) or 1(2), and t is an n-1vector of innovations. This VAR can be re-written as:

$\Delta yt = \mu + \pi y_t-i + {}^{p-1}{}_{\Sigma} s_i \Delta y_t-i \; {}^{\Sigma}{}_t$………….......(4)
i = 1

$\Pi = {}^{p}{}_{\Sigma} A_i - 1$ and $s_i = - {}^{p}{}_{\Sigma} \; A_j$ ……………....(5)
i = 1 j = I + 1

If the coefficient matrix Π has reduced rank, r <n then there exist *nX r* matrices α and β each with rank r such that Π = αβ* and $\beta^* y_t$. y_t is stationary r is a number of co-integrating relationships, the elements of α are known as the adjustment parameters in the vector error correction model and each column of β is a co-integrating vector.

It can be shown that for a given r, the maximum likelihood estimator of defines the combination of y_{t-1}that yields the r largest canonical corrections of Δy_t with y_{t-1} after correcting for lagged differences and deterministic variables when present. Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of Π matrix: the Trace Test (TT) and maximum Eigen value test are shown in equations (7) and (8) respectively.

$J_{trace} = -T \; \Sigma^p 1n \; (1 - \lambda i)$ …………………...(6)
i = r + 1
$J_{max} = - T1n \; (1 - \lambda r + 1)$…………………… (7)

where *T* is the sample size λi and is the i^{th} largest canonical correlation. The TT tests the null hypothesis of r co—integrating vectors against the alternative hypothesis of n co-integrating vectors. The maximum eigenvalue test, on the other side, tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of r+1 co-integrating vectors.

Error Correction Model

The error correction model is specified as follows for poultry prices:

$$\Delta C_{t-1} = b_o + \Delta b_1 z_{1t-1} + \Delta b_2 y_{2t-1} + \Delta b_1 x_{1t-1} + \Delta b_2 x_{2t-1} + \Delta b_3 x_{3t-1} + \Delta b_4 x_{4t-1} + \Delta b_5 x_{5t-1} + \Delta b_6 x_{6t-1} + \Delta b_7 x_{7t-1} + ECM_{t-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

where
C= prices of poultry (in Naira)
X_1 = capital (capital allocated to agriculture in naira)
X_2= inflation rate
X_3 = credit (credit allocated to agriculture in naira)
X_4 = interest rate
X_5 = labour (agricultural labour size in numbers)
X_6 = Tariff rate
X_7 = exchange rate
ECM =error correction term
t = time trend.

RESULTS AND DISCUSSIONS

Descriptive statistics of the variables

The summary statistics of the variables used in this study was examined and discussed considering the mean, median, minimum and maximum values. Other statistics considered include the standard deviation, CV (variance), skewness and kurtosis of variables.
The mean value of the dependent variables used in this study which include the production of poultry, the price of the poultry and the import of poultry, their mean values were 102,619 tons, 111,753 (naira) and 2,332.97 tons respectively.(Table 1).

Table 1. Summary Statistics, using the observations 1961 - 2014

Variable	Mean	Median	Minimum	Maximum
Production (output)	102619.	111355.	37360.0	192313.
Price	111753.	85700.0	-177547.	446088.
Import	2332.97	527.000	-295.667	19392.0
Capital	80081.6	43913.5	29.2000	229825.
Inflation	7.11989	7.96864	-31.3275	72.8355
Credit	119503.	87046.2	422.733	317764.
Interest rate	13.5904	14.6969	5.33747	31.6500
Labour	7.31279e+007	7.22619e+007	4.73354e+007	9.98183e+007
Tariff	8.61017	0.000000	0.000000	100.570
Variable	**Std. Dev.**	**C.V.**	**Skewness**	**Ex. Kurtosis**
Production (output)	43111.9	0.420115	0.107021	-1.05838
Price	162750.	1.45634	0.409493	-0.706966
Import	4352.25	1.86554	2.79763	7.22823
Capital	81354.4	1.01589	0.412491	-1.42227
Inflation	23.1144	3.24645	0.692896	0.571126
Credit	108267.	0.905974	0.353760	-1.37593
Interest rate	6.86015	0.504778	0.396601	-0.886074
Labour	1.54744e+007	0.211607	0.0684362	-1.19338
Tariff	16.2850	1.89137	3.56826	16.8454

Source: Food and Agriculture Organization database and CBN bulletin various issues

Unit root test of the variables

Prior to using the time series data for analysis, the variables were subjected to a stationary test using Augmented Dickey - Fuller test (ADF) to ascertain the order of integration of the variables.
The unit root test attempts to determine whether a given time series data is consistent with a unit root process. The presence of unit roots could lead to false inferences in regression between time series.
From the results of the Augmented Dickey-Fuller (ADF) unit root test presented in Table 2, all the variables were stationary at first difference. The coefficients compared with the critical values revealed that all the variables were stationary at first difference and on the basis of this; the null hypothesis of non-stationary was rejected and safe to conclude that the variables are stationary. This implied that the variables are integrated into order one. If two or more series are individually integrated (in the time series sense), the individual series are first-order integrated (I(1)) but some (cointegrating) vector of coefficients exists to form a

stationary linear combination of them. The series may drift apart in the short-run, then follow a common trend which permits a stable long-run relationship between them.

Table 2. Unit root test of the variables

Variables	Level		Difference		Order of integration
	test with constant	test without constant	test with constant	test without constant	
Production	2.75489	-0.52343	-0.74121	-2.13905	I(1)
Price	-1.69361	-1.49947	-3.16866	-3.19578	I(1)
Imports	-2.21822	-2.78978	-4.75049	-4.69971	I(1)
Capital	1.52881	0.196067	-1.22579	-7.63163	I(1)
Inflation	-1.24286	-1.02008	-5.37773	-5.48825	I(1)
Credit	1.16079	1.14675	-0.87916	-2.31344	I(1)
Interest	-0.16259	-1.43681	-1.7349	-1.76536	I(1)
Labour	1.85077	1.62657	-0.34174	-5.64888	I(1)
Tarrif	-0.95661	-1.52493	-2.93734	-2.91239	I(1)
exchange rate	1.366114	2.408458	-6.96388	-6.43637	I(1)

Source: Food and Agriculture Organization data base and CBN bulletin various issues
Note: I(1) are integrated at first difference while -4.1498, -2.0005 & -1.71793 are Mackinnon critical value for rejection of hypothesis of unit root applied at 1%, 5% & 10% respectively.

Trends of poultry prices in Nigeria from 1961-2014

The trend in poultry price is presented in Figure 1, poultry product prices showed a normal trend two times the periods under investigation. Prices started rising from 1960 and climaxed in 1975. Some factors like income population, liberal tariff, easy oil money, improved the first rise in price regime from 1975 to 1980. The prices crashed to the point that even local production was greatly affected. Demand at this point outpaced supply. The government liberalized importation of poultry products which the market major off-takers took advantage of to expand their operation to meet the surging demands. High records of dumping and smuggling were witnessed.

Price situation came up late 80's with the ban on importation of poultry products and introduction stringent tariff measure. This brought importation of poultry productions to all time low has been confirmed. This price situation climaxed in 1995 with a sharp vertical fall in prices. Since feed represents between 60-70% of the total cost of production, a lot of attention is channeled to Feed. Feed is not only cost but obviously the major one; the entire main driver has gone up by more than the general inflation level over the last few years. Animal feeds mills within this period ran out of yellow maize in the country and there was a ban on importation of yellow maize. And the local maize producers could not meet the demand of the population and feed millers. These pushed the maize prices up, so any price increases needed to cover not only the under-recoveries of the last few years out also the coming feed price increases. Prices of feed moved in the other direction which further weakened competitiveness position in the poultry industry – "no longer chicken feed" poultry product prices rose due to rise due to the demand and pressure on maize price. These results confirmed what [2] stated that high prices supply globally are a common feature of global poultry production, with feed cost representing around 70% or more of total production cost globally. Owning this period, producers depended on day-old chicks and poultry whose purity could not be ascertained. This resulted in stunted growth in poultry and low productivity among laying birds. Three was a low investment by individuals and corporate organizations reason being that Poultry production is a capital intensive volume-driven, low margin business and risk-laden.

The sharp and vertical fall in prices was as result of avian influenza which badly affected poultry industry. There was no demand for poultry products, which resulted in poultry product glut and sharp fall in poultry prices within the short period. The poultry products farmers which were very attractive poultry farmers suffered a great blow which made many operators close shops. The forecast clearly shows that the poultry prices are expected to increase in the six years.

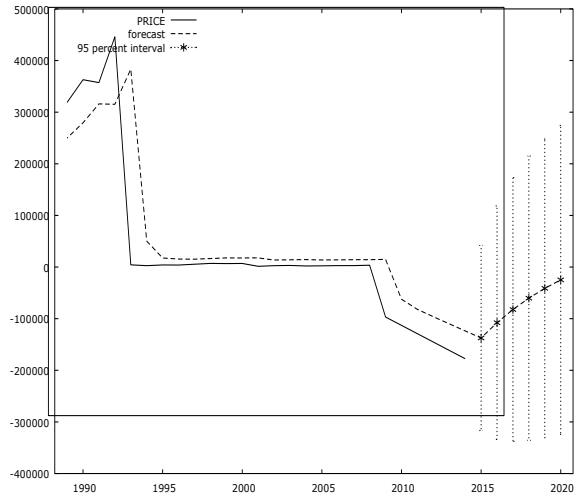

Fig 1. trend of poultry prices in Nigeria
Source: Computations from the data obtained from FAO stat various issues

Determinants of poultry price in Nigeria

The factors determining poultry price in Nigeria were examined in this section. Since the unit root test for the variables revealed that all the time series variables were integrated into the same order 1(1), cointegration test was done to establish the presence of long run relationship among the variable in the poultry production model. The error correction model shows the speed of adjustment of the dependent variable to changes in the independent variables included in the import model.

Cointegration estimates for the poultry price model

When linear combinations of variables are stationary, then cointegration becomes necessary. This implies that a long-run relationship may exist among them, which connotes that they may be disparity among them in the short run but in the long, there will be unity among them. To establish whether a long run relationship exists among the variables or not, cointegration test Johansen's multivariate method was carried out and reported in table 3 below. Using the trace statistics, the results points out that the null hypothesis of no cointegration among the variables are rejected in favor of the alternative hypothesis with four cointegrating variables at 1%,5% and 10% levels of significance because the values exceed the critical values. This indicates that there are at least four cointegrating variables, which implies that a unique long run relationship exists among the variable and the coefficient of estimated regression can be taken as equilibrium values.

Table 3. Unrestricted Cointegration Rank Test (Trace) for poultry price model

Hypothesized		**Trace**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.851843	301.8343	197.3709	0.0000
At most 1 *	0.650444	202.5412	159.5297	0.0000
At most 2 *	0.607626	147.8843	125.6154	0.0011
At most 3 *	0.504789	99.23627	95.75366	0.0282
At most 4	0.445582	62.69214	69.81889	0.1622
At most 5	0.262040	32.02061	47.85613	0.6110
At most 6	0.148940	16.21957	29.79707	0.6967
At most 7	0.126762	7.833379	15.49471	0.4834
At most 8	0.014981	0.784910	3.841466	0.3756

Trace test indicates 4 cointegrating Eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Computations from the data obtained from FAO stat and CBN bulletin various issues. Note: ***, **, * are statistically significant at 1%, 5% and 10% respectively.

Error correction model for the factors affecting poultry price in Nigeria

Since the variables are integrated in the same order as presented in the unit root test, this led to the co-integration analysis which clearly shows the presence of four cointegrating equations. The result of the co-integrating equation as presented in Table 4.

The error correction term (ECM) which shows the speed of adjustment of the determinants of the price from the short run to the long run. The ECM coefficient of 87.2 % indicates that the speed of adjustment of the dependent variable from the short run to the long run was high.

Imports of poultry product were statistically significant at 10% and positively influencing the price of poultry products. This implies that an increase in the level of imports still forces the price of the domestic poultry products up.

The interaction of the world price of poultry products with the domestic price tends to force the domestic price up [7]. The capital was statistically significant at 5% and negatively influencing the increase in the prices of the poultry products. This implies that prices of poultry products decrease with the availability of capital for domestic investment in the poultry sub-sector.

Table 4. Error correction Regression result for the factors affecting poultry price

Variables	***Coefficient***	***Std. Error***	***t-ratio***	
Const	265013	176464	1.5018	
Δ Import_1	5.05346	2.72785	1.8525	*
Δcapital_1	-1.18453	0.571597	-2.0723	**
Δinflation_1	-1130.04	564.362	-2.0023	*
Δcredit_1	-0.21641	0.583204	-0.3711	
Δ Interest_1	-8159.53	2684.05	-3.0400	***
Δlabour_1	-0.00352394	0.00369976	-0.9525	
ΔTARIFF_1	1530.19	625.305	2.4471	**
Δ Exchange rate_1	-402.586	382.53	-1.0524	
Δ Production_1	-0.386313	0.862826	-0.4477	
Δ price_1	1.17295	0.112934	10.3862	***
ECM	0.871548	0.0935365	9.3177	***
Mean dependent var	113060.4	S.D. dependent var	164020.7	
Sum squared resid	1.04e+11	S.E. of regression	50411.45	
R-squared	0.925520	Adjusted R-squared	0.905537	
F(11, 41)	46.31642	P-value(F)	1.45e-19	
Log-likelihood	-642.2833	Akaike criterion	1308.567	
Schwarz criterion	1332.210	Hannan-Quinn	1317.659	
Rho	-0.104075	Durbin's h	-2.293204	

Source: Computations from the data obtained from FAO stat and CBN bulletin various issues. Note: ***, **, * are statistically significant at 1%, 5% and 10% respectively.

Inflation was significant at 10% and negatively influencing the prices of poultry products in Nigeria. This implies that the increase in the level of inflation forces the producer price down. The actual price received by the producers will not be a true reflection of the actual price due to inflationary pressures in the long run. This is also applicable to increase to the interest rate which was significant at 1% and negatively affecting the price of poultry products in the long run. This implies that the actual price paid for the poultry product does not reflect the true value in the long run due to the high level of inflationary trends.

Tariff and lag value of the price were statistically significant at 5% and 1% respectively and positively influencing the price of the poultry products. This implies that the increase in the tariff rate to checkmate the importation of poultry products will result in the increase in the domestic producer price of poultry products in the long run. The price of the poultry products in the previous year influences the increase in the price of the poultry products subsequently.

Impulse response of poultry prices

This means the test track the time path of the sudden changes that can be exposed to different variables of the model and how other variables respond to any sudden change in any variable of the model variables of the study. And Figure (2) Shows Impulse Response Function of poultry price to a sudden change rate of one standard deviation in each of the imports, labor, capital, credit, inflation, production, interest rate, exchange rate, and tariff.

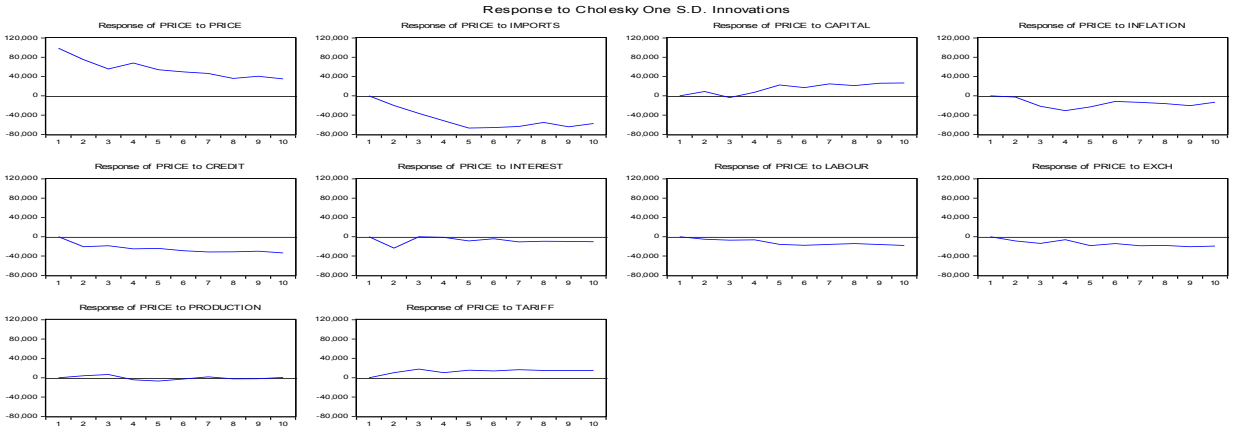

Fig 2. impulse response of poultry prices
Source: Computations from the data obtained from FAO stat

Price responds to shocks in the previous year's price by continuously decreasing. Price responds negatively to shocks from the import of poultry products as this forces the price of

products down in the short run. The price of poultry products responds positively to shocks in capital available for poultry production as this forces the price of poultry products up. Shocks in inflationary trends cause the downward trend the prices of poultry products in Nigeria. Shocks from credit, interest, labor and exchange rate affected the price of poultry products negatively, while the shock from domestic poultry production had a minimal impulse on the price of the poultry products. Shocks in the tariff rate resulted in positive trend in the price of the poultry products.

CONCLUSIONS

From the result of the trend analysis, it is obvious that the price of poultry products have continued to be on the increase. When there are import restrictive policies against the importation of poultry products, the prices of poultry products increases swiftly and with the failure of local production to meet the demand for the poultry products smuggling becomes imminent.

Imports do not really force the price of poultry products down rather it increases the price of poultry product in the long run but in the short run, it appears to be decreasing. Capital availability. Prices of poultry products decrease with the availability of capital for domestic investment in the poultry sub-sector. The increase in the level of inflation forces the producer price down. The actual price received by the producers will not be a true reflection of the actual price due to inflationary pressures in the long run. the increase in the tariff rate to checkmate the importation of poultry products will result in the increase in the domestic producer price of poultry products in the long run.

Recommendation

Based on the findings of this research, the following recommendation are proffered

(i)Continuous importation of poultry products into the country temporarily reduces the price of products but actually increases in the long run. Importation of poultry products into the country should be regulated and stopped completely.

(ii)A well-articulated import control measures should be adopted and not necessarily tariff increase. An outright ban and border control will go along to help stabilize domestic poultry prices

(iii)Capital availability for investment in the poultry production will lead to the stabilization of poultry prices in the long run. A special policy for the provision of capital to the poultry farmers should be instituted.

(iv)Inflation control should be insured in order o stabilize the price of poultry products.

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PRELIMINARY RESEARCH ON USING INDUSTRIAL PLANTS IN CONSTRUCTIONS

Raluca FERNEA (ISTOAN), Daniela Lucia MANEA, Daniela Roxana TĂMAȘ-GAVREA, Olimpiu Ioan MIRON

Technical University of Cluj-Napoca, Department of Civil Constructions and Management, 28 Memorandumului Street, 400114, Cluj-Napoca, Romania Emails: ralucafernea@gmail.com, daniela.manea@ccm.utcluj.ro, roxana.tibrea@cif.utcluj.ro, miron_ioan_olimpiu@yahoo.com.

Corresponding author: ralucafernea@gmail.com

Abstract

The research was based on the identification of several products from industrial plants made for the constructions sector and able to satisfy the needs of supporting the farming sector and a sustainable economy. Building friendly environmentally materials today are only possible if the products are based on renewable resources. The natural resources will help the construction industry to reduce the pollution and to be more eco-friendly. Trying to develop new materials the present paper is focus on hemp products. The first part present the raw materials used for the new composite products based on hemp and polyvinyl acetate and the second part of the paper show the results obtain for sound absorption coefficient, reaction to fire and mechanical strengths. The hemp products will have a positive impact on the environment reducing the emission of CO2 and also will help to preserve natural resources.

Key words**:** *hemp, mechanical strengths, polyvinyl acetate, reaction to fire, sound absorption coefficient, sustainable materials*

INTRODUCTION

New trends in research and in the development of materials for the sector of constructions aim at passing on from products based on limited and non-renewable resources to environmentally friendly products, based on renewable raw materials. A large part of the renewable raw materials is vegetal in origin.

Research on the use of natural fibres and of the waste originating from the processing of industrial plants or as reinforcements in composite materials has come to be the basis for the materials used in civil engineering [8].

Among industrial plants, literature presents hemp as totally renewable materials: seeds can be used in food; fibres can be used for textile materials, paper production, vehicle panels and hemp shives for the constructions sector. As hemp cultivation does not require special care, hemp can bring in significant economic benefits [5].

According to the data presented by the Food and Agriculture Organization of United Nations Statistics division, since 2010-2013, in Europe, an increase in the cultivation of hemp is seen at continental level (Fig.1) [3].

An explanation for the increase in hemp production at European level could be the extended research during the recent years regarding hemp plant.

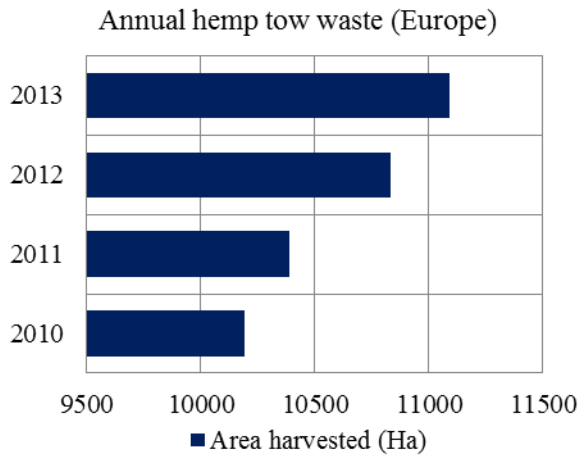

Fig.1. Europe hemp tow waste area
Source: Own interpretation

It is estimated that globally there are over 25,000 products based on hemp, and that now, in over 30 countries, industrial hemp is grown as a raw material for the world market [4].

This study is focused on the use of industrial plants in the production of new building materials in the composition of which lightweight aggregates are also found, such as perlite and/or vermiculite.

MATERIALS AND METHODS

Materials

Hemp is an industrial plant that easily adapts to the growth conditions and has a large variety of species. Its stem contains 20-40% fibers and 60-80% hemp shives or crust. Hemp has the following chemical composition: cellulose (55-72%), hemicellulose (8-19%), lignin (2-5%), wax (<1%) and minerals (4%).
Hemp shives exhibit a larger content of lignin (19-21%) and hemicellulose (31-37%), but a smaller content of cellulose (36-41%) [1].
Polyvinyl acetate is polyvinyl glue, containing 80% water; it is white in color. It behaves well in the context of elements containing a high percentage of water. It has high water solubility and consequently it is more recommended for interior use [2].
Lightweight aggregates, perlite (vermiculite) are lightweight insulating materials, produced by expanding the natural volcanic rock to get a cellular structure [7], at high temperatures. Perlite (Fig.2) is a mixture of silica dioxide SiO_2-75% and aluminum oxide Al_2O_3 -23%.

Fig.2 Lightweight aggregates- Perlite
Source: Own portfolio.

Perlite is regarded as a green material, of high porosity and a density between 150-200 kg/m^3. It is used in thermally insulating mortars and concretes due to its thermal insulation properties; it does not degrade in time, it does not burn at temperatures between -200^{o}C and +850^{o}C [6]. Taken as a good thermal, acoustic and fire insulator, perlite does not pollute the environment; it is catalogued as a form of natural glass, chemically inert and with a pH of approximately 7[9].
Vermiculite (Fig. 3) is a granular material, with the appearance of mica, rich in iron, magnesium and silicate ions. It is utilized as an aggregate in fire resistant mortars, having a density of 110 -130 kg/m^3 and water absorption of 60-70 % of the volume [10].

Fig. 3. Lightweight aggregates- Vermiculite
Source: Own portfolio.

Formulae structure

The products under investigation were made from hemp mixed with polyvinyl acetate, to which lightweight aggregates, such as perlite and/or vermiculite were added. Three formulae were obtained, their composition being given in Table 1.

Table 1. Formulae structure

Name	Composition
C_3+P_2	C_3-Hemp 60% P_2- Perlite 40 %
C_3+V_2	C_3-Hemp 60% V_2- Vermiculite 40 %
C_3+PV_2	C_3-Hemp 60% PV_2- Perlite with vermiculite 40 %

Source: Own determination.

In the three formulae, the amounts of hemp and polyvinyl acetate were identical and constant, only the amount of lightweight aggregate was modified. The polyvinyl acetate amount added in the mixtures was in ratio 1:2 hemp - polyvinyl alcohol and 1:4 lightweight aggregate - polyvinyl acetate. The formulae (Fig. 4) were mixed mechanically

with a mixer; the compaction in the work forms was performed manually, with a ram. After 24 hours the products were stripped from the forms.

Fig. 4. Visualization of component materials of the 3 recipes: a. C_3+P_2, b. C_3+V_2, c.C_3+PV_2
Source: Own portfolio.

Determination of physical and mechanical properties

After the three formulae were dried up, samples were tested for acoustic, mechanical properties and fire reaction.

Regarding the acoustic part, the sound absorption coefficient was determined for a frequency range of 0-6,400 Hz, with the help of Kundt tube (Fig. 5.a) and the Pulse software (Fig. 5.b). The equipment belongs to the technical equipment of the Transylvania University of Brasov.

To determine the values of sound absorption coefficient, two circular shape specimens were made, with the diameter of 28 mm and 100 mm, for every specimen.

The curves of the sound absorption coefficient for the frequency ranges 0-1,200 Hz and 500-6,400 Hz were compiled in the Pulse software and a curve with the values of the sound absorption coefficient in the interval 50-6,400Hz was found.

Fig.5. Determination of acoustic absorption coefficient
a. Kundt tube, b. PULSE software.
Source: Own portfolio.

The reaction to fire of the materials was put to test in the laboratory of the Rigips Company from Turda (Fig. 6.a). The test consists in an arrangement of the specimen to fire, at both ends, (Fig. 6.b), at a temperature of 950ºC, and then the failure time was recorded.

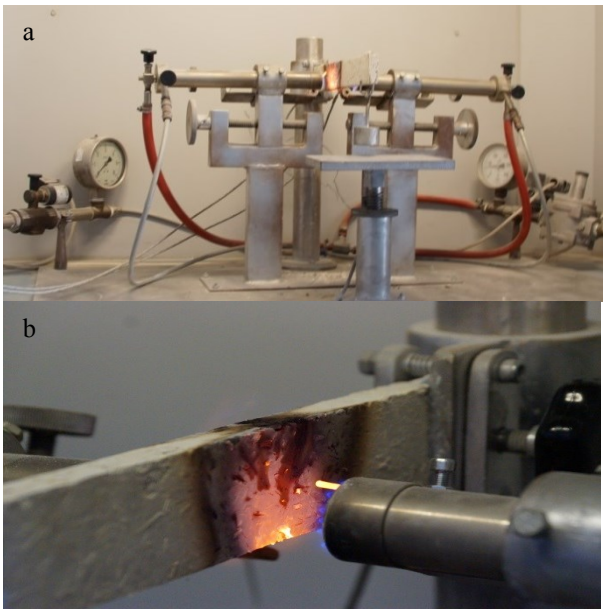

Fig. 6. Reaction to fire determination
a. Equipment
b. Specimen detail
Source: Own portfolio.

From a mechanical point of view, the samples were placed to three tests, where resistance to compression and flexural tensile strength were tested on prisms of 40x40x160 mm, while axial tensile on specimens with breaking section 5cm^2.

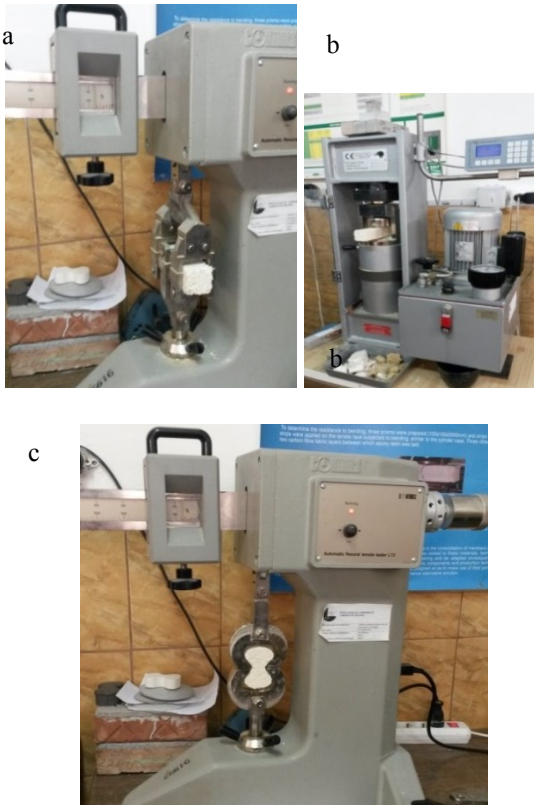

Fig. 7. Determination of mechanical properties
a. Fruhling Michaelis(flexural tensile strength)
b. Hydraulic press
c. Fruhling Michaelis (axial tensile)
Source: Own portfolio.

Compressive resistance was calculated with the hydraulic press (Fig.7.b), flexural tensile strength and axial tensile with the Fruhling Michaelis device (Fig. 7.a,c), from the laboratory of the Faculty of Civil Engineering of the Technical University of Cluj Napoca.

RESULTS AND DISCUSSIONS

Sound absorption coefficients

The values of the sound absorption coefficient for the three formulae (Fig. 8) highlight that the sample with the best behaviour as an sound absorbing material is the formula containing both perlite and vermiculite in the mixture (C_3+PV_2).

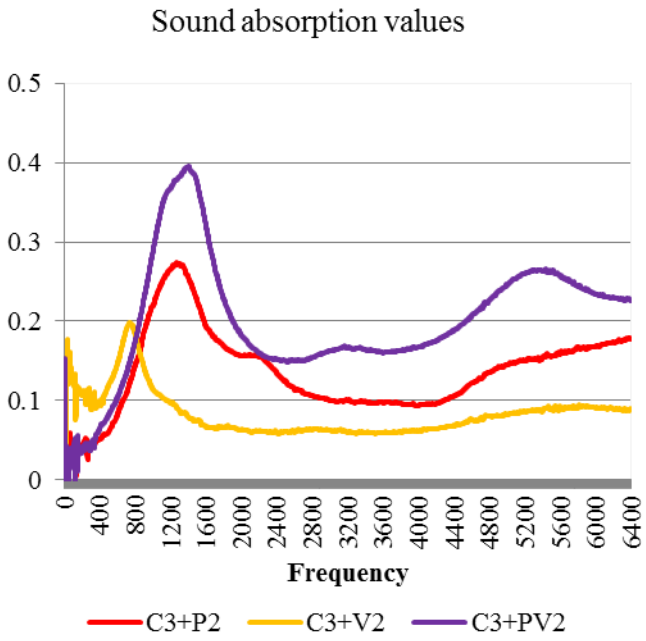

Fig. 8. Sound absorption coefficient values.
Source: Own calculation.

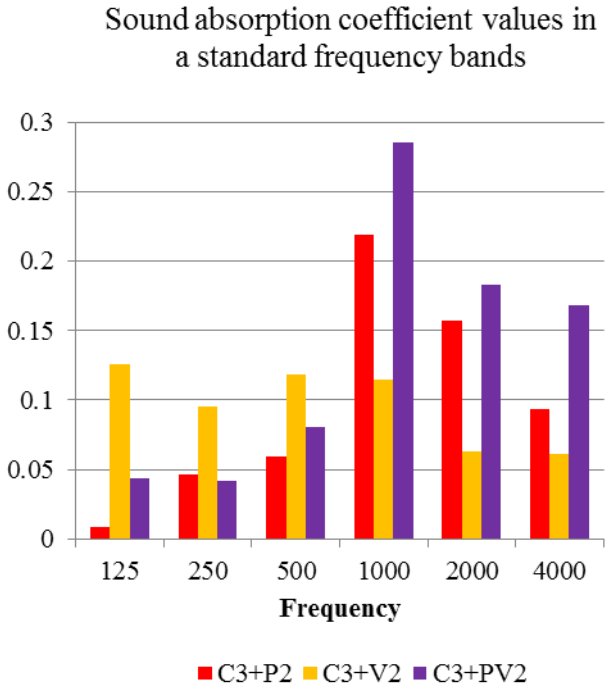

Fig. 9. Sound absorption coefficient values in frequency ranges.
Source: Own calculation.

The mixture of hemp with vermiculite only records the smallest values; so that a first idea that perlite has a positive effect can be forwarded, for the frequency interval 1,000-6,400 Hz, relative to noise protection

materials.

Fig. 9 presents the values of the sound absorption coefficients in frequency ranges. Mention should be made that vermiculite positively influences the values of the sound absorption coefficients in the range 0-500 Hz, after which the effect of perlite and vermiculite is more significant at 100-4,000Hz.

In brief, at the end of the analysis of sound absorption coefficient it is recommended to continue the research on the influence of the perlite and vermiculite amount upon hemp samples, considering that it can become a potential product on the market of sound insulation materials.

Tests of reaction to fire

The study of the reaction to fire of the materials based on hemp and lightweight aggregates is only a starting study, taking into account that both hemp and polyvinyl acetate have low level properties in reaction with fire.

The use of lightweight materials, such as perlite and vermiculite, confers samples a small stability to fire, they resist for several seconds at a temperature exceeding 950 ^{0}C, when volcanic rocks resist normally at temperatures ranging between -200^{o}C and +850^{o}C.

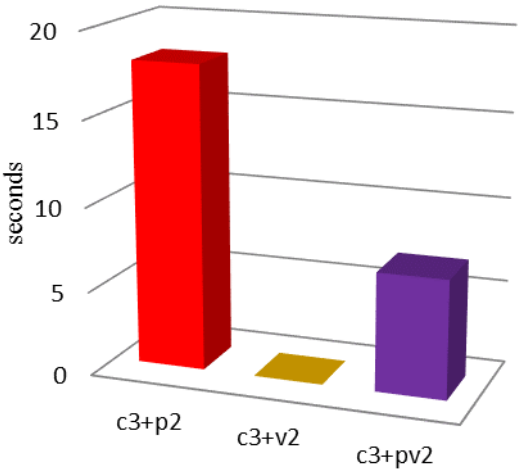

Fig.10. The reaction to fire of the formulae
Source: Own calculation.

In such conditions, it is found that samples containing perlite have a longer reaction to fire compared with the sample made of hemp and vermiculite (Fig. 10).

In further studies, the plan is to continue to study several solutions for fire protection of materials made from hemp and polyvinyl acetate.

Mechanical strengths

The mechanical properties of the three formulae were tested with the hydraulic press and the Fruhling Michaelis equipment, after 28 days from sample casting.

The hemp and polyvinyl acetate based materials present resistance to compression values (Fig. 11) over 2N/mm^2 when perlite is included. On the other side, the vermiculite sample records a value for the compressive strength that is smaller by about one unit than that of the perlite sample.

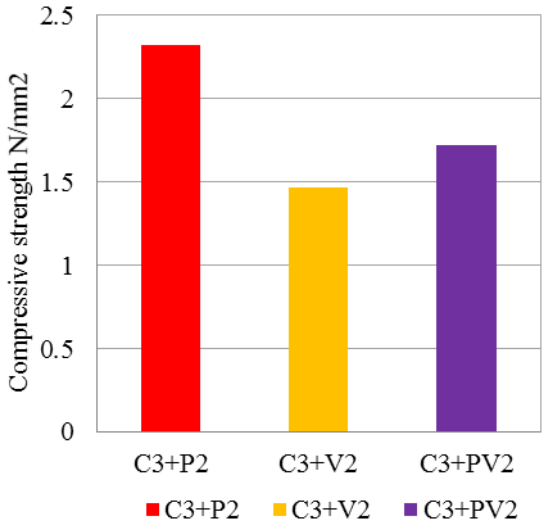

Fig.11. Mechanical strengths -Compressive strength
Source: Own calculation.

In the case of the flexural tensile strength test (Fig. 12), the situation is similar, as the sample made with hemp, perlite and polyvinyl acetate records the highest value (1,5 N/mm^2), compared to the other two formulae. With respect to samples C_3+V_2 and C_3+PV_2, the difference in the values of the bending strength is quite small, the two samples present close values as C_3+PV_2 has about 1,2 N/mm$_2$, while sample C_3+V_2 presents the value of 1,1 N/mm^2.

To axial tensile (Fig.13), sample C_3+PV_2 is the weakest of the three formulae, as sample C_3+V_2 overcomes it, compared to other previous results for the compressive and

flexural tensile strength. Exceeding by little the value of 3,5 N/mm^2, sample C_3+P_2, has the best behaviour to axial tensile test.

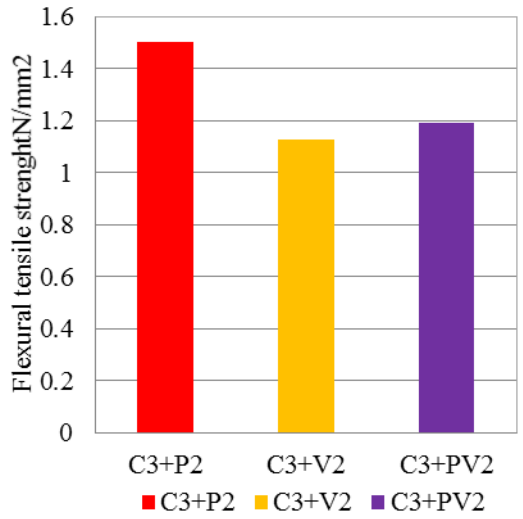

Fig.12. Mechanical strengths -Flexural tensile strength
Source: Own calculation.

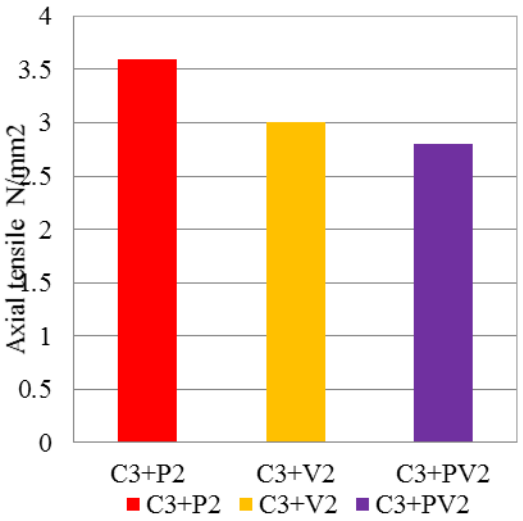

Fig.13. Mechanical strengths - axial tensile strength
Source: Own calculation.

In sum, an analysis of the mechanical properties of the compositions with hemp and polyvinyl acetate plus lightweight aggregates shows that added perlite records best values for the mechanical properties, and suggests that further investigation of the volcanic rock properties mixed with hemp shives should be performed.

CONCLUSIONS

During the three tests, the materials including perlite in the composition recorded the highest values both in the mechanical properties and in their reaction to fire. However, the sound absorption coefficient values are shown to depend upon the mixture of perlite and vermiculite, which can provide a high acoustic absorption.

More in-depth studies related to the resistance to fire and improvement of the acoustic absorption coefficient could lead to a material able to successfully replace materials having synthetic products in their composition. The preliminary research made here highlights that properly developed hemp-based products can become a sustainable alternative in the market of building materials.

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PREDICTION OF STRAWBERRY CHEMICAL COMPOSITION BY IMAGING ANALYSIS PROCESSES

Tarek FOUDA, Adel ELMETWALLI, Shimaa SALAH

Tanta University, Faculty of Agriculture, Agricultural Engineering Department, Egypt,
E-mail: tfouda@yahoo.com, Shimaa2010atia@yahoo.com

Corresponding author: tfouda@yahoo.com

Abstract

The goal of this research is to analyze images of strawberry fruits and related the results with chemical properties under using different applications of gibberellic acid and citrate potassium. The work was carried on spring 2016 at private farm in Tanta ELgharbia governorate, Egypt. The chemical properties such as the total soluble solid and anthocyanin was determined under different treatments and related with images indices. The ENVI software package was used to analyze the images of orange fruits and three bands, RGB, (red, green, blue) were derived for each image until obtaining the R, G, B colors then color indices Red/ Green ratio (R/G), hue, intensity (I). The results showed that there are significant correlation with some chemical and color indicators. The results obtained in this research demonstrated that hue, intensity and R/G ratio indices gives understanding about and total soluble solid and anthocyanin.

Key words: *prediction, chemical properties, strawberry, colour parameters and gibberellic acid*

INTRODUCTION

Strawberry (Fragaria x ananassa Duch) is one of the most popular vegetable crops. In Egypt, it occupies an important position among the untraditional vegetable crops due to its multifarious use as local fresh consumption, food processing and exportation, Also it is a very rich source of bioactive compounds including vitamin E, vitamin C, b-carotene and phenolic compounds (phenol acids, flavan-3-ols, flavonols, and anthocyanins. Strawberry are valued for to their antioxidant content. Egypt ranked the fourth on the world in Strawberry production. Harvested area of strawberries in Egypt are 6,029 (Ha), yield 422,825 Hg/Ha in 2013 [4]. Strawberry are famous vegetable consumed freshly and as processed food in Egypt. The fruits were harvested in immature stage based on the fruit size and skin color. The mineral nutrition, as well as the cultivar, climatic conditions, agronomic practices and water supply, directly influences the quality of strawberry [14].

Biofertilization method plays an important role in the plant nutritional requirements. Whereas, biofertilizers enhance crop productivity through nitrogen fixation, phosphate solubilization, plant hormone production, ammonia excretion and controlling various plant diseases Strawberries are a good source of ascorbic acid (AA), anthocyanin's and flavone's and, among the fruits, they have one of the highest antioxidant activities evaluated by oxygen radical absorbance capacity [3].

The sum of red, green and blue colour (R+G+B) intensities and the ratio of $((G+B-R)/(R+B+G))^2$ were strongly correlated (R^2=0.95 and 0.89 respectively) with the total solid content of strawberry fruits. This two indices could be used to decide the correct maturity stage of the strawberry fruits. With reducing the values of these indices, increase the TSS of fruits. Consequently, the lowest values of indices indicates the highest total solid contents in fruits [1].Potassium (K) is also highly demanded by the crop for directly favoring fruit quality and increasing the contents of total soluble solids and ascorbic acid, besides improving aroma, taste, color and firmness of fruits [11]. Physical and chemical properties of the cultivar 'Aromas', such as external color, titratable acidity, pH and soluble solids, were influenced by combined doses of N and K applied through fertigation [12]. Like anthocyanins, the

amount of AA is also dependent on the strawberry cultivar and ripening degree, although the average content (60 mg/100 g) is high enough to consider strawberry as one of the richest sources of AA among fruits. Multispectral imaging is used to detect pigment concentration and soluble solid (sugar) in fruits [10]. Colour is one of the most important attributes in fruits and vegetables because it directly influences the consumer decision to accept or reject a particular product. Thus producers strive to prevent colour defects in the products that reach the market, and to ensure that the different batches of products (for example canned, bagged, etc.) show similar colours. In the industry, colour is measured using a colorimeter [8]. The relationships between different maturity time and total soluble solid (Tss), pH, acidity, percentage of liquid, and (TSS/acidity), during maturity time increasing the total soluble solid (TSS), pH, percentage of liquid and (TSS/acidity) increased from 8.20 to 10.06 (Brix, %), from 2.84 to3.07 from 41.54 to 49.83 % and from 6.7 to 9.00 respectively while decreased acidity from 1.25 to 1.07 % [6].There are significant correlation between RGB, hue and saturation indices and some chemical properties such as total soluble solid (Tss), ph, acidity and percentage of liquid of orange fruits [5]. Hue, intensity, saturation and VARI index with some chemical properties which changes such as acidity, percentage of liquid, ph, total soluble solid (tss), tss/acidity, chlorophyll a, chlorophyll b and also carotenoids concentration at different maturity days. [13].

MATERIALS AND METHODS

This work were carried out at private farm in Shoni, Tanta, ELgharbia governorate, Egypt during March and April 2016 to measure some chemical and color properties of strawberry fruits underusing two applications of gibberellic acid (GA_3) and one application of three applications of citrate potassium (c.p.) through 12 different treatments as follows in Table. 1.

(1)-Fruit chemical properties

Different chemicals of fruits were determined before and after the applications of nutrition

-The (Total soluble solid) tss was estimated from a single digital refractometer reading taken from the combined juice extracted from the fruit.

- Anthocyanin was determined in the peels as (mg/ 100 g) by using extraction solution contains 85 ml ethyl alcohol 95 %+ 15 ml HCl 1.5 N that was added to 4 g fresh berry peel. The mixture was left for at least 24 h, then 2 ml of the filtrate was used to determine the optical density at 535 nm [7].

Table 1. The plant case and applications treatment

Plant		Applications Treatment
A	Mothers only	0 ppm (GA_3)+ 0 gm/5L (c.p.)
B		0 ppm (GA_3) +1.25 gm/5L (c.p.)
C		0 ppm (GA_3) +2.5 gm/5L (c.p.)
D		25 ppm (GA_3) + 0 gm/5L (c.p.)
E		25 ppm (GA_3) +1.25 gm/5L(c.p.)
F		25 ppm (GA_3) +2.5 gm/5L (c.p.)
G	Mothers which found with 5 runners	0 ppm (GA_3) + 0 gm/5L (c.p.)
H		0 ppm (GA_3) +1.25 gm/5L (c.p.)
I		0 ppm (GA_3) +2.5 gm/5L (c.p.)
J		25 ppm (GA_3) + 0 gm/5L (c.p.)
K		25 ppm (GA_3) +1.25 gm/5L(c.p.)
L		25 ppm (GA_3) +2.5 gm/5L (c.p.)

Computer visioning system

The system consisted of an imaging box with non-reflective black cloth connected to a digital camera of 16.4 Megapixels. The camera was mounted at 25 cm from the bottom of the imaging box. The position of the two light sources was adjusted to provide uniform light intensity. Images were taken to capture images of fruit free from shadows. Following capturing images, they stored on a personal computer for the analysis. Capture cards (WinFast DV2000 with a resolution of 320H X 240V). A personal computer was used for analyzing the images.

Image Analysis system

Strawberry fruit samples were captured by the camera, transferred to the PC through the capture card, digitized, and stored on the PC. The ENVI software package was used to analyze the images of orange fruits and three bands, RGB, (red, green, blue) were derived for each image until obtaining the R, G, B colors then color indices Red/ Green ratio (R/G), hue, intensity (I) as shows in fig. 1 and three bands, RGB, (red, green, blue) were derived for each image until obtaining the R, G, B colors then color indices Red/ Green ratio (R/G), hue, intensity (I) as shows in fig. 2 the whole

procedure followed until obtaining the R, G, B colors and indices.

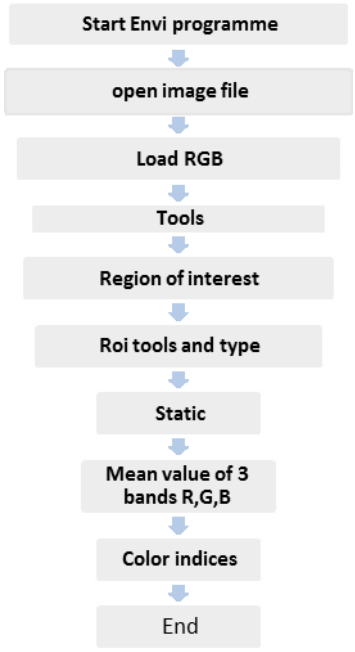

Fig. 1. The steps to produce (R, G, B colors) by ENVI software

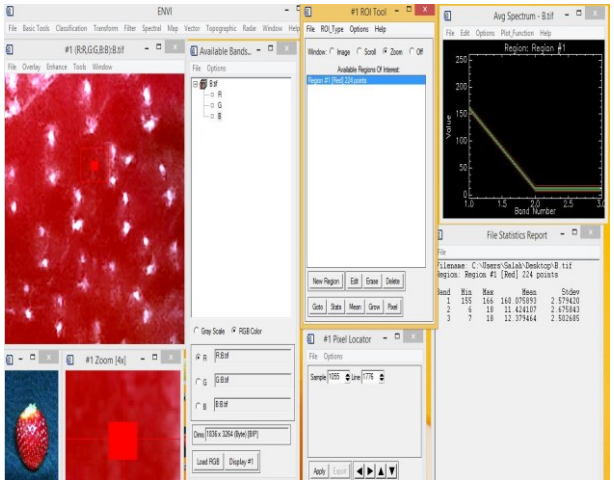

Fig. 2. A window of ENVI programme showing the spectral signature and associated statistics obtained from a strawberry fruit

(2)-Fruit color properties

Red/ Green ratio (R/G) according to [2], hue and intensity (I) according to the following equations [9]

$$H = COS^{-1}\left\{\frac{(2R-G-B)/2}{\left[(R-G)^2+(R-B)(G-B)\right]^{1/2}}\right\}$$

$$I = \frac{1}{3}(R+G+B)$$

RESULTS AND DISCUSSIONS

During strawberry fruits ripening its color change from green, light red and then after full maturity reached to dark red color while anthocyanin is produced and starts to increase and disappeared other pigments. The computer vision and image analysis program used to differentiate chemical strawberry properties.

The results in fig. 3 showing that the high value of hue was 0.66824 in treatment (D) and the low value was 0.27443 in treatment (K) while the minimum and the maximum value of anthocyanin were 7.298031 mg/100gm in treatment (K) and 22.99728 mg/100gm in treatment (D).

The results in fig. 4 showing that the high value of hue was 1.282715 in treatment (D) and the low value was 0.906227 in treatment (H , K) and the low and the high value of (total soluble solid) tss were 4.3 (Brix,%) in treatment (K) and 8.2 (Brix,%) in treatment L.

The results in fig. 5 showing that the high value of intensity was 132.5062 in treatment (C) and the low value was 64.06764 in treatment H while the minimum and the maximum value of anthocyanin were 7.298031mg/100gm in treatment (K) and 22.99728 mg/100gm in treatment (D) .

The results in fig. 6 showing that the high value of intensity was 140.84 in treatment (A) and the low value was 50.1087 in treatment (J) and the low and the high value of (total soluble solid) tss were 5 (Brix,%) in treatment B and 7.6 (Brix,%) in treatment(L).

The results in fig. 7 showing that the high value of R/G ratio was 1.055226 in treatment (I) and the low value was 0.93.527 in treatment (A) while the minimum and the maximum value of anthocyanin were 1.026816 mg/100gm in treatment (A) and 13.06657 mg/100gm in treatment (K).

The results in fig. 8 showing that the high value of R/G ratio was 2.416913 in treatment (H) and the low value was 1.082603 in treatment (C) and the low and the high value of (total soluble solid) tss were 4 (Brix,%) in treatment (C) and 7.6 (Brix,%) in treatment (L).

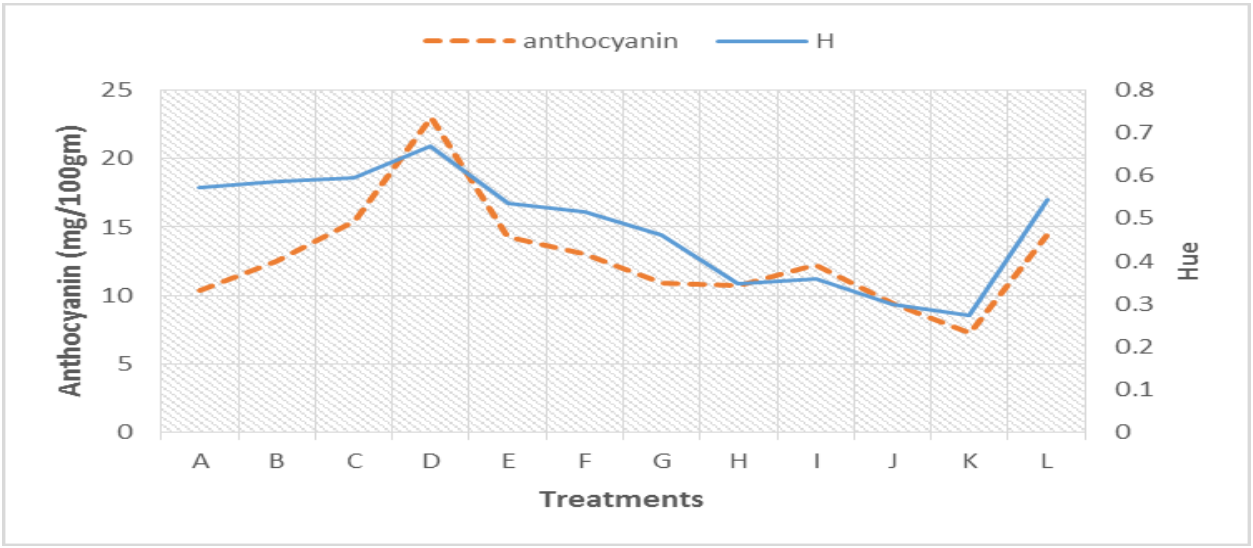

Fig. 3. Effect of gibberellic acid and citrate potassium on anthocyanin and hue during strawberry maturity

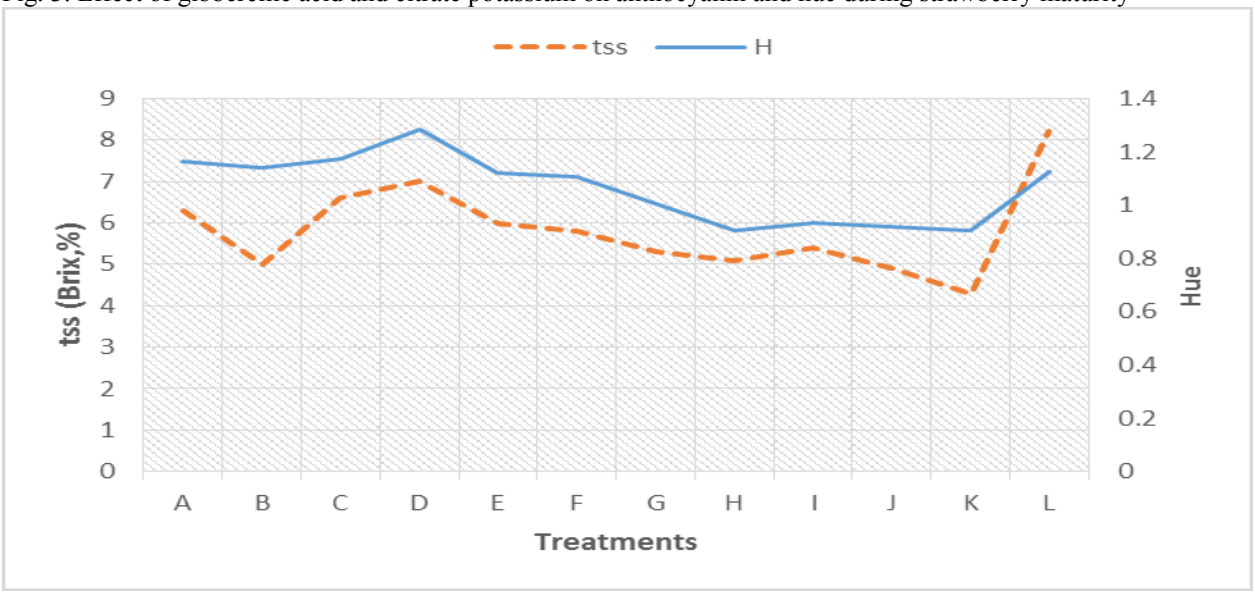

Fig. 4. Effect of gibberellic acid and citrate potassium on tss and hue during strawberry maturity

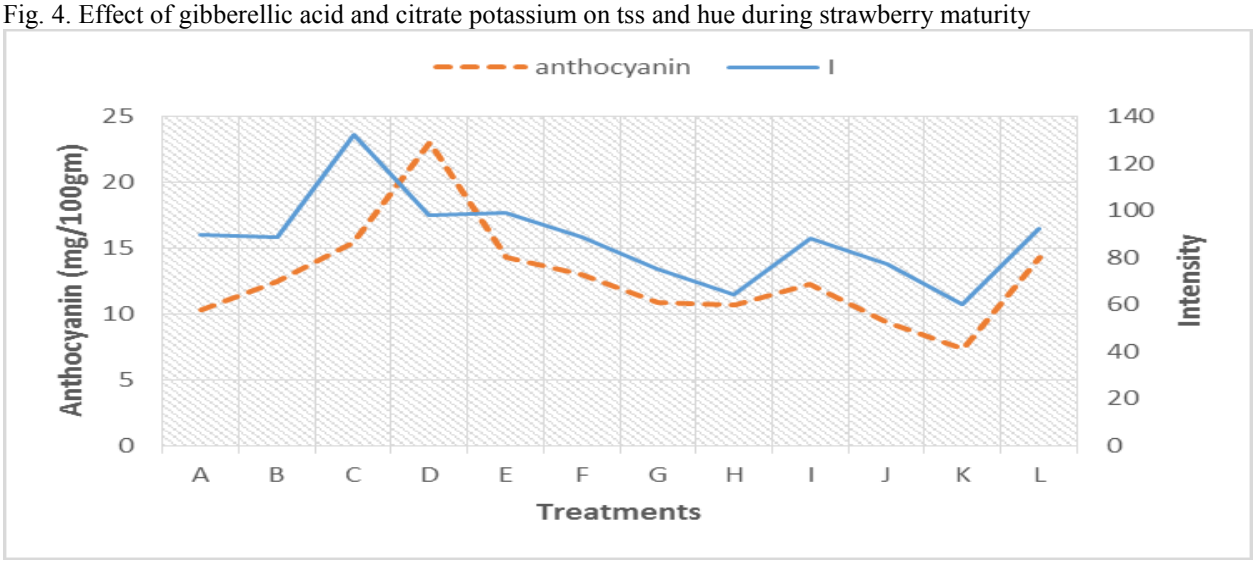

Fig. 5. Effect of gibberellic acid and citrate potassium on anthocyanin and intensity (I) during strawberry maturity

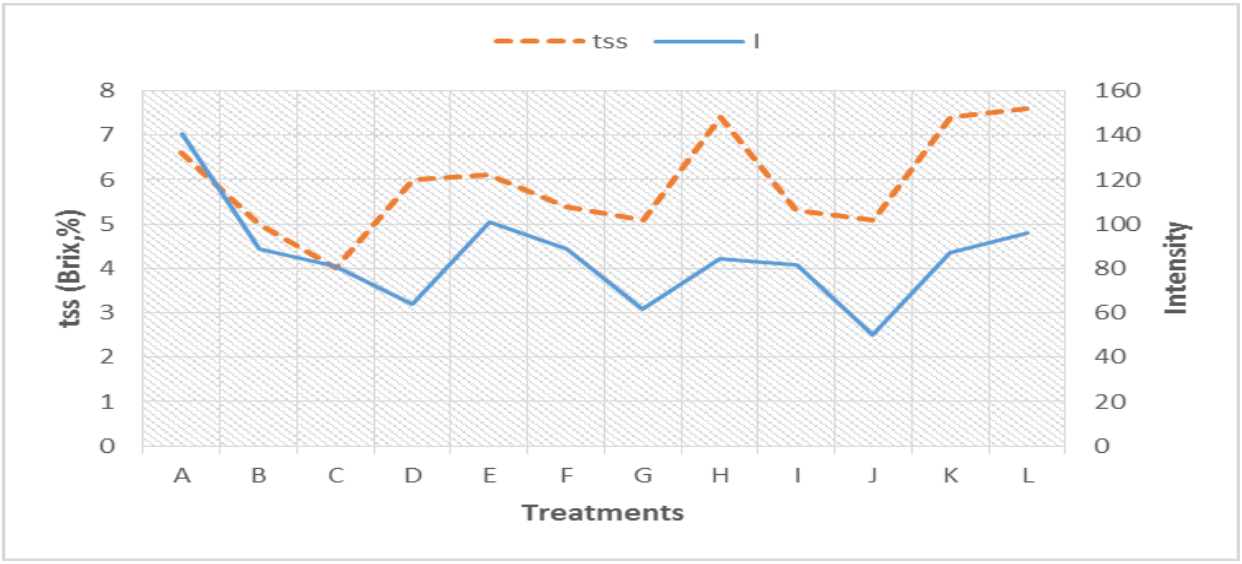

Fig. 6. Effect of gibberellic acid and citrate potassium on tss and intensity (I) during strawberry maturity

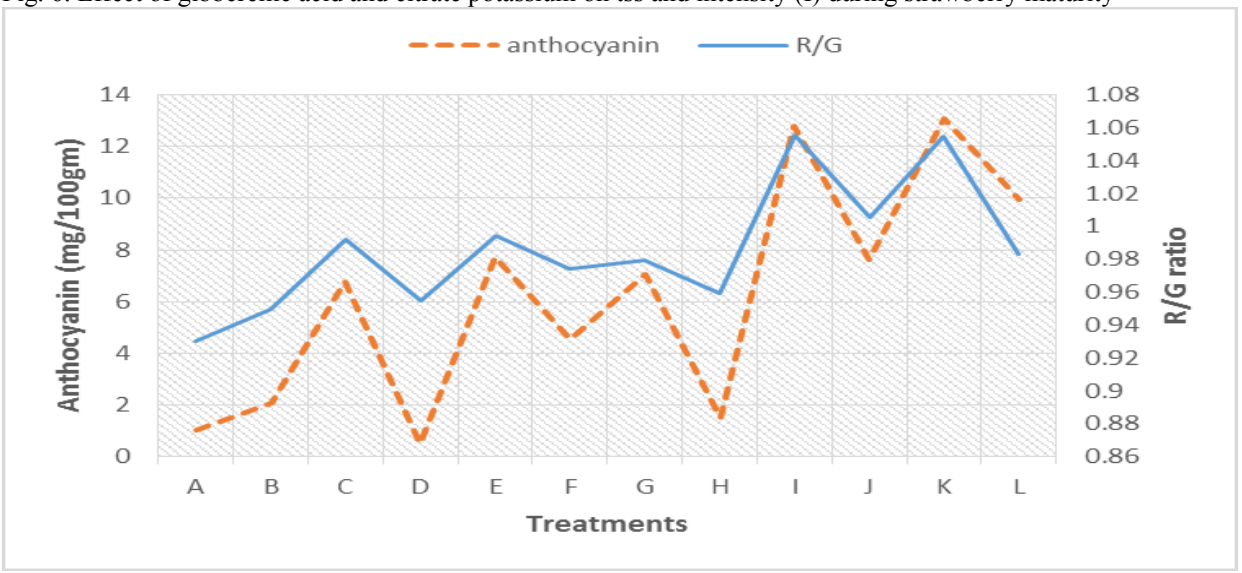

Fig. 7. Effect of gibberellic acid and citrate potassium on anthocyanin and (R/G) ratio during strawberry maturity

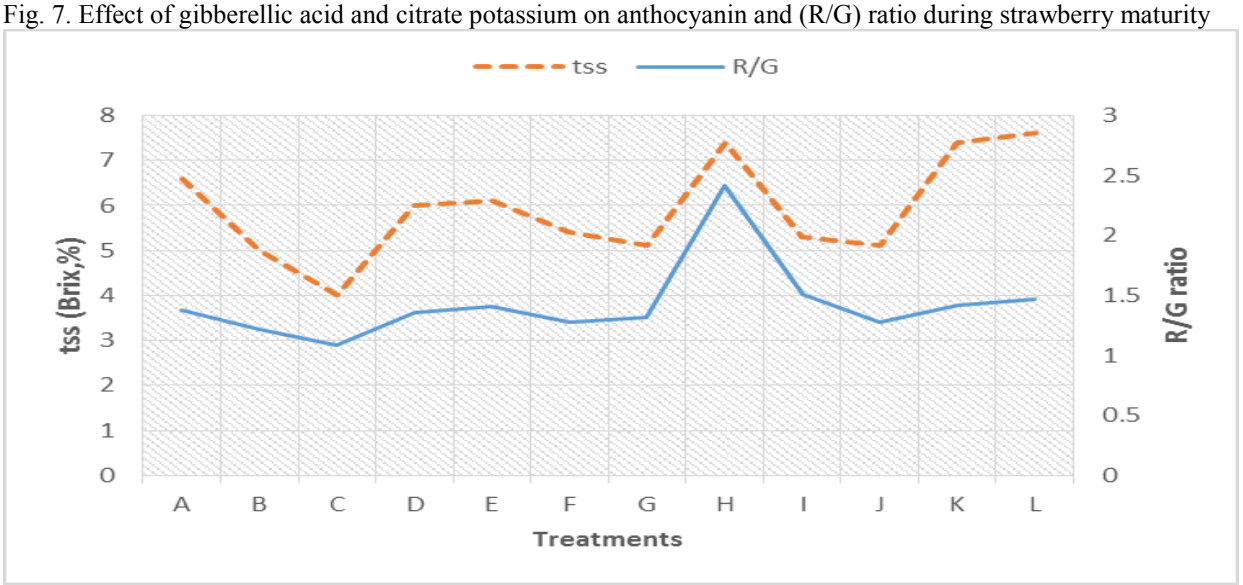

Fig. 8. Effect of gibberellic acid and citrate potassium on tss and (R/G) ratio during strawberry maturity

CONCLUSIONS

The results obtained in this research demonstrated that hue, intensity and R/G ratio indices gives understanding about and total soluble solid (tss) and anthocyanin.

-Intensity provide a better indication of total soluble solid (tss).

-With 25 ppm gibberellic acid +2.5 gm/5L citrate potassium was the highest value to total soluble solid (tss) as follow 8.2(Brix,%).

-With 25 ppm gibberellic acid + 0 gm/5L citrate potassium there were the same highest value of anthocyanin as follow 22.99728 mg/100gm.

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USING FADN DATASET

Nicola GALLUZZO

Association of Geographical and Economic Studies in Rural Areas, Via Salaria per L'Aquila 76 scala A, 02100, Rieti, Italy, Email: asgear@libero.it

Corresponding author: asgear@libero.it

Abstract

Slovenian farms scattered in small rural villages are characterised by poor utilizable agricultural areas (UAA) which are lower than the average value assessed in the European Union countries. The assessment of the economic consequences of financial subsidies allocated by the Common Agricultural Policy (CAP) towards farmers is made by an annual survey in a sample of farms belonging to the Farm Accountancy Data Network (FADN). The purpose of this paper was to investigate by a quantitative approach, over the time 2004-2013, in the FADN dataset main correlations among different economic variables, such as financial subsidies allocated by the CAP on Slovenian farms stratified in function of the main typology of farming which is a dummy variable of the productive specialization. Summing up, funds allocated by the first and second pillar of the CAP have acted on the farm level of income hence, the European Union by specific funds should implement the level of investments stimulating also the level of land capital pivotal in getting better the technical and economic efficiency in Slovenian farms.

Key words**:** *typology of farming, rural development, financial subsidies, crop specialization*

INTRODUCTION

The average value of utilizable agricultural areas (UAA) in Slovenian farms equal to 8 hectares is relatively poor comparing it to the average agrarian surface in 28 European Union states and in the same time it is under the average amount equal to 14.2 hectares assessed in the European Union (EU), 50.1 hectares pointed out in the European north-western regions and 12.0 hectares assessed in countries located in the southern European countries [6] [7].

After the enlargement of the European Union in 2004 and in 2007 statistical data have highlighted as in new comers member states of the EU such as Cyprus, Slovenia and Malta, the average value of utilizable agricultural area is approximately close to 7.10 hectares which is under the average value observed in the nearest countries as Italy and in other ones located in the basin of the Mediterranean sea [6]. According to the data published by the Slovenian National Institute of Statistics, since the early 2000s there has been a significant increase of the utilizable agricultural areas (UAA) which has reached the peak of almost 7 hectares [16]. Comparing statistical data in the Agricultural Census carried out in 2000 and in 2010, there has been an increase of utilized agricultural areas predominately characterised by permanent grassland from 5.6 hectares to 7.00 with Slovenian regions such as Osrednjeslovenska, Savinjska, Podravska and Pomurska (Fig. 1) where in 2010 the agricultural surface was close to 13 hectares or more [16].

According to the data published by the Eurostat in 2016, more than 40,000 Slovenian farms have a surface lower than 5 hectares and only one thousand have an agrarian surface above 100 hectares located predominantly in plane areas, even if since 2000 to 2013 the large farms arose by 10%. In general, as a consequence of the economic crises and recession in the middle 2000, the number of Slovenian farmers declined by 14,000 units and this phenomenon has involved manly small agrarian enterprises managed by family farms [3].

In Slovenia the primary sector has been able to express a poor buffer effect in contrasting the unemployment, in halting the rural out-emigration from the countryside and socio-economical marginalization [5][15][19]. In some new comer Member States of the EU the primary sector has been a buffer tool to

adsorb workforce even if many farms classified as semi subsistence enterprises did not carry out a positive action in lessening the poverty in rural areas [5]; hence, the impact of financial subsidies has been positive in implementing job opportunities and also in stimulating a socio-economic development in rural areas by the L.e.a.d.e.r. initiatives, which have implied a revitalization of rural areas by new enterprises and job chances [8; 9; 10; 11].

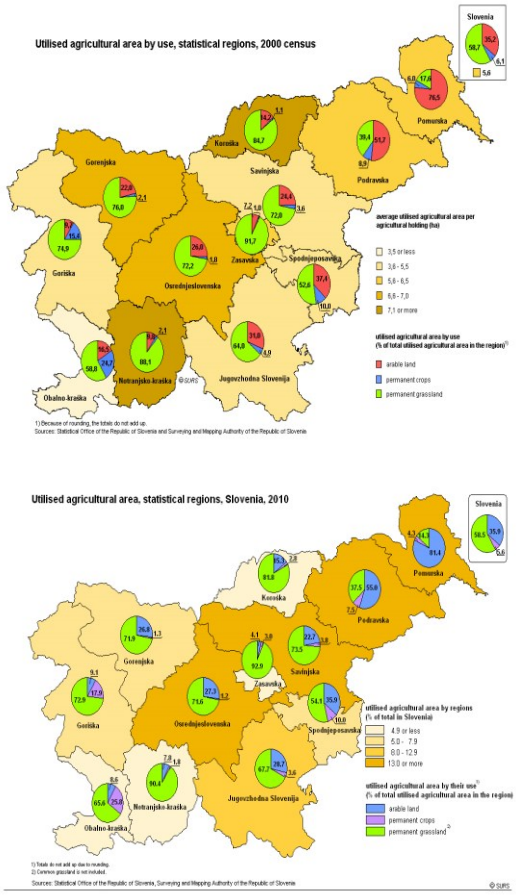

Fig. 1. Evolution of Usable Agricultural Areas in Slovenian regions throughout the Agricultural Census. Source: http://www.stat.si/TematskaKartografija

Before the enlargement of the European Union in 2004 Slovenian farms have received significant and specific financial supports in order to face the phase of transition from a centralized economy to an open one using specific programmes such as Sapard (Special Accession Programme for Agriculture & Rural Development) which has allocated more than 500 million Euros during a six year time 2000-2006 able to restructure the productive context and socio-economic fabric [12] [17].

Several studies have been carried out in order to assess if there is a nexus between dimension of farm, in terms of usable agricultural areas, and technical, allocative and economic efficiency in different European countries [4] [13] [14] with some effects on the level of farm net income and financial subsidies allocated by the CAP.

In general, findings have corroborated the theoretical framework according to which the level of efficiency and consequently the level of income is correlated both to the farm dimension (land capital) and also to the productive specialization. In fact, the level of specialization, in terms of typology of farming, is able to act on the level of investments and assets and on an efficient use of factors of production.

The Farm Accountancy Data Network (FADN) is an instrument established by the Council Regulation 79 in 1965 aimed at assessing the income of agricultural holdings and specifically some impacts of the Common Agricultural Policy actions towards farmers. FADN has been set up to gather accounting data in a sample of European farms.

Aim of the research

The main research question was addressed to investigate, using a quantitative approach, over the time 2004-2013 in Slovenian farms part of FADN dataset, the role and function of financial subsidies allocated by the CAP in the first and second pillar and other variables such as Utilized Agricultural Areas (UAA), total inputs, total assets, payments allocated by the CAP to stayed behind rural areas (LFA payments), on the level of farm net income. An another stage of this study has been focused on an analysis of the main descriptive statistics in different types of farming (TF) such as defined and grouped by the European Commission in the Regulation 1242/2008. In Slovenia FADN dataset covers a field of observation close to 62% of total farms stratified 14 TF clusters as proposed by the Commission Decision (CE) 2003/369.

The source of data has investigated only the balanced types of farming (TF) or rather whole Slovenian cross section FADN dataset made up by complete data for each year since 2004 to 2013 omitting TF without data

investigated in some years.

MATERIALS AND METHODS

Using a quantitative approach and different source of data from 2004 to 2013 published by the European Union in the FADN dataset and by the Slovenian Institute of Statistics, this research has estimated by a multiple regression model main correlations among the dependent variable farm net income in Slovenian rural areas and the independent variables financial subsidies allocated by the first and second pillar of the CAP, payments towards disadvantaged rural areas (LFA payments) and financial aids disbursed by the Common Agricultural Policy in the second pillar aimed at stimulating Rural Development initiatives.

In this study it has used a multiple regression model, estimating parameters by the Ordinary Least Square (OLS) throughout the open source software GRETL 1.8.6. In its algebraic form of matrix, the multiple regression models can be so expressed [18]:

$$y = X\beta + \varepsilon \qquad (1)$$

where y is the dependent variable and ε is the statistical error but both are vectors with n-dimensions; hence, X is a matrix of independent variables which has a dimension n x k.

In analytical terms, the model of multiple regression in its general formulation can be written in this way [1] [2] [18]:

$$y = \alpha_0 + \alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4 + \varepsilon_{jt} \qquad (2)$$

where y is the dependent variable or rather the level of farm net income in Slovenian farms part of the FADN dataset,

α_0 is a constant term,

x_1, x_2, x_3, x_4 independent variables such as total subsidies allocated by the CAP, payments for Less Favored Areas (LFA), total support for rural development, total assets, total inputs and capital land in term of utilised agricultural areas.

α, β, γ, δ estimated parameters of the model,

ε_{jt} term of statistic error.

Basis assumptions, to use a multiple regression model, are [1] [2]:

(i) statistic error u_i has conditional average zero that is $E(u_i|X_i) = 0$;

(ii) (X_i, Y_i), $i = 1\ldots\ldots n$ are extracted as distributed independently and identically from their combined distribution;

(iii) X_i, u_i have no fourth moment equal to zero.

There is no correlation among regressors and random noise if the value between β expected and β estimated is the same; in order to analyze if there is also heteroschedasticity on standard errors in the multiple regression model, it has used White's test on the error terms [18].

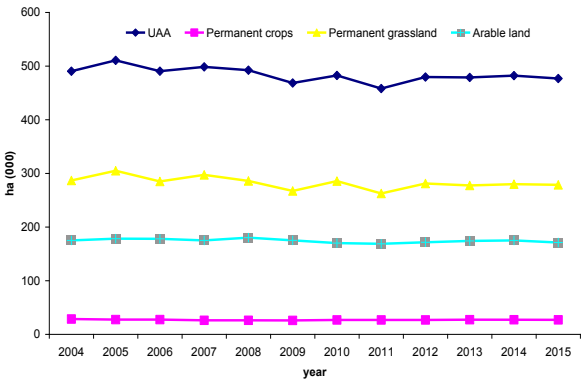

Fig. 2. Utilizable Agricultural Areas and different distribution of the main crops in Slovenia.
Source: Own elaboration on data Eurostat.

RESULTS AND DISCUSSIONS

Since 2004, in Slovenia the Utilized Agricultural Area has had some fluctuations which depended upon the actions of agro-forestation, financed by the CAP, and a growth of permanent grassland and permanent crops supported by national authorities and by the European Union (Fig. 2) even if permanent crops have been lower than 30,000 hectares. Findings have pointed out a stable value from 2004 to 2015 of arable crops in Slovenian rural areas.

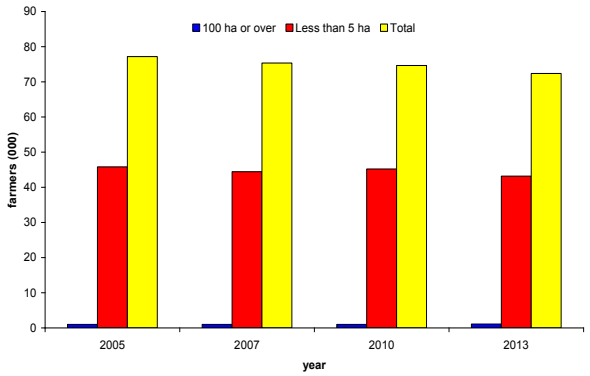

Fig. 3. Dimension of Slovenian farms and its evolution over the time.
Source: Own elaboration on data Eurostat.

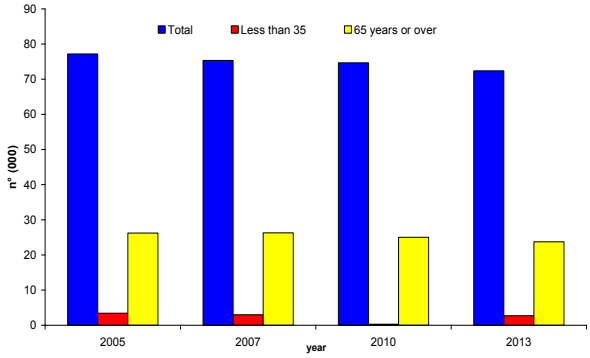

Fig. 4. Age of owners in Slovenian farms.
Source: Own elaboration on data Eurostat.

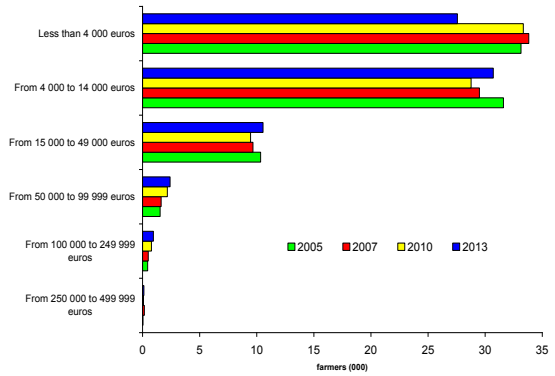

Fig. 5. Evolution over the time of Slovenian farms stratified in function of the variable standard output.
Source: Own elaboration on data Eurostat.

Focusing the attention on the dimension of farms, in terms of hectares of usable agricultural areas, the data published by Eurostat have highlighted as more than 50% of Slovenian farms have a poor surface which is lower than 5 hectares and no more than 1,000 farms have an agrarian surface above the threshold of 100 hectares (Fig. 3). This trend, stable over the time of investigation, has corroborated the need of farmers in implementing the land capital in order to ameliorate the level of investments and efficiency.

The bottleneck and the main downside in the management of Slovenian farms is the age of owners; in fact, more than one fourth, value stable over the time 2005-2013, of farmers has an age above 65 years and the main percentage of farmers is managed and owned of agrarian entrepreneurs with an age between 55-64 years and less than 2,000 farms are managed by farmers under 35 years old (Fig. 4).

In current price, Slovenian farms, stratified in function of their own level of standard output, have pointed out as more 30,000 of agrarian enterprises have got less than 4,000 euro and this value is increased sharply in 2007 and it is diminished in 2013 (Fig. 5). Addressing the attention on the other clusters of standard output, findings have highlighted a significant increase of this variable comparing the values of standard output in 2013 to some of them assessed in 2010.

Table 1. Average of specific costs in different typology of farming assessed in Slovenian farms over the time 2004-2013

Typology of farming	Specific crop costs (€/ ha)
Specialist wine	1,024.18
Specialist orchards fruits	1,096.48
Specialist milk	183.47
Specialist sheep and goats	39.90
Specialist cattle	77.44
Specialist granivores	297.21
Mixed crops farms	565.63
Mixed livestock farms	172.63
Mixed crops and livestock farm	252.05
Total in all FADN farms	220.63

Source: Own elaboration on data FADN published on the website http://ec.europa.eu/agriculture/rica/database/database_en.cfm

According to the data published by the FADN dataset, the average value of crop costs over the time 2004-2013 has pointed out as farmers specialized in orchard and other fruits have had the highest level of specific costs such as farmers specialized in producing wine (Table 1). In all Slovenian farms belonging to the

FADN dataset, the average value of specific cost has been close to 220 euro per hectare even if specialized agrarian enterprises in cattle-breeding and sheep-goats farming have highlighted the lowest levels of crop costs.

Table 2. Main correlations among investigated variables in Slovenian farms part of FADN dataset over the time 2004-2013

Variable correlation	Value
Labour input and total output	6.25E-19 ***
Labour input and Utilized Agricultural Areas	4.37E-88 ***
Total input and total output	n.s.
Utilized Agricultural Areas and total costs	4.50E-14 ***
Farm Net Income and total specific costs	0.026 **
Farm Net Income and total assets	1.38E-38 ***
Farm Net Income and financial subsidies allocated by the CAP	n.s.
Farm Net Income and Less Favoured Areas subsidies	4.68E-11 ***
Utilized Agricultural Areas and Less Favoured Areas subsidies	5.48E-39 ***

** 5%; *** 1%; n.s. not significance

Source: Own elaboration on data FADN published on the website http://ec.europa.eu/agriculture/rica/database/database_en.cfm

The main correlations among labour input and total output and utilized agricultural areas in all farms belonging to the FADN dataset, during the ten year time of investigation, have pointed out a significant nexus of correlation (Table 2).

A correlation has been found between the variables farm net income and total assets and between the variables farm net income and financial subsidies allocated towards stayed behind rural areas; in the same time, the impact of payments disbursed by the first and also by second pillar of the CAP did not act on the level of farm net income in Slovenian farms.

The farms specialized in granivores have pointed out the highest levels of labour costs, usable agricultural areas and specific costs (Table 3). Findings have highlighted as fertilizers costs in typology of farming as granivores have been higher than other typologies of farming and this is correlated to their own activity of production, which has a nexus to the highest level of farm net income (Table 3).

Table 3. Average values of variable investigated over the time 2004-2013 in Slovenian farms part of FADN dataset

Typology of farming	Labour input (€)	UAA (ha)	Total output (€)
Wine	3,678.47	4.59	29,510.22
Orchards fruits	3,826.29	5.96	31,625.17
Dairy cows	3,874.07	15.57	40,715.40
Sheep and goats	2,723.53	12.54	11,650.10
Specialist cattle	2,899.57	10.72	13,754.00
Granivores	3,525.77	23.14	79,886.00
Mixed crops	2,817.18	7.04	18,817.25
Mixed livestock	3,164.86	9.04	15,348.30
Mixed crops and livestock	2,919.13	9.37	15,428.60
Total in all FADN farms	3,174.56	10.95	22,166.50
Typology of farming	**Crop protection cost (€)**	**Farm Net Income (€)**	**Total assets (€)**
Wine	1,424.00	11,986.00	191,861.67
Orchards fruits	3,170.67	9,961.00	156,726.67
Dairy cow	329.90	11,378.50	258,787.00
Sheep and goats	82.90	746.30	236,900.30
Specialist cattle	104.10	2,683.80	196,335.20
Granivores	1,382.00	25849.56	367,786.00
Mixed crops	781.38	6,425.13	152,300.63
Mixed livestock	291.00	1,790.20	142,451.50
Mixed crops and livestock	495.30	3,631.60	148,910.70
Total in all FADN farms	472.30	5,930.70	191,507.90
Typology of farming	**Total inputs (€)**	**Total specific costs (€)**	**Total fixed assets (€)**
Wine	19,888.33	4,857.89	167,233.56
Orchards fruits	27,957.00	6,890.67	146,531.33
Dairy cow	39,121.50	20,026.80	244,449.70
Sheep and goats	16,773.50	4,287.50	229,951.80
Specialist cattle	17,536.80	6,509.50	186,768.30
Granivores	73,705.78	42,850.44	333,650.67
Mixed crops	16,495.00	5,092.50	145,689.75
Mixed livestock	18,493.90	8,304.80	132,666.30
Mixed crops and livestock	17,836.70	7,085.50	140,081.80
Total in all FADN farms	23,026.50	9,570.20	180,628.30
Typology of farming	**Total subsidies by CAP (€)**	**LFA subsidies (€)**	**Support for rural development (€)**
Wine	2,518.78	300.89	1,851.67
Orchards fruits	4,667.83	605.67	2,273.50
Dairy cow	9,015.90	1,571.50	3,167.20
Sheep and goats	6,339.00	1,688.70	4,228.30
Specialist cattle	6,691.20	1,470.50	3,156.10
Granivores	14,216.33	1,207.33	5,926.78
Mixed crops	4,111.13	554.88	2,038.75
Mixed livestock	5,170.00	836.20	2,048.30
Mixed crops and livestock	6,018.70	742.60	2,771.10
Total in all FADN farms	6,621.10	1,108.90	2,960.00
Typology of farming	**Seeds and Plants (€)**	**Fertilizers Cost (€)**	**Total crops output / ha (€)**
Wine	97.11	360.56	6,382.943
Orchards fruits	543.50	1,035.67	4,871.352
Dairy cow	654.30	1397.10	663.088
Sheep and goats	133.80	133.80	323.209
Specialist cattle	221.00	357.50	466.693
Granivores	2,003.22	3,117.00	1,095.633
Mixed crops	1,250.13	1,013.38	2,357.293
Mixed livestock	424.60	692.80	761.940
Mixed crops and livestock	545.20	896.20	954.904
Total in all FADN farms	520.40	869.90	942.261

Source: Own elaboration on data FADN published on the website http://ec.europa.eu/agriculture/rica/database/database_en.cfm

Slovenian agrarian enterprises specialized in sheep and goats breeding have pointed out the poorest levels of labour costs, output and inputs even if these latter farms have got significant amount of financial subsidies allocated in terms of LFA payments and also in terms of financial aids disbursed by the

second pillar of the CAP.

Drawing the attention on the financial subsidies allocated by the European Union throughout the Common Agricultural Policy in the first and second pillar, findings have pointed out as agrarian enterprises specialized in granivores such as pig breeding and chicken farming have got the highest level of total subsidies by the CAP such as dairy farms (Fig. 6). Farms specialized in sheep and goats as a consequence of the large dimension of agricultural areas, scattered predominantly in disadvantaged rural areas, have received the highest level of LFA payments close to 1,700 euro.

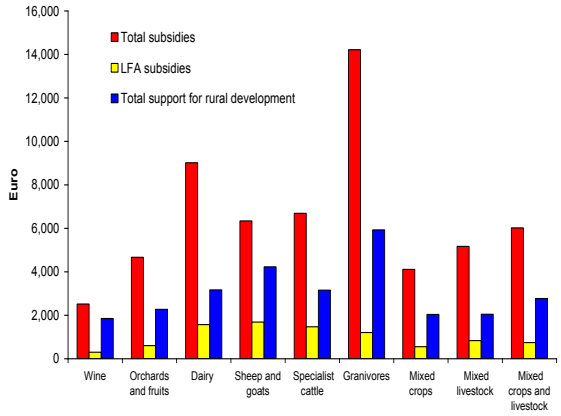

Fig. 6. Average value of financial subsidies allocated by the CAP towards Slovenian farms.
Source: Own elaboration on data FADN published on the website http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

The multiple regression model fits well with the purpose of the research because the level of R^2 and adjusted R^2 have been equal to 0.73 and 0.71.

The level of farm net income has been directly correlated to the independent variables agricultural areas, total inputs and payments allocated by the second pillar of the CAP (Table 4). Total assets, payments disbursed in favour of disadvantaged rural areas (LFA aids) and total subsidies allocated by the Common Agricultural Policy correlate indirectly to the independent variable farm net income; hence, farms with the highest level of subsidies allocated by the CAP and by the LFA supports, located predominantly in Slovenian stayed behind rural areas, have had the poorest level of farm net income corroborating the hypothesis according to which agrarian enterprises in mountainous and hilly areas have to be supported by the public aids in order to reduce the socio-economic marginalization of rural areas.

Table 4. Main results in the multiple regression model over the time 2004-2013 in Slovenian farms part of FADN dataset. Dependent variable Farm Net Income

Dependent variables	Coefficient	Standard error	t value	p-value	Significance
Constant	5,452.07	1438.65	3.7897	0.00030	***
Utilized Agricultural Areas	897,705	274.61	3.2690	0.00163	***
Total inputs	0.44	0.0806	5.5098	<0.00001	***
Total assets	-0.05	0.0086	-6.395	<0.00001	***
LFA payments	-5.60	1.7696	-3.168	0.00222	***
Rural Development Plan payments	1.93	0.7204	2.687	0.00886	***
Total subsidies allocated by the CAP	-1.25	0.5528	-2.276	0.02568	**

** 5%; *** 1%
Source: Own elaboration on data FADN published on the website http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

Table 5. Main correlations in Slovenian farms between economic size and land capital.

Variable	Years		
	2007	2010	2013
Economic size versus UAA	0.26 *	0.48 **	0.66 **
Economic size versus livestock units	0.79***	0.89***	0.93***
Economic size versus Annual Working Units	-0.4***	0.37***	0.27***

* significance at 10%, ** significance at 5% ; significance at 1%
Source: Own elaboration on data published on the website http://www.stat.si/StatWeb/en

Economic size and the variable utilized agricultural areas increased over the height year time of investigation and these two variables have pointed out to be directly correlated (Table 5). Findings have pointed out as there is a direct nexus between livestock units and economic size hence, large

size farms have had the most significant level of income, which is increased since 2007 to 2013.

CONCLUSIONS

Findings have pointed out as the size of farms, in terms of usable agricultural areas, is a pivotal variable able to act on the level of farm net income and investments. In general, both in Slovenia and also in many other European countries a new generation of farmers has taken over farms halting the aging phenomenon typical of rural areas.
Furthermore, local and national authorities in order to face the out emigration and rural marginalization in Slovenian countryside have to address their efforts in allocating more financial resources towards a growth of land capital with the consequence to stimulate an high specialization in agricultural enterprises by technical intensive investments linked to an adequate and efficient level of land capital.
In general, it is important also to address enterprise's attempts towards a diversification of activities inside the farm rather than the productive diversification in a perspective of multifunctional farms able to get the most by the environment and the peculiarities of Slovenian farms. In fact, specialized farms have had the best results in farm net income and in terms of economic and technical results compared to mixed farms.

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FARM STRUCTURES IN THE EUROPEAN UNION

Iulia GRADINARU (CRISTEA), Dorina MOCUTA

University of Agronomic Sciences and Veterinary Medicine Bucharest. 59 Marasti Boulevard. District 1. 011464, Bucharest, Romania, Phone: +40213182564, Fax: +40213182888, Email: dorinamocuta@yahoo.com

Corresponding author: dorinamocuta@yahoo.com

Abstract

Through its programs, the EU seeks to mitigate the situation by allocations especially for small and medium farms, those with conditions disfavoring, constraints and even the cessation of certain allowances for holding very large, stimulating young farmers setting up new farms medium sized organization of small farmers in the marketing structures of production, etc. That the great latifundia largely own land on lease and concession and thus land ownership is maintained by the rural population, can be a basic to improve the situation. The purpose of the paper is point out some considerations about agriculture in EU, CAP (common agricultural policy) farm structure using the data provided by Eurostat Database. The EU cohesion policy could be a significant driving engine of economic growth, being supported by the objectives of Europe 2020 Strategy and to obtain the commitment of the member states as regards the application of necessary reforms.

Key words: *rural development. EU agriculture, farm structure, standard of living*

INTRODUCTION

Agriculture is a huge industry that involves rural areas and its communities, natural resources and not least, human resources.
Most of the European countries want to maintain a strong agricultural policy with a budget that can guarantee significant revenue producers and food security of the population. However there are certain interest groups that put together states with eye to eye on the future Common Agricultural Policy, the community of interest being generated either for financial reasons in conjunction with a design more liberal on agricultural policies (group of countries liberal),the recent past frustrating that produced significant social and economic gap (it is former communist countries), certain economic and social realities in the old European states (large share of agriculture in the economy and employment structure of fragmented farms, the high percentage of disadvantaged areas) who European states more conservative product group.
Memberships (formal) in a group or another is given by the positions and solutions on supporting agriculture and especially the extent and future direct payments.[5]

Agriculture is one of the largest and most significant industries in the world. Agriculture, as we all know, is the backbone of any country.
Agricultural productivity is important not only for a country's balance of trade, but the security and health of its population as well.
Agriculture covers a wide range of subjects: economic situation, financial aspects, structure, trade, rural development, markets et cetera.
"*Increase in agricultural production and the rise in the per-capita income of the rural community, together with the industrialisation and urbanisation, lead to an increased demand in industrial production*"-Dr. Bright Singh [5].
Agriculture is the basic source of food supply of all the countries of the world—whether underdeveloped, developing or even developed. Due to heavy pressure of population in underdeveloped and developing countries and its rapid increase, the demand for food is increasing at a fast rate. If agriculture fails to meet the rising demand of food products, it is found to affect adversely the growth rate of the economy. Raising supply of food by agricultural sector has, therefore, great importance for economic

growth of a country [6].
Agriculture provides employment opportunities for rural people on a large scale in underdeveloped and developing countries. It is an important source of livelihood.
The knowledge of agricultural sector and its behaviour is mandatory also at EU level, fact that will help the business to set up a trend.
The interest for such information is to justify a business in the agricultural sector, such as foreign seed production companies which are developing commercial activities in Romania. A relevant example is the utility of the customer relationship management systems in the development of commercial and marketing business area of a company.
The information in big lines about agriculture in general, crop distribution and farms split will create a clear picture about the importance of using this kind of systems in the operational sector of a company which is providing to the final consumer -the farmer-, the seed.

MATERIALS AND METHODS

In the paper is used data collected from the EU data base Eurostat. Aspects such as: the size of agricultural holdings, the farm labour force, agricultural land, agriculture statistics - the evolution of farm holdings use were pointed out.

RESULTS AND DISCUSSIONS

The structure of agriculture in the Member States of the European Union (EU) varies as a function of differences in geology, topography, climate and natural resources, as well as the diversity of regional activities, infrastructure and social customs.
In 2013, there were 10.8 million agricultural holdings within the EU-28. The utilised agricultural area (UAA) in the EU-28 was almost 175 million hectares (some 40.0 % of the total land area), giving an average size of 16.1 hectares per agricultural holding.
In terms of utilised agricultural area, France and Spain had the largest share of the EU-28's agricultural land, with 15.9 % and 13.3 % shares respectively, while the United Kingdom and Germany had shares just under 10.0 %.

Table 1. Key indicators — share in EU-28 total. 2013

	(%)			
	Number of agricultural holdings	Utilised agricultural area (UAA)	Number of agricultural holdings	Utilised agricultural area (UAA) (ha)
EU-28	100.0	100.0	10,841,000	174613,900
France	4.4	15.9	472,210	27,739,430
Spain	8.9	13.3	965,000	23,300,220
United Kingdom	1.7	9.9	185,190	17,326,990
Germany	2.6	9.6	285,030	16,699,580
Poland	13.2	8.3	1,429,010	14,409,870
Romania	33.5	7.5	3,629,660	13,055,850
Italy	9.3	6.9	1,010,330	12,098,890
Ireland	1.3	2.8	139,600	4,959,450
Greece	6.5	2.8	709,500	4,856,780
Hungary	4.5	2.7	491,330	4,656,520
Bulgaria	2.3	2.7	254,410	4,650,940
Portugal	2.4	2.1	264,420	3,641,590
Czech Republic	0.2	2.0	26,250	3,491,470
Sweden	0.6	1.7	67,150	3,035,920
Lithuania	1.6	1.6	171,800	2,861,250
Austria	1.3	1.6	140,430	2,726,890
Denmark	0.4	1.5	38,830	2,619,340
Finland	0.5	1.3	54,400	2,282,400
Slovakia	0.2	1.1	23,570	1.901,610
Latvia	0.8	1.1	81,800	1,877,720
Netherlands	0.6	1.1	67,480	1,847,570
Croatia	1.5	0.9	157,450	1,571,200
Belgium	0.3	0.7	37,760	1,307,900
Estonia	0.2	0.5	19,190	957,510
Slovenia	0.7	0.3	72,380	485,760
Luxembourg	0.0	0.1	2,080	131,040
Cyprus	0.3	0.1	35,380	109,330
Malta	0.1	0.0	9,360	10,880

Source: Eurostat, 2016

By contrast, the largest number of agricultural holdings was in Romania (3.6 million), where one third (33.5 %) of all the holdings in the EU-28 were located. Poland had the second

highest share of agricultural holdings (13.2 %). some way ahead of Italy (9.3 %) and Spain (8.9 %).

Table 2. Average utilised agricultural area per holding. 2010 and 2013 (1)

	2010	2013
EU-28	14.4	16.1
Czech Republic	152.4	133.0
United Kingdom	90.4	93.6
Slovakia	77.5	80.7
Denmark	62.9	67.5
Luxembourg	59.6	63.0
France	53.9	58.7
Germany	55.8	58.6
Estonia	48.0	49.9
Sweden	43.1	45.2
Finland	35.9	42.0
Ireland	35.7	35.5
Belgium	31.7	34.6
Netherlands	25.9	27.4
Spain	24.0	24.1
Latvia	21.5	23.0
Austria	19.2	19.4
Bulgaria	12.1	18.3
Lithuania	13.7	16.7
Portugal	12.0	13.8
Italy	7.9	12.0
Poland	9.6	10.1
Croatia	5.6	10.0
Hungary	8.1	9.5
Greece	7.2	6.8
Slovenia	6.5	6.7
Romania	3.4	3.6
Cyprus	3.0	3.1
Malta	0.9	1.2
Norway	21.6	23.0
Switzerland (2)	17.7	:
Montenegro (2)		:
Iceland (2)	616.1	:

Source: Eurostat, 2016
(1) Iceland not shown for reasons of scale: 2010 value was 616 hectares.
(2) 2013: not available.

The average size of agricultural holdings in the EU-28 increased from 14.4 hectares per holding in 2010 to 16.1 hectares per holding in 2013, resulting from an 11.5 % fall in the number of holdings and a 0.7 % fall in the utilised agricultural area.
The total farm labour force in the EU-28 was the equivalent of 9.5 million annual working units in 2013, of which 8.7 million (92 %) were regular workers.

Table 3. Share of regular workers in the farm labour force and distribution by work intensity, 2013

	Analysis of labour force (% of total)			Farm labour force (1 000 AWU)		
	Full-time regular	Regular but not full-time	Total regular	Total	Regular	Full-time
EU-28	38	53	92	9,508,560	8,733,630	3,649,380
Latvia	37	63	100	82,090	81,770	30,050
Croatia	23	76	99	175,050	173,250	40,070
Malta	30	68	98	4,450	4,380	1,340
Lithuania	21	77	98	144,770	142,450	30,380
Ireland	44	54	98	163,690	160,610	72,800
Estonia	60	38	98	22,060	21,550	13,260
Poland	47	51	97	1,918,550	1,866,450	892,330
Austria	24	72	97	111,160	107,740	27,210
Slovakia	54	43	97	50,600	49,030	27,460
Slovenia	30	66	96	82,450	79,470	24,840
Czech Republic	71	25	96	105,080	101,070	75,130
Denmark	71	25	96	54,470	52,280	38,750
Luxembourg	74	22	96	3,530	3,380	2,600
Sweden	41	53	94	59,320	55,670	24,450
Romania	7	87	94	1,552,630	1,451,870	101,310
United Kingdom	63	30	93	275,370	256,670	173,830
Bulgaria	37	56	93	320,230	298,380	119,090
Portugal	36	56	92	323,470	298,550	117,270
Hungary	30	62	92	433,700	400,020	130,760
Cyprus	30	62	92	16,550	15,240	4,980
Finland	54	38	92	57,550	52,990	31,320
Belgium	68	24	92	56,730	52,010	38,640
Germany	58	31	89	522,730	466,830	303,880
Greece	29	60	89	463,860	412,450	134,400
France	66	22	88	724,690	640,480	479,890
Netherlands	55	31	86	153,310	131,750	83,850
Italy	38	48	85	816,920	696,240	306,570
Spain	40	42	81	813,550	661,050	322,920
Montenegro (1)	39	59	98	47,870	47,060	18,780
Switzerland (1)	33	65	97	95,960	93,550	31,520
Norway	26	67	93	44,000	40,860	11,400
Iceland (1)	46	47	92	4,170	3,850	1,910

Source: Eurostat, 2016

Utilised agricultural area accounted for two fifths (40.0 %) of the total land area of the EU-28 in 2013, with a further 9.0 % of the land belonging to agricultural holdings, either in the form of wooded areas (6.7 %) or other land not used for agriculture (2.3 %).
More than half of all arable land was given over to

cereals, which accounted for one third (33.2 %) of the total utilised agricultural area in 2013. Permanent grassland and meadow was predominantly pasture and meadow, which had a 21.9 % share of the total utilised agricultural area, compared with shares of 11.4 % for rough grazing and 0.8 % for permanent grassland and meadow not used for production, but eligible for subsidies [7].

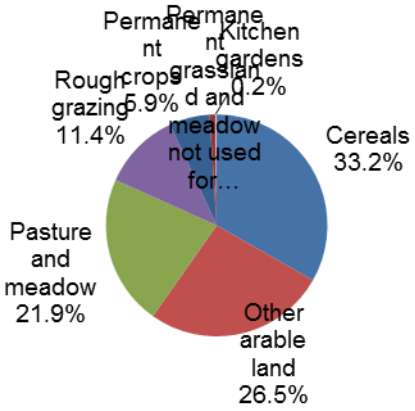

Fig. 1. Utilised agricultural area by land use. EU-28
Source: Eurostat

The arable crop area in the EU is expected to continue its slow decline. About 45 % of the EU is covered with agricultural land [8].

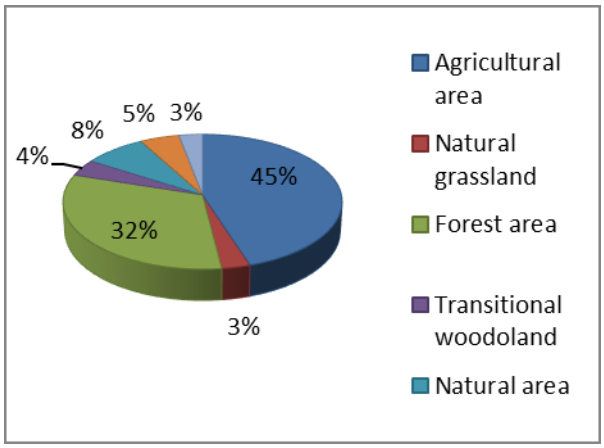

Fig. 2. Share of agriculture in total land cover
Source: DG Agriculture and Rural Development. Context indicator CCI 31 Land cover

According to the European Commission Communication, the Common Agricultural Policy will remain an integrated policy, a strong policy, consisting of two support pillars, in the next years, too. The medium-term strategic objectives are based on the challenges and concerns of the last years, being generous objectives, yet sometimes divergent as scope and means. One of the objectives is:

Support to the farm sector, so that the farms could provide high quality, clean and diversified agricultural products, obtained by the respect of sustainable production principles. Hence an efficient agriculture is desired at the same time protecting the environment, water, animal health and welfare, plant health and by complying with the public health regulations [3].

The aim of the common agricultural policy (CAP) is to provide a stable, sustainable production of safe food at affordable prices for consumers, ensuring also a decent standard of living for 22 million farmers and agricultural workers.

EU farm policy [1] – the common agricultural policy – serves many purposes:

-helps farmers produce sufficient quantities of food for Europe

-ensures this food is safe (for example through traceability)

-protects farmers from excessive price volatility and market crises

-helps them invest in modernising their farms

-sustains viable rural communities. with diverse economies

-creates and maintains jobs in the food industry

-protects the environment & animal welfare.

EU farm policy has evolved considerably in recent decades to help farmers face new challenges and also in response to changing public attitudes.

The impact of agriculture on the country's growth is definitely quite high and that is why efforts need to be made to improve it. Various schemes should be integrated for the betterment of the farmers along with guiding them on the new ways of farming. Measures need to be taken to overcome the loss due to heavy or inadequate rainfall so that the farmers can live a happy life.

Agriculture is not only the major sector of the country but a powerful one as well. Its importance cannot be denied as it accounts to the high GDP.

The role of small farms in EU agriculture and in maintaining the economic vitality of the rural area is also recognized. That is why the

Parliament agrees on granting a specific, simplified aid to small farmers, and invites the Commission to find certain transparent and flexible criteria by which the small farm status should be defined by each Member State. It is not clear whether this would presuppose a different approach of these criteria by each Member State or a unitary approach [10].

There are 13.7 million farms in EU-27, out of which 3.9 million in Romania (28.7%). While in EU-27 the average farm size is 12.6 hectares, in Romania the average farm size is only 3.5 ha. i.e. four times smaller. The differences are even higher if the economic size is considered: the EU-27 average is 11.3 ESU and only 1 ESU in Romania.

Table 4. Farm structure in Romania and in EU-27

	Unit of measure	Romania	EU-27
Number of farms	no.	3,931,350	13,700,400
Utilized agriculture area	ha	13,753,050	172,485,050
Labour force	AWU	2,205,280	11,696,730
Average farm size	ha	3.5	12.6
Share of farms by different size classes	%		
< 5ha		89.9	70.4
5-50 ha		9.8	24.5
> 50 ha		0.4	5.1
Average economic farm size	ESU	1.0	11.3
Share of farms by economic size classes	%		
< 2 ESU		94.0	60.8
2-100 ESU		6.0	36.9
> 100 ESU		0.0	2.2
Importance of semi-subsistence farms			
Number of farms under 1 ESU	Nr.	3,064,670	6,389,390
Share of farms under 1 ESU	%	78.0	46.6

Source: calculations based on European Commission's data. 2010

According to the provisional data of the Agricultural Census, in the agricultural year 2009-2010, Romania's agricultural area totalled 15.86 million ha out of which the utilized agricultural area per total country was 13.298 million ha, with an average agricultural land area per holding of 3.45 ha. Out of this land, 62.5% is arable land. 33.8% pastures and hayfields. 2.4% permanent crops and 1.4% kitchen gardens.

The non-utilized agricultural area totalled 0.88 million ha and the idle agricultural area (according to the statistical research study "Crop production by main crops in 2010") was 1.35 million ha.

According to the Agricultural Census provisional data, 55.6% of total holdings have less than 1 ha (2.13 million holdings) and their total area (1.03 million ha) accounts for 6.8% of total.

The structure of farms over 1 ha (farms complying with the minimum CAP support criterion) is presented in Fig. 3.

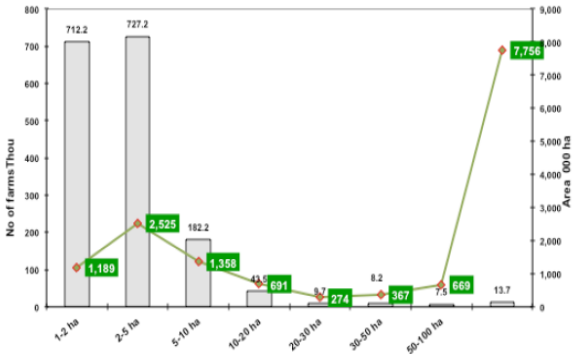

Fig. 3. Structure and number of agricultural holdings over 1ha

Source: Agricultural Census provisional data. NIS. 2011

As it can be seen 18.5% of total farms have 1-2 ha and 7.5% of total area. 20% of total farms have 2-5 ha and operate about 16% of total area and 0.4% of holdings have over 100 de ha and 49% of total area.

The labour employed in the EU-27 agricultural sector totalled 2.2 million annual work units (AWU) which represented about 18.8% of the labour force employed in the primary sector.

The main characteristic of EU agriculture is represented by the family farms. which on the average provide 1 – 1.5 jobs (EU. 2010).

As it can be sees from Table 5.9. in Romania the agricultural production is mainly based on the small-sized semi-subsistence farms, which have an extremely large share - 78%.

In the year 2005, in EU-27, one-fifth of farmers had agricultural training, while in Romania their share was 2.7 times lower (7.4%).

Table 5. Vocational training in agriculture in Romania and in EU-27

	Romania %	EU 27 %
Share of farmers with basic agricultural knowledge or with completed agricultural training	7.4	20.0

Source: according to European Commission's data. 2010

CONCLUSIONS

The agriculture provides food items to the country which helps to prevent buying the same from countries. This reduces the problem to a large extent and proves beneficial in the growth of the nation too. It is better if the country does farming in most of the staple food products.

So it is very clear that agriculture is of great importance not only to the people but in the country as a whole. Steps and measures should be taken to improve agriculture ways thus making it a powerful sector to trade for.

Special attention should be given to this sector so that farmers use the latest technology for agriculture that results in higher yield. Better the agriculture, higher will be the growth of the nation.

As a conclusion of the data presented above, a good scenario for a seed producer company is to start and develop a commercial action in Romania. Selling certified seeds to Romanian farmers encourages the companies to develop besides all the legal financials commercial aspects an operational department meant to sustain and create relationships with customers.

The link and the relationship between the farmer and the provider of any input should be strong built on trust and on a win-win situation.

The development of any business in agriculture meant to increase its profitability offers the opportunity to anyone to identify the actual needs of customer and help them to serve them in a better way [9].

The progress in agricultural sector provides surplus for increasing the exports of agricultural products. In the earlier stages of development, an increase in the exports earning is more desirable because of the greater strains on the foreign exchange situation needed for the financing of imports of basic and essential capital goods [11].

The Commission Communication on the cohesion policy highlights the importance of this policy for reaching the objectives from "Europe 2020 Strategy" and reiterates the need to consolidate its role, so as to guarantee an intelligent, sustainable and inclusive growth, at the same time promoting the harmonious development of the Union and of all its regions through the diminution of regional disparities.

Although the important role of this policy in job creation, in increasing human capital, construction of critical infrastructure and environment protection improvement is recognized, in the less developed regions the effects of this policy implementation have not been significant yet, which imposes an ambitious reform. mainly in the concentration of resources to reach the objectives of Europe 2020 Strategy and to obtain the commitment of the member states as regards the application of necessary reforms so as to ensure this policy implementation by focusing more on the obtained results. In this context, the cohesion policy could be a significant driving engine of economic growth, in the conditions of the European policies coordination [4].

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THE IMPACT ON THE SMALL BUSINESS IN THE AGRICULTURAL SECTOR IN ORDER TO ENHANCE COMPETITIVENESS

Liliana GRINCIUC, Tatiana BUJOR

State Agrarian University of Moldova, 44 Mircesti, Chisinau, Republic of Moldova, Phone: + 373 22 432 432, Emails: lgrinciuc@gmail.com, bujortania@yahoo.com

Corresponding author: lgrinciuc@gmail.com

Abstract

This article shows the evolution of SMEs in Moldova. The country's economy depends largely on the development of entrepreneurship. Agriculture was a major component of the Moldovan economy. The last two decades the service sector is the main engine of economic growth in Moldova. For the development of the agrarian sector of Moldova SME sector is of particular importance. Promoting small business in agriculture will ensure the increased competitiveness of the sector.

Key words: *business agents, competitive economy, development, entrepreneurship, small business*

INTRODUCTION

The development of entrepreneurship is an important element in the process of creation of an efficient and prosperous market economy [4]. Small business, in essence, is a promoter of technological initiatives, a key determinant of competitive economy and the main source of creating new jobs [10]. Small business activity in Moldova began to unfold as independent phenomenon, developing into unfavorable economic conditions and the indefinite transition period from planned economy to market relations economy. In Moldova, SMEs constitute a significant part in the total number of businesses, it provides employment and a modest level of income, it provides market saturation of goods, it participates in the creation of GDP [6].

MATERIALS AND METHODS

Methodological investigations is the economic information the sources published in various books, administrative documents, the National Bureau of Statistics and publications in the field of various scholars. Preference was given to the statistical method of analysis and synthesis.

RESULTS AND DISCUSSIONS

The economy of country depends largely on the development of entrepreneurship, especially in the sphere of small and medium enterprises.

Small business sector in the Republic of Moldova, otherwise as in most developing countries, arose as result of structural reforms, made of the transition from the centralized economy to the market economy [7].

Quantitative impact of SMEs on economic growth is estimated by the indicator weight of SMEs in GDP. The indicator SME share in GDP varies significantly in different countries [1].

Small business enterprises account for over 90% of all businesses, nowadays being considered the backbone of the national economy. In the formation of the gross domestic product, SMEs contributed in 2010 by 28.3% or 6.7 percentage points less than in 2006. The rate of small business agents in the total number of operators has also an increasing trend, although it is not so obvious. Within 20 years, Moldova's SME sector has grown both in terms of quantity and quality. The global economic and financial crisis was reflected negatively on SMEs. The research of crisis impact on the results of this sector, of some groups of SMEs, allows to consider more concrete possibilities and their

restrictions under unfavorable external environment, to argue their improvement of regulatory policy [7].

The considerable increase in the share of small businesses was observed in 1996 (83.3%) compared with 1995 (55.3%); It reached a peak in 2013 (93.3%).

After the decreasing of small business agents, (from 2000 to 2003) there was observed o growth in 2004, to 115.7% (this increase was due to incentives provided by the state of small business in accordance with art. 49 of the Tax Code Moldova). In 2013 SME share is 97.4% (50, 9 thousand units) [2].

The overwhelming majority of small business enterprises is based on private property – 91.3% in 2003 and 90% in 2013.

In the period 2006-2014 SMEs recorded a positive trend in all indicators, which shows that the sector as a whole is profitable and contributes positively to the formation of national income. The best results were recorded in the category of small enterprises.

In Moldova, SMEs account for around 97% of all enterprises in the country and reflects the stable growth of the sector due to both improve the business environment, as well as improving the regulatory framework related to entrepreneurship.

The evolution of the small and medium enterprises in all enterprises in the years 2005-2014 is characterized by the following indicators [2], (Table 1.).

Table 1.The evolution of the small and medium enterprises in all enterprises in the years 2009-2014

Years	Nr of enterprises, thousands			Nr of employees, thousand persons			Sales revenue, mil. lei		
	Total	SMEs	The share of SMEs in total, %	Total	SMEs	The share of SMEs in total, %	Total	SMEs	The share of SMEs in total, %
2009	44.6	43.7	97.8	539.2	316.2	58.7	146,447.0	57,480.0	39.2
2010	46.7	45.6	97.7	526.2	309.4	58.8	177,503.2	65,263.2	36.8
2011	48.5	47.3	97.5	510.2	294.2	57.7	207,676.8	71,887.6	34.6
2012	50.7	49.4	97.5	519.9	300.2	57.7	211,759.3	73,057.0	34.5
2013	52.2	50.9	97.4	524.5	298.4	56.9	231,601.4	77,413.2	33.4
2014	53.7	52.3	97.4	519.0	291.7	56.2	263,051.2	83,650.3	31.8

Source: NBS [2]

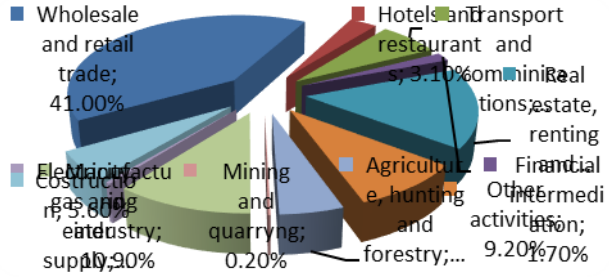
Currently, state policy is oriented towards supporting entrepreneurship, it continues to shift, primarily to create a stable and favorable conditions for its development [9].

The analysis on growth development of SMEs indicate the average size of enterprises in the sector. Revenues from sales on average per enterprise in 2014 amounted to 1.599 million lei or by 79 thousand (5.2%) more than in 2013. Revenues from sales of SMEs in an employee average is 286,800 lei or by 27.4 thousand (10.5%) more than in 2013. The number of employees on average per enterprise in 2014 was 6 people, being at the level of 2013.

Traditionally, agriculture has been a major component of the Moldovan economy. The impact of transition to a market economy and, associated with this, collective farms and state disintegration had negative impact on the agricultural sector [3].

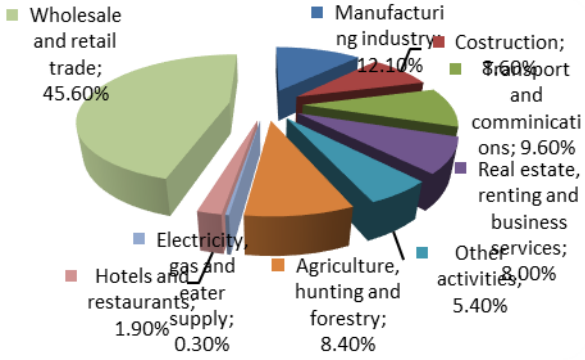
Moldova's economy has had a great Agro-industrial tradition, but in the last two decades the services sector is the main engine of economic growth of the country. This sector during the analyzed period reached 63.5% in 2011. The share of agriculture in GDP declined from 31.0% in 2004 to approximately 12.27% in 2013 [2]. However, when the agricultural sector is combined with agro-processing sector, the importance of agriculture as a sector of the Moldovan economy combined represent about 30% of GDP.

The dynamic evolution of the number of SMEs on the main types of activities is as follows:



2010

Fig. 1. The share of SMEs in the profile of the main types of activities in the year 2010.
Source: NBS [2].



2014

Fig. 2. The share of SMEs in the profile of the main types of activities in the year 2014.
Source: NBS [2].

The major part of SMEs is operating in the field of trade, representing about 20,500 enterprises in 2014, or 45.8% of all SMEs, increasing in 2013 (20.0 thousand enterprises, or 40.0% of total SMEs). In manufacturing industry in 2014 have enabled the SME 4800 or 12.1% of all SMEs. The number of these enterprises compared to the years 2012 and 2013 has declined a hundred enterprises and their share decreased by 0.5 p.p.

Share of agriculture increased in 2014 compared to 2010 by 3.3 pp. (from 5.1% to 8.4%), but the share of SMEs in the agricultural sector is very low – only 2.9 thousand units or 5.5%. Most of these enterprises are micro-enterprises.

In the years 2006-2014 SMEs in most sectors of the national economy recorded downward values development. Except in 2009, revenues from sales decreased in all branches of activity of small and medium enterprises, in addition to financial activity.

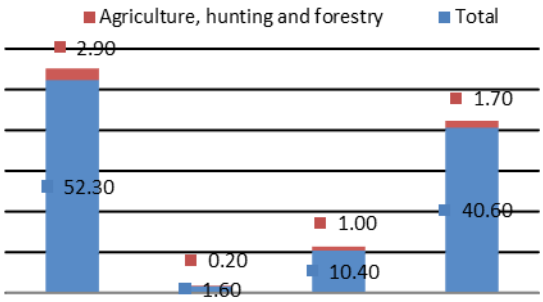


Fig. 3. Number of SMEs in the agriculture sector in the years 2010-2014.
Source: NBS [2].

Thus, if in 2009 the revenues from sales of SMEs decreased compared to 2008 by 7504.1 million lei, then in 2010-2014 they increased significantly.

This is due to the flexibility of SMEs, most if complying with micro class, which are characterized by an additional volatility (it restructures and refocuses more quickly).

Efficient funding of the business sector, especially in agriculture, depends largely on government policy in supporting small business. That is why the support of the state has a great importance for small business. It could be conditioned by two factors, namely, primarily small business has a social and macroeconomic effect, and secondly it is in conditions of unequal competition. In conditions of unequal competition, the basis could be organizational support, special legal and economic assistance and foundation stage [9].

CONCLUSIONS

For the development of the agrarian sector of Moldova SME sector is of particular importance.

Feature key indicators of SMEs, assessing of the potential and contribution of this sector in the economic development of Moldova's evolution, including the crisis last year, will enable to identify areas of strength and weaknesses of Moldovan SMEs compared to

other European countries, to argue the main directions and measures to support the state.

The crisis has had an impact on several indicators characterizing socio-economic development of countries it also had a negative impact on business development.

SMEs in Moldova participates quite active in the production of goods and services, meet demand, especially on the internal market. Characteristic for Moldova is lack of cooperation between large enterprises and SMEs, so SMEs contribute primarily at the consumer market saturation.

The support and development of SMEs increase trust between business and authorities, creating a more favorable environment for business also to achieve other economic policies – by sectors, regional, investment, innovation and so on.

Currently, small businesses are at the inalienable and most dynamic market economy as well as being a promoter of technological and economic initiatives, a primary source of innovation and an important determinant of high productivity and competitive economy, being also relevant for the Republic of Moldova.

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BEEF MEAT IN ROMANIA – REALITIES AND OPPORTUNITIES TO IMPROVE SELF-SUFFICIENCY ON LONG TERM

Mariana GRODEA

Institute of Agricultural Economics, INCE, the Romanian Academy, 13, Calea 13 Septembrie, District 5, Bucharest, Phone/Fax:021/3182411; 0722633295,
E-mail: marianagrodea@yahoo.com

Corresponding author: marianagrodea@yahoo.com

Abstract

From the perspective of reaching food security, for Romania, beef meat (accounting for 10% in the total meat consumption structure, in the year 2015) is important both for dietary diversity and for the complex contribution to the valorization of the country's agricultural resources, through the export of live animals inclusively. With a 45% decrease of live weight beef production, after the accession to the EU, with a poor quality of carcasses, as 77.9% of carcasses come from slaughtering adult cattle, out of which 49.5% cows, the beef sector in Romania is not currently in the situation to best use the opportunities provided by the European Single Market. The aim of the paper is to identify new opportunities for relaunching the domestic beef meat production, through investments on the long term, having in view the support to the sector under the NRDP 2014-2020 measures, for the long-term improvement of self-sufficiency to about 90%.

Key words**:** *self-sufficiency in beef, investments, production*

INTRODUCTION

Having in view the 79.6% self-sufficiency in beef in the year 2015, which implies a chronic deficit in the consumption of this product, this paper aims to identify new opportunities for relaunching Romanian consumption in order to reach a self-sufficiency level of 89.6% at the 2038 horizon, from the perspective of cattle raising sector stabilization, in the context of the European market stabilization.

The alternative to raise beef cattle in Romania is considered by experts [9] as an immediate income source for the producers who cannot obtain conform milk, mainly in the context of milk quota removal starting with April 1, 2015. That is why the entrepreneurship spirit must be stimulated, mainly in the young rural people.

Even though the beef and baby beef is not a traditional product in the Romanian consumers' diet (only 10% of the total meat consumed is represented by this meat type), the fact that about 35% of the cattle herds in Romania are of Simmental type – very suitable for beef production – the beef sector seems to have good prospects, as beef has a great growth potential compared to the other meat assortments; yet consumption will grow only gradually, with the increase of people's incomes and level of education on nutrition [13].

Guaranteeing food security does not imply only meeting the consumption needs in quantitative terms, but also refers to ensuring a certain qualitative and assortment structure. Thus, for Romania, the average per capita food consumption requirement, according to FAO, is 2,700 kcal. and minimum 55 g of proteins, out of which about 50 % should be of animal origin, as animal protein has a high biological value. Considering this reference level, we can estimate that in Romania, an average consumption of 40.3 grams/capita/day in 2014 does not ensure a protein intake that is satisfactory in terms of meeting the normal physiological needs of human body. The second qualitative element that must be considered at this indicator refers to the structure of protein consumption, i.e. the share of animal proteins in total daily protein intake[14]. The experts in nutrition consider that the optimum share of animal protein intake in total daily protein intake must be higher than 60%. In Romania's case, in the year 2014, the animal proteins

accounted for 49.7% of total protein consumption, which once again confirms the inadequacy of the Romanians' food consumption to the normal physiological needs.

According to the Food and Agricultural Organization [6], about 870 million people suffer from the lack of basic foodstuffs (out of which 81% are living in southern Asia, Sub-Saharan Asia and eastern Asia), in spite of the fact that sufficient potential exists to feed the entire world population from the world agricultural production. That is why the redistribution of foodstuffs across different continents represents one of the main problems of today's society

At the same time, about two-thirds of the meat animals throughout the world depend on cereals and soybeans [4]. This demand for animal feeding means that people compete against farm animals for food. On the other hand, the increase of food prices in recent years has been determined by the economic growth on long term, in several developing countries, which (a) has put increasing pressure on crude oil and fertilizer prices, due to the intensive nature of their economic growth resources and (b) led to meat demand increase and hence of the demand for animal feed [5].

In this context, food self-sufficiency as part of food security should be understood as the capacity of a country to cover its population's consumption needs from domestic production, avoiding as much as possible imports from other countries [8].

Another author, [7], analyzes food security from the agricultural potential perspective, i.e. the number of persons that can be fed from one hectare of agricultural land. Thus, according to this author, Australia can feed 0.1 people, USA – 0.8 people, France – 2.9 people, Germany – 4.5 people, Japan – 10.5 people. He also advocates that the agricultural potential diversity is given by the different support levels to farmers, under the form of subsidies. Thus, while in Europe, about 50% of the agricultural income comes from direct payments, in other countries such as Japan, this share is around 20%.

Other authors, [11], consider that the calculation modality of self-sufficiency in meat must take into consideration the fact that a part of the meat quantity obtained from domestic production is based on imported feed, and hence the self-sufficiency level must be adjusted by a feed-meat conversion ratio.

A comparison with certain European countries with regard to self-sufficiency in beef reveals different situations. Thus, in the year 2013, while in Poland the self-sufficiency significantly increased to 416% (as against 125% in 2003), in other countries such as the Czech Republic, Hungary and Slovakia self-sufficiency ranges from 106 to 130% [12]. According to the two authors, Poland's situation is a result of the significant decrease of beef consumption, from 7 kg/capita in 2003 to 1.6 kg/capita in 2013 (-77%), under the background of the massive rise of exports and of non-attractive prices on the domestic market, corroborated with a weak domestic supply in quality terms.

MATERIALS AND METHODS

Targets on short term (2020), medium term (2028) and long term (2038) for the production of meat were established, on the basis of an analysis model (of food balance sheets) used by the National Institute of Statistics, in conformity with the FAO and Eurostat methodologies; the main indicator, for which levels corresponding to the three time horizons were proposed, was the utilizable production, from which we can obtain the available supply (by adding imports and deducting imports). The ratio of utilizable production to available supply, expressed in percentage terms, represents the self-supply level (indicator that expresses the self-sufficiency rate for the respective product).

The method used for the development of scenarios on self-sufficiency increase was based on statistical calculations of the yearly average increase rate, rate of increase and the dynamics index of utilizable beef production, beef imports and exports. These were correlated with the trends of the period 1990-2015, calculated on the basis of information from the "Food Balance Sheets" and "Population's Consumption Availabilities"

from the National Institute of Statistics. At the same time, FAO long term forecasts on the evolution of production, demand, import and export were taken into consideration (World Agriculture Towards 2030/2050) and of population 2024 Prospects for EU agricultural markets.

The financial needs for the beef cattle sector, by the three time horizons, were estimated by the analysis of the way in which the NRDP 2007-2013 measures were developed, as well as the evaluation of the impact of future measures funded under NRDP 2014-2020.

RESULTS AND DISCUSSIONS

From Romania's food security perspective, beef (accounting for 10% in the structure of total meat consumption, in the year 2015) is an important product, both for dietary diversification and for the complex contribution to the valorization of the country's agricultural resources, through the export of live animals inclusively.

The comparison of beef consumptions of the different European countries reveals quite significant differences across countries. Thus, Italy ranks first, with 25.4 kg/capita/year, being one of the main European countries with the greatest number of cattle farms and with the largest exports of beef in the region. The consumption of this country is 15 times higher than that of Poland (1.6 kg/capita/year) and about 4 times higher than that of Romania (6.3 kg/capita/year).

The production of beef from cattle slaughtered in slaughtering units (carcass meat), in EU-28, in the year 2014, was 7.3 million tons, the main producers being France (19%), Germany (15%), the United Kingdom (12%) and Italy (10%), all these summing up 56% of total beef production of EU-28 [2]. Romania ranks 20th on this list, with a beef production in carcass of 29.2 thousand tons. The poor quality of carcasses from Romania is given by the fact that 77.9% come from slaughtering adult animals, out of which 49.5% cows, as against the EU average of 30%. Other negative aspects in Romania, as compared to the European Union, refer to the following:

- the share of calves under 8 months old that are slaughtered in slaughtering units is 18-20%, compared to 5% in the European Union;
- the slaughtering weight of calves under 8 months old is extremely low, of only 45 kg/head, compared to 137 kg/head in the European Union;
- Romania massively exports calves of 120-150 kg live weight, mainly to Italy and Croatia, instead of fattening them up until they reach 650 kg, to be exported afterwards.

In this context, the analysis of self-sufficiency in beef in the period 1990-2015 reveals that this had an oscillating evolution throughout the investigated period (Figure 1), with the lowest value in the year 2006 (75%), and the highest in 1993 (106%).

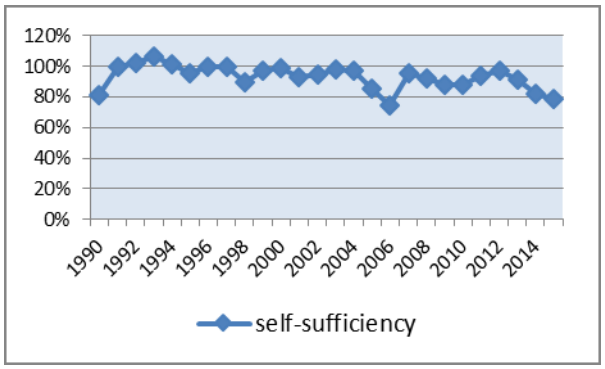

Fig. 1. Evolution of self-sufficiency in beef, 1990-2015 - %
Source: Own calculation.

The situation for the year 2006 can be explained by the fact that in that year, prior to its accession to the European Union, Romania had the highest level of imports from the period 1990-2013 (53.9 thousand tons). This because the average import price of frozen meat was down from 1.68 euro/kg in 2005 to 1.47 euro/kg in 2006 (-12%), with 98.9% of imports coming non-EU countries (Brazil). In the year 1993, the quantitative exports, mainly of live cattle, had the highest volume from the period 1990-2013 (19 thousand tons), as a result of the geographic reorientation of trade flows to the developed countries of the European Union.

Considering a desirable improvement of self-sufficiency in beef to 89.6% towards 2038, Table 1 presents the short, medium and long term targets (for production, imports and exports). In estimating these targets, we took

into consideration the national evolutions (1990-2014) and the European [1] and world [10] forecasts for the period 2015-2026. Thus, the European institutions expect an increasing world demand for beef, due to the evolutions in the developing countries, which favours the increase of EU exports. On the medium term, per total EU, it is estimated that beef production will resume its downward trend, with the production in 2026 slightly under the production obtained in 2014.

Thus, the resulted indicators, as presented in Table 1, reflect the increase of utilizable production in the period 2015-2038 by 23.1 thousand tons (23.4%), of exports by 4.0 thousand tons (46.9%), while imports will decrease by 7.3 thousand tons (-21.5%).

Table 1. Target indicators for beef (in fresh meat equivalent)

	u.m.	Baseline situation (2015)	Short term (2020)	Medium term (2028)	Long term (2038)
Utilizable production	thou. tons	99.0	101.0	111.1	122.1
Import	thou. tons	33.9	31.8	29.3	26.6
Export	thou. tons	8.5	6.7	8.9	12.5
Supply availability	thou. tons	124.4	126.2	131.5	136.3
Self-supply level	percentage	79.2	80.1	84.5	89.6

Source: own calculations

These estimated targets were based on two hypotheses, which mainly refer to the support to the cattle raising sector under the MARD programs, i.e. the *de minimis* aid for purchasing heifers from specialized beef breeds (measure launched in 2014), transitory national aids, coupled support scheme in the beef sector (2015 - 2020), which add to the support under the NRDP 2014-2020 measures for the improvement of the general performance of agricultural holdings (investments on agricultural holdings), improvement of small-sized farm management and market orientation increase (support to the development of small farms), increase of the number of young farmers who start an agricultural activity for the first time as heads of holdings (support to setting up of young farmers).

Estimating the (production, import, export) indicators by the 3 time horizons was based on the following yearly average rates (Table 2).

Table 2. Yearly average rates for beef in fresh meat equivalent (%)

	2015-2020	2020-2028	2028-2038
Production	+0.4	+1.2	+0.95
Import	-1.3	-1.1	-0.95
Export	-3.5	+3.1	+3.4

Source: own calculations

The result of beef production increase will be reflected in the increase of yearly average consumption per capita from 6.3 kg in 2015 to 6.9 kg in 2028 and to 7.3 kg in 2038, under the background of improving the meat quality produced on specialized farms

Starting from the present situation, i.e. a level of supply from domestic beef production of 79.2% (2015), the estimates of the necessary investments for reaching the proposed targets were based on the following hypotheses supporting the long term development of the cattle raising sector:

-Continuation of financial support from EU and national funds

-Continuation of the cattle farm consolidation process

-Speeding up the investment rate in performant technologies, new machinery and equipment, modernization of farm buildings and the genetics of animals (the investments target the increase of the share of commercial farms for young cattle fattening (with more than 36 animal heads) from 13 % in 2014 to 25% in 2020, to 50% in 2028 and to 80% in 2038)

The necessary investments, by the three time horizons, are presented in Table 3.

Table 3. Financial resources necessary to reach the proposed targets - beef (mil. euro)

Investments –mil euro	**Short term 2020**	**Medium term 2028**	**Long term 2038**
on commercial farms, with over 36 cattle heads for fattening (animals, shelters, machinery and equipment, transport means)	85.1	130.8	235.1

Source: own calculations

The investments in performant technological systems for beef cattle raising (feeding and maintenance) can be supported under NRDP

2014-2020, estimating an amount of 85 million euro from public funds for investments in the period 2016-2020; this amount should be increased in the period 2021-2027 (131 million euro) and in 2028-2038 (235 million euro). Part of these amounts could be also covered by the payments to farmers from areas with natural constraints, mainly the cattle raisers from the mountain area.

CONCLUSIONS

The proposed targets can be reached if:
-Productivity per animal increases (large weight gains, feed consumption diminution, improvement of carcass quality and composition, higher slaughter yields)
-This is feasible through investments in the genetics of animals, namely the utilization of specialized cattle breeds for beef production in the crossing with local breeds
-Thus hybrids can be obtained adapted to our country's conditions with great weight gain, with high quality carcasses and a very good conversion of fodders obtained on pastures and meadows
-The economic farm size increases (Standard Output value) increases, having in view that, at present, 82% of the cattle farms have an economic size under 8000 euro, out of which 33% are in the category 2000-3999 euro, which makes them non-eligible for access to EU funds by farmers
-The investments in performant technologies, new machinery and equipment and modernization of farm buildings are intensified.
Reaching the proposed targets for beef is an ambitious objective that could be facilitated both by financial allocations for investments and by the initiation of national programs for the specialization of small farms that own beef cattle, mainly in the hilly and mountain areas, which are ideal areas for raising cattle.
However, the increase of beef production through the increase of herds is not always the most economical solution, as this presupposes additional costs for animal shelters, feeding and care. It would be desirable to obtain high yields by increasing the productivity per animal, i.e. increase of body weight, higher weight gains, diminution of feed consumption and improvement of carcass quality and composition.

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TECHNICAL EFFICIENCY OF POULTRY ENTERPRENEURS IN ABIA STATE: A STOCHASTIC FRONTIER APPROACH

Obasi Oscar IGWE, Daniel Chinedu NWAOGU, Franca ONYEGBULE

Michael Okpara University of Agriculture Umudike, Abia state, Nigeria. Department of Agricultural Economics, Department of Agribusiness and Management. Phone: +2348063425721, Email: danielchinedu32@gmail.com

Corresponding author: danielchinedu32@gmail.com

Abstract

This study examined the technical efficiency of the agribusiness poultry entrepreneurs in Abia state. Multi-stage sampling technique was adopted in selecting 180 poultry farmers. An estimated gamma value (γ) of 42.11% was highly significant at 1% level of probability implying that 42.11% of random variation in the output of the poultry entrepreneurs was due to the inefficiency in their respective farms and not as a result of random variability. Feed and drugs/vaccines were positively related to output of the poultry operators respectively while labour input and capital inputs were negatively related to output of the poultry. The average poultry operators were able to obtain 81% of potential output from a given mixture of production inputs. Age and credit access negatively influenced the technical efficiency of the poultry entrepreneurs while stock size, business experience and level of education positively affected efficiency of the entrepreneurs. Insufficient funds and theft were the major problems affecting poultry farming in the study area. Efforts to reducing the costs incurred on fixed items by these entrepreneurs should be encouraged such as provision of timely loans and credits by banks to reduce time lag in production cycles. Credits inform of stocks, feeds and drugs/vaccines from trusted sources will boost productivity, efficiency and income with little financial burdens.

Key words**:** *efficiency, entrepreneurs, poultry, stochastic, Abia*

INTRODUCTION

If agribusiness is stretched to the farthest limits, more than 75% of all business operations in Nigeria may be classified as agribusiness in form or typology and it provides a broad range of investment opportunities for both institutional and private investors [22]. Thus, there are strong synergies between agribusiness and the performance of agriculture for development.

A growing trend in developing countries is the complexity in isolating the process of agribusiness and its contribution to Gross domestic product, reduction of poverty and food insecurity scourge. This sector is doubtlessly considered crucial in providing a blueprint for economic development. This importance is echoed by studies carried out by [23, 20]. The need for efficiency in this sector becomes very important given the geometric rise in population and consequent rising food demand. Thus, efficiency in agribusiness sector is critically important if output is to increase at a sufficient level to meet escalating demand for food [18]. Food remains a basic human need and major source of nutrients needed for human existence, hence, the need for its availability and accessibility. There is a global clue that food abound and yet, more than 780 million people are chronically malnourished. The condition is worse in developing nations where millions of people simply cannot obtain the food they need for a healthy and productive life.

The result is a big gap between national supply and national demand for food. Progress in the agricultural sector has remained unsatisfactory. Common staples in most Nigerian homes are insufficient and do not provide a balanced diet as such, malnutrition is prevalent in most homes. This has led to massive importation of foods and massive foreign debt. This is true following empirical data which revealed that while food output increased at 2.5%, food demand increased at a rate more than 3.5% due to high rate of population growth of 3.18% [8, 1, 9].

There is therefore a case for ensuring the enforcement of agribusiness support systems at both micro and macro levels and engaging active policy actors in achieving increased food production, food security and livelihood stability through the instrumentation of the agribusiness sector having provided a template on its capacity to drive economic development.

The term efficiency was introduced by [7] based on the concept of Koopmans (1951). Debreu (1951), Kumbhakar *et al*. (1991), and Battese and Coelli (1995) propose the redial type of efficiency measurement and recommend that the factors responsible for inefficiency should be considered for measuring the performance or production efficiency. [5] observed that measures of inefficiency are based on residuals derived from the estimation of a stochastic frontier. The productive efficiency of the firm can be described as its ability to produce output with a certain bundle of inputs in a given technological context. A number of studies such as [4, 25, 11] examined the technical efficiency of manufacturing firms of developing countries.

Stochastic frontier approach is also widely used in measuring technical efficiency, allocative efficiency, and economic efficiency for the agricultural sector. [17, 10, 12, 26, 27, 15] used this technique to estimate technical efficiency of this sector. This study uses the stochastic frontier approach to assess the technical efficiency of the seafood processing firms of Bangladesh with the assumption that the actual production cannot exceed the maximum possible output with the given input quantities [2, 16].

Increasing efficiency implies either more output is produced with the same amount of inputs or that fewer inputs are required to produce the same level of output [24]. The highest productivity (efficient point) is achieved when maximum output is obtained for a particular input level. Hence, productivity growth encompasses changes in efficiency, and increasing efficiency has been shown to raise productivity [24] and in this study, the poultry sub-sector.

MATERIALS AND METHODS

The study was carried out in Abia State, Nigeria. Abia State is located in the south east geopolitical zone of Nigeria. The state lies between longitude 04 45' and 07 00' and 08 10' East. The state has a population of about 2,833,999 persons [19]. Geographically, the state lies within latitude 4^{o} 49 and latitude North of equator and longitude 6^{o}47 North and longitude north of Greenwich meridian. The state is known for her agricultural strides including crops and livestock farming. Almost all the households in the state engage in chicken production at varying levels. However, data was collected only from commercial poultry farmers. A multi-stage sampling technique was adopted. One LGA was selected from each of the three (3) agricultural zones from which two (2) autonomous communities were selected from where thirty (30) poultry entrepreneurs were selected. Thus, a total of 180 poultry agribusiness enterprises were selected for this study.

To estimate the production function and technical efficiency of the agribusiness poultry entrepreneurs, the Cobb-Douglas and Translog forms of the Stochastic Production Function were analyzed. As a rule of the thumb, the Cobb-Douglas is selected over the Translog when the second order coefficients of the Translog are less than zero. Generally, a stochastic frontier production function is defined by:

$$Y_i = f(X_i; \beta) \exp(V_i - U_i), \; i = 1, 2, \ldots\ldots\ldots\ldots (1)$$

where: Y_i is output of the i^{th} entrepreneur, X_i is the vector of input quantities used by the i^{th} entrepreneur, β is a vector of unknown parameters to be estimated, f () represents an appropriate function (e.g Cobb Douglas, translog etc). The term V_i is a symmetric error, which accounts for random variations in output due to factors beyond the control of the entrepreneurs e.g. weather, disease outbreaks, measurements errors etc., while the term U_i is a non-negative random variable representing inefficiency in production relative to the stochastic frontier. The random error V_i is

assumed to be independently and identically distributed as N(σ,sv^2) random variables independent of the U_i's which are assumed to be non-negative truncation of the N(σ,sv^2) distribution (i.e. half-normal distribution) or have exponential distribution.
This stochastic frontier model was independently proposed by [2 and 16]. The technical efficiency of an individual entrepreneur is defined in terms of the ratio of the observed output to the corresponding frontier output, given the available technology.
Technical efficiency

$$(TE) = Y_i/Y_i^* = f(X_i;\ \beta)\ \exp\ (V_i - U_i)\ /\ f(X_i, \beta)\ \exp\ (V_i) = \exp\ (-U_i) \quad \ldots\ldots(2)$$

where: Y_i is the observed output and Yi^* is the frontier output. The parameters of the stochastic frontier production function are estimated using the Maximum Likelihood method. For the purpose of this study, the production technology of arable crop farmers in Abia State, Nigeria is assumed to be specified using the Cobb-Douglas production frontier as follows [21]:

$$LnQ = b_0 + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4 + b_5 lnX_5 + V_i - U_i \quad \ldots\ldots (3)$$

where:
Q = Total value of poultry (₦)
X_1 = Feed (₦)
X_2 = Labour input (man days)
X_3 = Drugs/vaccines (₦)
X_4 = Capital inputs (made up of depreciation charges on farm tools/equipment, interest on borrowed capital, taxes, insurance and rent measured in naira)
$b_1 - b_5$ = Coefficients of the parameters to be estimated
$Vi - Ui$ = as earlier stated
In order to determine factors affecting the technical efficiency of the poultry entrepreneurs in the study area, the following model as formulated and estimated jointly with the stochastic frontier model in a single stage maximum likelihood estimation procedure using the computer software Frontier Version 4.1 was employed:

$$TEi: = a_0 + a_1 Z_1 + a_2 Z_2 + a_3 Z_3 + a_4 Z_4 + a_5 Z_5 + a_6 Z_6 + a_7 Z_7 \quad \ldots\ldots(4)$$

where:
TE_i = Technical efficiency of the ith poultry entrepreneur
Z_1 = Entrepreneur's age (Years)
Z_2 = Credit access (1=yes, 0=otherwise)
Z_3 = Stock size (Number of birds in stock)
Z_4 = Business experience (Years)
Z_5 = Cooperative membership (Dummy: Yes=1, otherwise=0)
Z_6 = Entrepreneur's level of education (Years)
Z_7 = Household size
$a_0 \ldots a_7$ = Coefficients of efficiency parameters to be estimated.

RESULTS AND DISCUSSIONS

Average statistics of the poultry entrepreneurs

The average statistics of the poultry enterprises are presented in Table 1.
The result showed a mean age of 41.2 years of entrepreneurs indicating that they are young and should be vibrant, enterprising and highly efficient.

Table 1. Average statistics

Statistic	Mean	SD	Min	Max
Age (Years)	41.22	7.60	26.00	55.00
Education	9.66	2.76	5.00	20.00
Experience	6.27	2.49	2.00	15.00
Household size	3.00	1.66	0.00	6.00
Number of birds	120	20.6	35	350
Income received	80,000	120.	30,000	400,000
Male (%)	56			
Married (%)	67			
Credit users (%)	65			
Cooperative				

Source: Field survey, 2016

The majority (56%) of the poultry enterprises are men dominated. The result shows that a large proportion of the poultry entrepreneurs (67%) were married. A mean experience of 11 years is fair as they respondents could stand on their own and take well-informed decisions. Experience plays an important role in improving the efficiency of entrepreneurs through allocation and utilization of resources since they can understand the intricacies of the business better.

The household size and structure of a family is a major determinant of a lot of important indices such as per capita income, consumption, and welfare and food security. It affects farm efficiency through the supply of labour at no cost especially where a majority of the household members are not dependents (aged and children). The result shows that a very large part of the poultry entrepreneurs (80%) are cooperative members. Membership of cooperative society is a strong requirement by commercial financial institutions to advance loans to farmers. The entrepreneurs kept a mean number of 120 birds. Poultry entrepreneurs with larger farm sizes are expected to be more efficient and profitable and vice-versa. The result shows that the respondents received an average of N80, 000 for every production cycle. With an increase in income, the entrepreneurs can re-invest the excess thereby increasing size and breaking the vicious cycle of poverty.

Determinants of output of the poultry entrepreneurs

To determine the factors affecting the output of the poultry entrepreneurs, the

Cobb-Douglas form of the stochastic production frontier model was employed. The model specified was estimated by the maximum likelihood (ML) method using FRONTIER 4.1 software developed by Coelli. The result is presented in Table 2.

The study showed a log likelihood function was -67.786 for the poultry entrepreneurs. The log likelihood function implies that inefficiency exist in the data set. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. An estimated gamma value (γ) of 42.11% was highly significant at 1% level of probability. This implies that 42.11% of random variation in the output of the poultry entrepreneurs was due to the inefficiency in their respective farms and not as a result of random variability. The value of sigma squared (σ^2) was significantly different from level of probability. This means that the inefficiency effects make significant contribution to the technical inefficiencies of the poultry entrepreneurs.

Table 2. Poultry entrepreneurs' Cobb-Douglas production function estimates

Variable	Parameters	Coefficient	Standard-error	t-ratio
Intercept	b_0	6.085	0.4521	13.4594***
X_1 = Feed	b_1	0.1245	0.0187	6.6578***
X_2 = Labour	b_2	-0.2221	0.0452	-4.9137***
X_3 = Drugs/vaccines	b_3	0.2019	0.0583	3.4634**
X_4 = Capital inputs (₦)	b_4	-0.5214	0.2001	-2.6060**
sigma-squared		0.6112	0.1254	4.8740***
Gamma		0.4211	0.1009	4.1734***
LR test of the one-sided error		98.006		
log likelihood function		-67.786		
Total number of observations		180		
Mean efficiency		0.81		

Source: Field survey, 2016

***, ** and * are significant at 1%, 5% and 10% respectively.

The average technical efficiency was 0.81 implying that on the average, the poultry operators were able to obtain 81% of potential output from a given mixture of production inputs. Thus, in a short run, there is minimal scope (19%) of increasing the efficiency, by adopting the technology and techniques used by the best entrepreneurs.

The coefficient of feed was positive at 1% level of probability implying that increasing the feed given the birds will increase their output (meat and egg). Coefficient of elasticity (marginal effect) shows that for every 1% increase in the volume of feed given the birds (usually measured in Kg), output will increase by 0.1245%.

The coefficient of labour was negatively related to output of the poultry entrepreneurs at 1% level of significance implying that an increase in labour input will lead a decrease in output. This further suggests that the labour input is over-utilized and as such, diminishing marginal returns is obtained. The result further implies that the entrepreneurs particularly utilized hired labour without monitoring the effect on their profits.

The coefficient of drugs and vaccine was positively related to output of the poultry entrepreneurs at 5% significant of level. This shows that an increase in the inputs increased the output. Capital inputs was negative for the entrepreneurs at 5% significant level implying that as depreciation costs increase, output decreases. This is expected since costs are leakages from farmers stock of resources.

Technical efficiency of poultry entrepreneurs in Abia state

The technical efficiency distributions of the poultry entrepreneurs as well as the efficiency determinants are presented in this section. The frequency distribution of the poultry entrepreneurs according to their level of efficiency is presented in Tables 3 and 4.

The result in Table 3 shows that majority (45%) of the poultry entrepreneurs had technical efficiency (TE) of 0.61 – 0.8 with a mean of 0.81 implying that on the average, the operators were technically efficient and well-positioned to increase output.

The poultry entrepreneur with the best and least practice had technical efficiencies of 0.90 and 0.22 respectively implying that on the average, output fell by 10% from the maximum possible level attainable due to inefficiency by the entrepreneurs.

Table 3. Frequency distribution of poultry entrepreneurs by technical efficiency

Efficiency level	Frequency (f)	Percentage (%)
≤ 0.3	15	8
0.21 – 0.40	21	12
0.41 – 0.60	27	15
0.61 – 0.80	81	45
0.81 – 1.00	36	20
Total	180	100
Minimum	0.22	
Maximum	0.90	
Mean	0.81	

Source: Field survey, 2016

The poultry entrepreneur with the best and least practice had technical efficiencies of 0.90 and 0.22 respectively implying that on the average, output fell by 10% from the maximum possible level attainable due to inefficiency by the entrepreneurs.

Determinants of technical efficiency by the poultry entrepreneurs

The factors affecting the technical efficiency of the poultry entrepreneurs as jointly estimated with the output determinants from the Frontier model is presented in Table 4.

Table 4. Determinants of tech. efficiency

Variables	Coef	S.E	t-ratio
Intercept	0.58	0.09	5.88***
Age of entrepreneurs	-0.12	0.05	-2.27**
Credit access	-0.24	0.09	-2.48**
Stock size	0.55	0.02	25.07***
Business experience	0.11	0.07	1.56*
Coop. membership	0.08	0.10	0.76
Level of education	0.21	0.01	11.29***
Household size	-0.11	0.09	-1.25

Source: Field survey, 2016

***, ** and * are significant at 1%, 5% and 10% respectively.

The negative coefficient of age (0.1255) for the poultry entrepreneurs implies that increasing age by one unit will decrease technical efficiency by 0.1255%. This finding

does agree with *a priori* expectation. It is expected that ageing entrepreneurs would be less energetic to work, leading to low productivity as well as low technical efficiency.

The coefficient of credit utilization (0.2451) had a negative relationship with technical efficiency among poultry operators. Credit availability shifts the cash constraint outwards and enables entrepreneurs to make timely purchases of those inputs which they cannot provide from their own resources. However, a negative relationship implies that these entrepreneurs are either under-utilizing the credits or they use them for unproductive ventures other than the reason for accessing them.

The coefficient (0.5541) for stock size was positive for the poultry entrepreneurs implying that technical efficiency will increase by 0.5541 unit with a one unit increase in stock size. Large size entrepreneurs are usually more stable and have easier access to credit facilities. These generate higher incomes and in turn increase efficiency. Business experience and level of education were positively signed for the poultry operators indicating that the more experience and knowledge (through education) they acquire, the more technically efficient they become.

Problems of poultry farming

The problems affecting poultry production in the study area are listed and ranked in their order of severity in Table 5.

Table 5. Problems affecting poultry entrepreneurs in the study area

Problems	(f)*	(%)	Rank
Insufficiency of fund	60	29	1st
Theft	52	25	2nd
Fire outbreak	43	21	3rd
Poor sales	28	13	4th
Bad road networks	26	12	5th
Total	**209**	**100**	

Source: Field survey, 2016
*Multiple responses

The result shows that insufficient funds and theft were the major problems affecting poultry farming in the study area.

CONCLUSIONS

This study examined the technical efficiency of the agribusiness poultry entrepreneurs in Aba, Abia state. The mean age of poultry farmers' estimated approximately at 45 years is an indication that the farmers are still in their productive age. The stochastic frontier maximum likelihood estimates result revealed significant positive influence of Feed and drugs/vaccines on the output (and invariably, profitability level) in the combined poultry enterprise while depreciation and labour cost exerted negative influence on output. For the efficiency model, stock size and business experience exerted positive influence the entrepreneurs' efficiency while credit access and age of the entrepreneurs had negative influence. However, the negative influence of credit could be explained by the poor conditions encountered, high interest rates, loan diversion and under-utilization of the said credits. Insufficient funds and thefts were the major challenges faced by these entrepreneurs.

Efforts to reducing the costs incurred on fixed items by these entrepreneurs should be encouraged. Government should make available certain incentives to farmers so as to avoid the problem of loan diversion. Credits inform of stocks, feeds and drugs/vaccines from trusted sources will boost productivity, efficiency and income with little financial burdens. The problem of fund insufficiency will be solved if these entrepreneurs form cooperatives such that they can pool their resources together and assist needy members. By this, they would certainly reduce the over-dependence on bank loans with its attendant problems. Formulation of policies that would discourage the importation of chicken will encourage more people to go into production since there would be an increased demand for the locally produced chicken. Such policies would guarantee confidence since glut in the market would be eradicated.

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ROMANIA'S SOYBEAN MARKET AND COUPLED SUBSIDIES

Iuliana IONEL

Institute of Agricultural Economics, INCE, Romanian Academy, Calea 13 Septembrie no. 13 District 5, Bucharest, Romania, Phone/Fax: +4022/318241: Mobile:+40723 1671 56, Email: 48ionel@gmail.com

Corresponding author: 48ionel@gmail.com

Abstract

In the paper we quantified the impact of Government's Decision no. 219/2015 upon the soybean market in Romania in the year 2015. The working method used is the cost-benefit analysis, which is frequently used to quantify the agricultural policy effect. For this purpose, we collected data on the soybean areas, production and trade with soybeans and soybean meal, as well as the prices for these products, both domestic prices and foreign trade prices. On the basis of existing data, we also estimated the minimum coupled support received by farmers per ton of soybeans and per cultivated hectare. The farmers who cultivated soybean in the year 2015 could receive the amount of 373.3 Euro/ha, out of which total subsidy for soybeans 181 Euro/ton, of which 113 euro/ton represented the national coupled support. If we compare the annual (2015) average soybean price without subsidy (480 Euro/ton), with the import price (434 Euro/ton), we could draw the conclusion that Romania does not have competitive advantage in soybean cultivation. At the same time, we find out that by subsidizing the domestic soybean production, the exported soybean production increased to 95 thousand tons, and with this export we also exported the subsidy worth 10,735 million Euro. At the same time, each Romanian contributed with 1.5 euro to the coupled subsidizing of soybean production, which finally went to export, to support the organic production of countries from Western-Europe and the consumption of organic products of animal origin implicitly.

Key words**:** *coupled subsidies, import and export price, soybean*

INTRODUCTION

The unfavourable weather conditions for soybean cultivation, mainly in Western Europe, corroborated with the low prices of soybean meal and beans on the international market, make the soybean crop non-attractive for Europe.

With the strong development of the European livestock sector in the late 60s and 70s, the trade with soybean intensified, while the imports from Latin America increased each year. This trend has been recently stabilized at the level of about 37 million tons imported in the European Union (EU) [6] .

The imports mainly consist of genetically modified soybean, as 88% of the world production is based on this technology. In other words, EU imports production from about 13.5 million ha under soybean in order to cover its domestic demand [10].

The only source of conventional soybean for Europe is Brazil, which produces both Genetic Modified Organism (GMO) and non-GMO soybeans; yet in this country, too, the biotech penetration rate reached more than 91% in 2013, and the production has rather a seasonal character, depending on the demand for animal feeding.

In the EU, the adoption of agricultural biotechnologies is rather slow, due to the regulation system, which is based on an extremely complex risk assessment by the competent authorities, European Food Safety Authority (EFSA).

However, EU authorized dozens of genetically modified products for import and utilization in human food, cultivated in other parts of the world. Thus, in the last decade, EU became the largest net importer of agricultural raw materials. Many of these products are obtained on the basis of agricultural biotechnologies, mainly soybean, maize and rapeseed for the production of animal feeds and cotton for the textile industry.

Romania was and continues to be a net importer of soybean meal, this product having one of the top positions in value terms, in the country's balance of trade [7]. However, there

was an obvious diminution of dependency on imports in the period when transgenic soybean was authorized for cultivation (1999-2006). While the soybean meal imports covered 11% to 30% of protein consumption until the accession to the EU in 2007, in the year 2014 the imports covered 71% of the national consumption needs, i.e. 586 thousand tons. The main suppliers of protein meal for Romania were Brazil and Argentina.

The agricultural policy is a component of the economic policy, which after the Second World War was based on the interventionist conception of production subsidizing and control and support to farmers' incomes, both in Europe and in America.

Governments' interventions influenced the demand/supply ratios and contributed to the periodical re-establishment of agricultural market equilibrium in these countries.

The cost of these interventions was and still remains high, and the effects were not satisfactory on long term and required fundamental reforms in the United States of America (USA) and the EU, depending on market evolutions [2].

In the year 2013, the European Commission under the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) set up the Focus Group on Protein Crops, in order to support innovation and research, aiming to increase the protein crop yields and to support the development of protein crops chain in the European Union.

In the year 2014, the European experts evaluated the challenges of the protein crop chain and identified solutions that can be implemented through agricultural consultancy, referring to good practices, demonstrative plots, utilization of certified seeds, fostering the adoption of new seed varieties by broadening the European genetic base of crops through long-term investments in the European agricultural research.

The increasing demand for soybean proteins, which are certified as non-GMO for the food industry, animal feeds and as raw material for the pharmaceutical industry, can stimulate farmers to cultivate conventional soybean, which also represents the core of the European Commission with regard to the crop diversification measures and the Greening policy [9].

The study funded by Donau Soja Association [2] reveals an important development potential for the soybean crop in Romania, Bulgaria and Moldova Republic.

According to the study, the governments should increase the support for soybean production and for the processing industry for this crop. The study estimates that Romania, Bulgaria and Moldova Republic have a total potential of soybean cultivation of about 0.8-1.0 million ha that could generate a production of more than 2 million tons, accounting for about 5% of the yearly consumption of the European Union, i.e. around 30% of the non-GMO soybeans that is utilized in EU each year.

MATERIALS AND METHODS

The general objective of the paper is to analyze the relevance, efficiency, effectiveness, impact and sustainability of coupled support intervention, from national funds, for soybean cultivation in the year 2015. The selected method that we used is the cost-benefit analysis, which is often indicated in policy evaluation [1].

The purpose of the cost-benefit analysis is to determine the costs associated to policy implementation and to determine the monetary value of the results of its implementation, calculation of the cost-benefit ratio and appreciate the policy effectiveness in economic terms [8].

The cost-effectiveness analysis necessarily includes the analysis of production factor costs in order to determine the costs associated to the progress made in reaching each objective. For instance, the costs and effects of the implementation of two or more policies in order to reach the same objectives could be compared [6].

A policy could be appreciated as more adequate out of cost-efficiency reasons in the case it had the same costs but yielded better results compared to other similar policies. Or a policy might be more advantageous if it achieves the same objectives as another policy, but at lower costs. Usually, the cost-

effectiveness analysis does not need the conversion of results in monetary terms, but a target must be established that includes measurable objectives.
But the cost-benefit analysis goes further and tries to identify a wider range of results than those strictly associated to the objectives of the group to which it is addressed [5]. This analyzes the relation between the financial intervention and the intensity of positive and negative effects upon the economic environment in general. In this respect, the financial inputs are quantified and each obtained result is identified.

RESULTS AND DISCUSSIONS

For the purpose of the paper, we collected data referring to the soybean areas and production in the period 1990-2015, Romania's foreign trade with soybeans and soybean meal, as well as the prices for these products, both on the domestic market and in the foreign trade. At the same time, on the basis of existing data we estimated the minimal support obtained by farmers for soybean production and per hectare. We quantified the effect of soybean supply on the Romanian market on the basis of the balance of the product.
Soybean supply in Romania largely comes from the soybean meal imports (60%), the domestic soybean production (22%) and the soybean imports (18%). In order to quantify the impact of imports upon the domestic market we converted the imports to the average soybean production (olympic average) to estimate the number of soybean hectares that must be cultivated for self-sufficiency in soybeans. While in the year 2006, when the Romanian farmers cultivated GMO soybean, we imported the equivalent of 32 thousand hectares, soybeans and meal, by the year 2015 the imports in hectares equivalent increased to 368 thousand hectares, although the area cultivated with soybean also increased (by 47 thousand ha) as a result of the introduction of the national coupled support for soybean.
As regards the prices of soybeans and soybean meal imports, one can notice that these are lower in Romania than in Rotterdam, as the quality criterion, i.e. the protein content, is not associated to prices.
Romania has a negative trade balance from the trade with soybean, which has recently grown larger as a result of the increase of vegetable protein demand destined for animal feeding under industrial system.

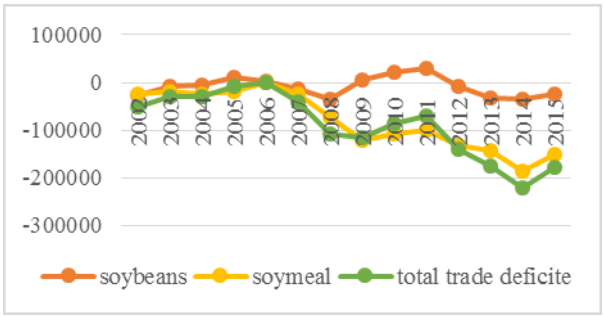

Fig. 1. Romania: balance of trade with soybean and soybean products
Source: Eurostat

Romania's foreign trade with soybean in the year 2015 was dominated by imports from the non-EU countries of 158 thousand tons and soybean exports to the EU countries of 55 thousand tons and 38 thousand tons to Turkey. The imports of soybean meal, as well as of soybeans, have a non-EU origin (445 thousand tons), while the exports mainly go to EU (135 thousand tons).
According to Government's Decision 219/30.03.2016, the farmers who cultivated soybean in 2015 could benefit from several forms of support per hectare (according to Table 1) such as: single area payment, redistributive payment, payment for environment-friendly agricultural practices, payment to young farmers, payment under the small farmer scheme, coupled support according to the National Transitory Aid 1 (NTA 1). Thus, farmers could receive a total amount of 373.3 Euro/ha for one hectare cultivated with soybean in the year 2015, out of which total subsidy for soybeans 181 Euro/ton, and national coupled support for soybean 113 Euro/ton.
At the level of the entire land area under soybean in the year 2015, all subsidy payments amounted to about 47,406 thousand Euro, out of which 29,770 thousand euro national coupled support (Table 1).

Table 1. Subsidies paid to farmers who cultivated soybean, in the year 2015

	Euro/ha	Soybean total (thou. euro)
Single area payment scheme	79.7	10,127
Redistributive payment	5- 51.1	**
Payment for agricultural practices beneficial for the climate and the environment	59.1	7,509
Payment to young farmers	19.9	**
Simplified small farmer scheme		**
Total direct payments soybean (1)	138.9	17,636
National Transitory Aids (NTA 1)	191.9	**
National coupled support soybean (2)	234.4	29,770
Total soybean subsidy (1+2)* euro/ha	373.3	47,406

Source: according to GD 2016 of 30.03.2016, *own calculations, **Lack of data

If we compare the yearly average soybean price of 299 Euro/ton, practiced on the domestic market, to the import and export prices, we can draw the conclusion that Romania has competitive advantage in soybean cultivation.

But if we add the subsidy allocated per ton of product to the price practiced on the domestic market, we can notice that the price on the domestic market with subsidy included amounts up to 480 euro/ton, exceeding the import price of. 434 euro/ton (Table 2).

Table 2: Romania: Soybean prices in 2015

	Soybean prices in 2015 (euro/ton)
CIF import price Constanta	391
FOB export price Constanta	434
Price of domestic production	299
Soybean subsidy	181
Soybean price domestic production plus subsidy	480

Source: Eurostat, MARD, own calculations

Thus, we can see that by subsidizing the domestic soybean production, soybean exports increased to 95 thousand tons, and together with this export we also exported the subsidy worth 10,735 million Euro (95,000 tons' soybeans export in 2015 x 113 Euro/ton subsidy).

CONCLUSIONS

The total budgetary effort for the coupled subsidies to the area cultivated with soybean in the year 2015 amounted to 29,770 thousand Euro, to 113 Euro/cultivated hectares respectively.

Subsidizing the soybean crop in the year 2015 determined the decrease of average yield per hectare (by 20% compared to 2014) with the increase of cultivated area (by 60%), while the total soybean production increased to 262 thousand tons (by 30%).

At the same time, soybean imports and exports increased by 66 thousand tons and respectively by 53 thousand tons, the balance of trade remaining negative.

This means that in the year 2015, each Romanian contributed with 1.5 Euro to the coupled subsidizing of soybean production, which finally went to export, to support the organic production of countries from Western-Europe and the consumption of organic products of animal origin implicitly.

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ASPECTS OF SUSTAINABLE DEVELOPMENT IN THE RURAL AREA. CASE STUDY

Andrei Radu IOVA, Daniela CREŢU, Elena LASCĂR

University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Mobile:+40740207985,E-mails:andrei_anglia@yahoo.com;danielacretu5@yahoo.com; elenalascar@yahoo.uk

Corresponding author: andrei_anglia@yahoo.com

Abstract

In order to analyze the inhabitants' perception in the rural area on aspects of sustainable development, starting from the realities of the socio-economical and technical-urban analysis of the rural area in Călăraşi county, 3 specific research methods were used: the dynami, deductive and quantitative economic analysis; SWOT analysis; the economic survey or participatory research involves collecting information from the territory using as research techniques "the questionnaire" and "the interview". The research recorded the population opinions and attitudes in 10 communes of Călăraşi county, regarding: the respondents awareness on the concept of sustainable development; cleanliness and care of the communes; prioritization of urgent investments in the studied area; the perception of changes and development potential of the area; assessing the social position of the respondents family; assessments on the quality of life in the rural area. The questionnaire, containing 13 questions, was applied on a total of 595 respondents from the 10 communes included in the study. The starting point in elaborating the questionnaire was the analysis of the social, economic and institutional situations which led to the identification of the key issues facing the localities and the potential for development. All 10 communes have common points on the population interest for the development of the local business sector; the local business sector accesed funds from various sources; there is a large available workforce, and potential for the socio economic development of the communes.

Key words: *questionnariee, commune, sustainable development, rural area, potential*

INTRODUCTION

By its role and functions, the agriculture is a major user of natural resources, long-term sustainability depends on the existing sustainable, renewable resources, particularly water and soil. The future projections show that all regions will be affected by the climate change, the regional differences in the evolution of the natural resources and the combined effects of the extreme pehnomena are becoming more and more obvious. [9] Our country is already facing current environmental stresses, including increased vulnerability in intensity and frequency of the climate extremes (drought, floods, heat, frost, pests and diseases, etc.), which produce important losses in all economic sectors, especially in agriculture, sector dependent on weather evolution [10].

The concept of sustainable development means all forms and methods of socio-economic development whose foundation is to ensure the balance between socio-economic systems and natural potential [6]

The most known definition of the sustainable development is given by the World Commission on Environment and Development (WCEF) in the report "Our Common Future", also known as the "Report Brundtland": "the sustainable development is the development that aims to meet the needs of the present without compromising the ability of future generations to meet their own needs"[10]

Based on these considerations we conducted a study on the inhabitants perception in the rural communities on the elements of sustainable development of this environment. It is important to establish resources, needs, opportunities, threats, competitive advantage. Without a strategy, the coherence is missing in the use of funds, resources are wasted, especially time, time passing in the detriment

of the population living in rural area [3].

MATERIALS AND METHODS

In order to analyze the inhabitants perception in the rural area on some aspects of sustainable development, starting from the realities of the socio-economical and technical-urban analysis of the rural area in Călăraşi county, 3 three specific research methods were used: dynamic economic, deductive and quantitative analysis; SWOT analysis; the economic survey or participatory research involve collecting information from the territory using as research techniques the "questionnaire" and "interview".
When analysing the aspects of sustainable development in the 10 communes subject to survey, the following sources of data and instruments for getting information about the current state and about the identification of local needs were used:
1.Research on documents. We analyzed the documents provided by town halls of the 10 localities, by Călăraşi County Council, the Department for Agriculture and Rural Development and other public county institutions, **in order to achieve the diagnostic analysis of the communes**, which included: data about the commune location, about the physical and geographical characteristics; statistics and censuses carried out at local level in the fields: demography, laborforce employment, economic environment, education and culture, environment protection; General Urban Plan (GUP).
2.On site research. On site quantitative research was achieved in the period October 2016 - January 2017 based on a semi-standardized questionnaire, applied face to face, to the respondents domicile and by interviewing the factors with administrative responsibilities. The research recorded the population opinions and attitudes in 10 communes in Călăraşi county regarding the awareness of the 595 persons questioned on the concept of sustainable development; cleanliness and care of communes; prioritization of urgent investments in the studied areas; the perception changes and potential of commune development; assessment of the social position of the respondents family: assessment on the life quality in the rural area.
The questionnaire containing 13 questions was applied on a total of 595 respondents from the 10 communes included in the study. The sample was selected with a statistic step of sampling based on electoral lists and on the Registry of Agriculture from the town halls in order to provide a representative sample in terms of age groups and income.

RESULTS AND DISCUSSIONS

Information is very important, it is considered the first step in making development, so in Table 1, we analyzed and presented the awareness of the 595 persons questioned on the concept of sustainable development: 72.3% of all respondents are familiar with the term of sustainable development; only 10.1% said they do not know the significance of this concept.

Table 1. Analysis of respondents awareness on the concept of sustainable development of the rural area

Specification	Total	
	no	%
Yes	430	*72.3*
	100	*x*
No	105	*17.6*
	100	*x*
I do not know	60	*10.1*
	100	*x*
Total	595	*100.0*

The rural waste differs in composition and quantity from the urban waste. The lack of public sanitation services in the rural area makes impossible to draw up a statitics of the rural waste, so that they can be assessed only approximately. The amount of rural waste is about 0.3 kg/inhabitant/day [1].
For the period 2016 - 2020 the prognosis of the quantity of waste generated by the rural area show that household waste will increase and uncollected and generated household waste will decrease from 2016 to 2020. It can be seen from this prognosis the concern for

waste management in the rural area. In all urban and rural localities, places are designated for waste disposal, but they have no measure to protect the environment and population health. Their location is, in most cases, inadequate, thus jeopardizing the sources of drinking water supply of the localities and landscape. In most rural communities that were studied waste collection is not done systematically, the study noting that waste is carried individually by the citizens in places under the administration of the town halls, where storage is tolerated. However, usually, in order to avoid transport, a large amount of waste is thrown at random, producing a diffuse pollution in the localities, with negative repercussions on groundwater and surface water, soil and air, and with negative effects on sustainable development of the localities and on the living conditions of the population. [7]

Cleanliness and care of the communes is an important aspect for sustainable development and a good developing for improving the living conditions of the inhabitants. Further on, in Table 2 we analyzed the respondents appreciation on this aspect.

Table 2. Appreciation on cleanliness and care of the locality depending on the respondents age

Age	UM	**Appreciation on cleanliness, care of locality**			Total	
		disssatified	Partially satisfied	Satisfied	no	%
< 40 years	No	67	41	30	138	23.2
41-50 years	No	52	37	36	125	21.0
51-60 years	No	29	32	49	110	18.5
61-70 years	No	21	34	60	115	19.3
>70 years	No	11	22	74	107	18,0
Total	No	180	166	249	595	100.00
	%	30.3	27.9	41.8	100	X

Noting that dissatisfaction with the cleanliness and care of the commune decreases from the age <40 years at the age> 70 years. However, the share is held by the responses of those who are satisfied with the administration of the commune on cleaning and housekeeping, respectively, 41.8% of the respondents are satisfied and 30.3 are dissatisfied with these aspects.

However, when we requested a comparison of the commune in which the respondents live and the communes around 57.98% of those questioned stated that is cleaner than the neighboring communes, only 14.29% considering it is less clean, as shown in Table 3.

Table 3. Comparison made by the questioned persons between the commune they live in and the neighbouring communes

Specification	Total	
UM	nr	*%*
cleaner	345	*57.98*
As clean as	165	*27.73*
Not ad clean as	85	*14.29*
Total	595	*100.00*

Table 4. Prioritization of the urgent investments in the studied localities

Specification	Total	
	no	%
Roads	475	79.83
Cultural center	160	26.89
School	200	33.61
Sewerage	545	91.60
Water	375	63.03
Gas	505	84.87
Respondents	595	*100.0*

The prioritization of the urgent investments is presented in Table 4: 91.6% of those questioned believe that the most urgent investment is sewerage; Gas investment is supported by 84.9% of the respondents; nearly 80% of those 595 questioned believe that an emergency is represented also by investment in roads; with a smaller proportion are those who support investment in water 63%, 33.6% school renovation and 27% cultural center.

The welfare of a community can be estimated by one dimensional measures such as: poverty rate, the rate of relative deprivation,

unemployment rate, infant mortality rate, life expectancy at birth [5] etc. We used besides these methods, also the respondents own vision and measurement of family welfare and social positioning in the community. In Table 5, we analyzed the respondents appreciation of the social position of their family, and we found out that the majority consider they can be included in the middle class, giving marks between 4 and 7, 62.2% in 1990, 79.8% in 2007 and 81.3% of the total in 2016. We see an increase in the percentages, quite important, over the 26 years. Extremes, with mark 1 to 3, the poorest decreased in percentage from 1990 to 2016, reaching to just 10.08% of the total and with mark 9 to 10, the wealthiest rose by 40 persons, respectively, from 0.84% to 7.56% .

Table 5. Evolution of appreciation of social position of the respondents family on a given scale (1 to 10), for the period 1990-2016

Specification	1990		2007		2016	
Mark	No	%	no	%	no	%
	160	26.89	115	19.33	60	10.08
1to 3	*100.0*		*71.9*		*37.5*	
	295	49.58	340	59.67	340	59.67
4 to 6	*100.0*		*120.3*		*120.3*	
	135	22.69	120	20.17	135	22.69
7 to 8	*100.0*		*88.9*		*100.0*	
	5	0.84	5	0.84	45	7.56
9 to 10	*100.0*		*100.0*		*900.0*	
Total	595	100	595	100	595	100

In table 6, we followed the social aspects that can directly or indirectly influence the respondents personal development, farms and finally the rural area.

At 4 of 6 aspects, a majority of those that are satisfied, namely (49.58% on house, 46.22% on occupation, 70.59% family life and 58.82% relations with neighbors);

In terms of health, 52.94% are partially satisfied, underlining the statements below regarding the health system. As it was expected, the income are those that cause the most complaints, 28.57% and 12.61% on the occupation.

Table 6. Structure of respondents appreciation on their own situation, regarding various social aspects

Specification	UM	dissatistifed	Partially satisfied	Satisfied	Total respond
Health	no	35	315	245	595
	%	*5.88*	*52.94*	*41.18*	*100.0*
House	no	25	275	295	595
	%	*4.2*	*46.22*	*49.58*	*100.0*
Occupation	no	75	245	275	595
	%	*12.61*	*41.18*	*46.22*	*100.0*
Income	no	170	290	135	595
	%	*28.57*	*48.74*	*22.69*	*100.0*
Familty life	no	15	160	420	595
	%	*2.52*	*26.89*	*70.59*	*100.0*
Relations with neighbours	no	35	210	350	595
	%	*5.88*	*35.29*	*58.82*	*100.0*

Regarding self-appreciation of some qualities of those questioned (Table 7), an overwhelming percent have those who appreciate the mentioned aspect. Confidence in their powers and skills demonstrate a great potential for development and highlights that the rural development process is not due to a lack of values and skills of the inhabitants, but rather the lack of support from the community, of the state and lower income, of poor health system as a whole remove the possibility of development of the rural area.

Tabel 7. Self-assessment, by marks, of the respondents characteristics and competences

Mark	Appreciation by marks (minimum- mark 1, maximum- mark 5)							
	1 and 2		3 and 4		5		Total	
UM	no	%	No	%	no	%	no	%
Initiative spirit	5	0.8	175	29.5	415	69.7	595	100
Welfare	5	0.8	180	30.3	410	68.9	595	100
discipline	-	-	194	31.9	401	68.1	595	100
Health	5	0.8	175	29.5	415	69.7	595	100
Family	5	0.8	125	20.9	465	78.2	595	100
Skill	-		155	26.1	440	73.9	595	100
Work	5	0.8	150	25.3	440	73.9	595	100
Ambition	15	2.5	140	25,2	430	72.3	595	100
Receptivity to new	5	0.8	180	30..3	410	68.9	595	100
Honesty	5	0.8	115	19.4	475	79.8	595	100
diligent	15	2.5	90	15.1	490	82.4	595	100
Realism	10	1.68	140	23.5	445	74.8	595	100
Courage, self confidence	-	-	130	21.8	465	78..2	595	100
Saving	-	-	150	25.2	445	74.8	595	100

Development can occur after various steps to improve the quality of life and the living conditions in each locality. The following

table presents some aspects, components of sustainable development, on which respondents were asked to assess.

Table 8. Respondents appreciation on various development characteristics of the locality

Specification	Dissatisfied		Partially satisfied		Satisfied		Total
	no	%	no	%	no	%	no
About your locality, in general	85	14.4	165	27.7	345	57.9	595
Cleanliness, care of locality	180	30.9	166	27.9	249	41.8	595
Public order in locality	152	25.5	138	23.2	305	51.3	595
healthcare	110	18.5	205	34.5	280	47.0	595
School, kindergarten	175	29.4	235	39.5	185	31.1	595
Transports in the area	318	53.4	228	38.3	49	8.3	595
Road in locality	287	48.2	257	43.2	51	8.6	595
Locality supply	145	24.4	216	36.3	234	39.3	595
Cultural life, possibilities to entertainment	308	51.8	216	36.3	71	11.9	595
Locality priest	76	12.7	134	22.5	385	64.8	595
Major	166	27.9	197	33.1	232	30.0	595

Regarding the aspects that are fundamental to the community development, measuring the respondents answers we see in Table 8: 30% are satisfied by the major, 41.8% of cleanliness and locality in general, 51.3% of public order, and 47% of healthcare and 64.8% of the locality priest; almost half of all those questioned are partially satisfied at the following categories: transport in the area of the locality supply, locality roads and cultural life; those who are dissatisfied, are ranging from 76 persons to the priest of the locality, to 318 persosn to the local roads.

Culture always followed maintaining and feeding the soul and spirit evolution of each era.

Once was agriculture, which the Romans called it “colere-cultus”. It was about growth and keeping the needs of life. What we need today is also an “agriculture”, of soul and spirit.

What is needed to maintain life, the spiritual food is represented by values to be cultivated. From the existential perspective culture is understood also as the cultivation of values[8]. Once this cultivation of values , the development of intellect, man, space occur. [3].

Table 9. Appreciation of questioned persons on the importance of commune development aspects

Specification	APPRECIATION WITH MARKS					
	Mark 1 and 2		Mark 3 and 4		Mark 5	
	no	%	No	%	no	%
Support from the budget	-	0	140	23.5	455	76.5
Reforms, provatization acceleration	52	8.8	123	20.6	420	70.6
Intensive development of agriculture	17	2.9	70	11.8	508	85.3
Achieving local autonomy	35	5.8	158	26.6	40.2	67.6
Development of culture institutions	70	11.7	123	20.7	402	67.6
Own effort of local communities	37	5.9	121	20.6	437	73.5
Development of non-agricultural sectors	37	5.9	20.6	5.9	437	73.5
Tourism promotion	105	17.6	121	20..6	368	61.8
Infrastructure development	70	11.7	140	23.4	385	64.7
Improvement of healthcare	72	11.8	121	20.6	402	67.6
Elaboration of projects adequate for locality development	52	8.8	88	14.7	455	76.5
Capital attracting	17	2.9	70	11.8	508	85.3
EU grants	17	2.9	88	14.7	490	82.4

With maximum importance (mark 5) were appreciated by most people all the characteristics, but depending on the obtained percentages, the most important were considered: support from the budget (76%), infrastructure development (65%) own effort of the community and development and non-agricultural sectors, with 67%, the intensive development of agriculture (85%) and EU grants (82%).

Less important for development (marks 3 and 4) were nominated: achieving local autonomy and development of cultural institutions (20.7%), improving healthcare.

The tourism promotion is the least appreciated way for development, it obtained 17.6% in mark 1 minimal importance.

The responds structure shows a certain homogeneity, concluding that the respondents consider all the ways listed above very important for the commune development.

CONCLUSIONS

By the questionnaire process of the 595 inhabitants of the communes, we consider that the active and continuous involvement of the

inhabitants in the socio-economic development of the communes will gradually increase, once with the awareness that every inhabitant must be actively involved in the community development of the locality where they live.

All the 10 communes have points in common, namely: the population is interested in local business sector development; local business sector accessed funds from various sources; there is a large available workforce; various funds can be accessed based on staff experience in the local administration; the existence of waste platforms; good electricity and telecommunications networks, the continued development of real estate; the existence of numerous companies in vegetable, livestock sector and agriculture services and sales; high share of private ownership of arable land; favorable natural potential for tourism development; existence of various educational and cultural buildings (schools, library, cultural center) [6].

The interested groups that could contribute to the development of the rural communities directly are local authorities, companies in the locality interested in promoting activities and in particular the manufactured products, interested in local economic development by promoting electronic commerce, providing financial and technical assistance for the adoption of innovative solutions in the private sector, teachers, students wishing to return to the commune after graduation, the committees of initiative established under the projects implemented over the last years in the locality and investors attracted by the facilities provided (infrastructure, the potential of young population, spaces, possibility to gas network connection in the near future, urban land available for construction of houses and for investments) [4].

In a hierarchy of the way in which local public services are operating, the sewerage system, gas, roads in the commune together with the drinking water network, are the main areas where the inhabitants feel the need for urgent and substantial improvements.

We appreciate as main opportunities: internal and cross-border cooperation development; SME sector development and services; increase of tourism potential and improvement of quality of tourist services; diversification of agricultural production; improvement of the education system; regeneration of the rural communities [7].

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NEED FOR MEANINGFUL MECHANIZATION STRATEGIES TO ENHANCE SUSTAINABLE AGRICULTURAL PRODUCTION IN BENUE STATE-NIGERIA

Hemen Emmanuel JIJINGI, Paul Osu SIMEON

Federal University Wukari, P.M.B 1020, Wukari, Taraba State – Nigeria Postal Code; 67001
Department of Soil Science and Land Resources Management, Phones: +2348069451802, +2348062536780, Emails: hijijingihemen@live.com, posimeon@yahoo.com

Corresponding author: hijijingihemen@live.com

Abstract

This paper briefly introduces mechanization and its application to agriculture. One of the main problems facing agricultural mechanization in Benue State is the adoption of mechanization strategies. These are often done by governments and international agencies that do not pay enough attention to the interest of small farmers and to the process of technology change. Other pertinent problems include prevalence of small fragmented farm holdings, high cost of hiring tractors for land/bush clearing; lack of classified data and information on the suitability; adaptability and performance of commercially available agricultural equipment as related to types and conditions of soils, crops and livestock; poor monitoring; inadequate repair and maintenance facilities; difficulties in obtaining spare parts; insufficient trained machinery operators; inadequate research programmes; poor credit facilities; poor maintenance culture; absence of incentives for indigenous design and manufacture of equipment and inadequate infrastructural facilities such an pipe bone water; poor road networks and electricity. The paper examines the actions of government and collaborating international agencies. The work is a scholarly inquiry using secondary data and personal visits of the researcher to Benue State owned Tractor Hiring Units. The result reveals several inadequacies which have promoted failures and meaningless attempt at mechanization in agriculture. The paper concluded that there is need for proper combination of hand tools technology, animal draught technology and mechanical power technology that are moderate enough to be supported by indigenous design, development and manufacture of the most needed tools, machinery and equipment and their spare parts.

Key words**:** *agricultural production, Benue state, enhanced, mechanization, strategies, sustainable*

INTRODUCTION

Mechanization is the art of using machineries to hasten production, accomplished task and reduce fatigue and human labour in order to produce better quality goods and services [1]. Farm mechanization has been defined as the process of development and introduction of mechanized assistance of all forms and at any level of technological sophistication in agricultural production in order to human drudgery, improve timeless and efficiency of various farm operations, bring more land under cultivation, preserve the quality of produce, improve living conditions and markedly advance the economic growth of rural sector [3]; [5]; [2]; [1]. In other words, agricultural mechanization is said to basically connote the exploitation and management of machines, engines and mechanical aggregates/installations in replacement of manual and draught animal works in agricultural production. In this way, it includes the efficient selection, operation, repair and maintenance and the replacement of machinery. It is a versatile field embracing the science of farm machinery and sources of power that are used to operate the various machines [14] The benefits of mechanization which have attracted the attention of farmers are timely field operations, higher field efficiencies, higher productivities and reduction in drudgery.

Agricultural mechanization goes beyond the use of tractors (tractorization), it also includes the development, application and management of mechanical aid for field production, water control, material handling as well as post-harvest operations [16]. [7] stated that agricultural mechanization encompasses the use of farm equipment including the power source that are used to operate the various

machines, while another author takes it to be the act of making judicious use of agricultural inputs such as seeds, irrigation water, fertilizer, herbicides or insecticides and farm equipment in order to maximize production with minimum cost [4]. According to [10], the widely and internationally acceptable definition of agricultural mechanization both as a term and concept, embraces the manufacture, marketing, distribution, selection, application, utilization, proper adjustment and operation as well as maintenance of all types of tools and implements, machines and equipment for agricultural land development, animal and crop production, for land preparation, feeds and fibres production including processing, preservation, storage and distribution or marketing while tractorization is the use of tractor to perform activities associated with agriculture.

The merits of agricultural mechanization include accelerated and increased agricultural output since it will enable farmers to cultivate a large area of land than is possible with the traditional farming techniques. It also reduces drudgery in farm work. It is improves the quality of field operation providing better soil environment for seed germination and plant growth; it allow for the production of large quantities of food; it maximizes yield by more efficient farm operations; it makes sure that farming operation such as planting is completed in a limited time; it provides more efficient water supply to the farmer through irrigation; it reclaims wastelands through drainage of water logged farms; it provides a higher standard of living for farmers and it facilitates the processing and preservation of farm produce thereby reducing wastes [5]. In summary it facilitates the intensification and expansion of production in agriculture. **Its demerits** include very heavy capital investment in machinery; management of exposed soils in tropical climatic conditions; its requirement of competent hands for adjustments maintenance and repairs of the machinery, etc, hence the agricultural mechanization challenges of peasant farmers in Gboko Local Government Area of Benue State [6]. The merits outweigh the demerits, thus, Benue State has to embrace it, if it is to be able to feed the teeming population. There is no other way out. **Agricultural mechanization must become a reality, if the state is to become self-reliant in food production and in the production of industrial raw materials.**

The main objective of this paper is to highlight the poor strategies adopted for agricultural mechanization pursuit in Benue State, and to profer the strategy that will grow and strengthen the application of mechanization to enhance the sustainable development of agriculture and the rural areas in Benue state in particular and Nigeria in general.

MATERIALS AND METHODS

Study Area

The study area is Benue state. It is in the middle belt region of Nigeria. It lies within Latitudes 6^0 15' and 8^0 North of the Equator and Longitudes 7^0 45' and 10^0 East of Greenwich Meridian as shown in Fig. 1 below.

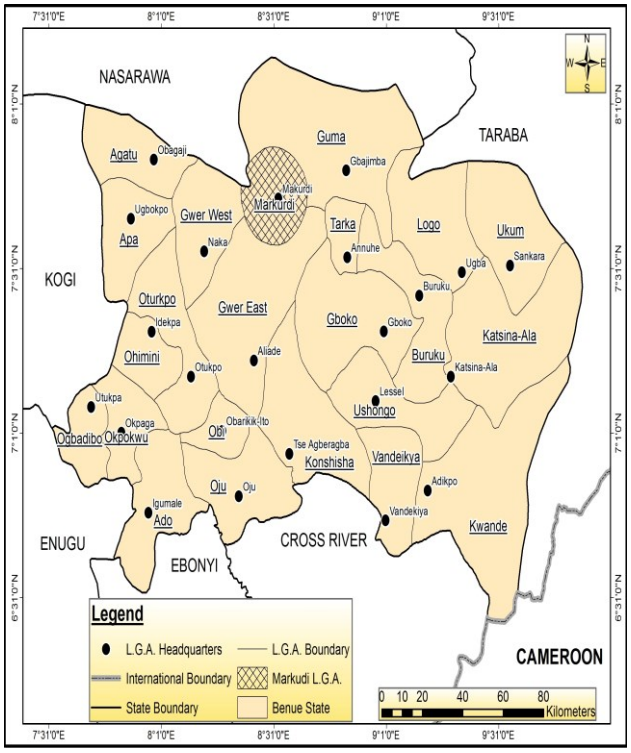

Fig. 1. Map of Benue State.

It has a population of about 4, 253,641 [8] and land mass of 34,059 Km^2. It is inhabited

predominantly by the Tiv and Idoma ethnic groups. With its capital at Makurdi, Benue State has high forest and Guinea savannah vegetations and it is a rich agricultural zone. Some of the crops grown are maize, Potatoes, Cassava, Soya Beans, Guinea corn, Flax, Yams, Sesame, Rice, and Ground nuts.

The study is a scholarly inquiry based on secondary data and personal visits of researchers to Benue State government owned Tractor Hiring Units (THU).

RESULTS AND DISCUSSIONS

The Status of Agricultural Mechanization in Benue State

Benue state agricultural development policy and strategy is built around supporting the rural farmers who work principally with primitive hand tools and the epileptic promotion of simple mechanical aggregates of tractor and plough, tractor and harrow and tractor and broadcasting equipment. The animal draught technology is non-existent. These explain the subsistence level of the state agriculture as a result of the failure of the epiletic "tractorisation" instead of mechanization. Irrigation and drainage infrastructures support is lacking.

The government owned tractor hiring units have collapsed and the rural farmers left to do just what hand tools can do, even as the farming age continue to rise astronomically. The state needs to borrow from the experiences of growing Asian economies like India, Malaysia, Thailand and the grown economy of China. But for now, the state agricultural production is based predominantly on hand tools and it has proved to be inadequate. The hand tools mostly used in Benue State include cutlasses, matchets, shovels, spade, diggers, trowels, hoes, axes, rakes, forks, shear and mattocks. When the overall agricultural production is considered for Benue State, the percentage of human power is up to 87 % yet power output of a human being is a maximum of 0.07 kW [7] or 0.69 kW of energy [16] and this of course varies with environmental conditions and type of nutritional intakes, and it is further limited by stress, especially at the high temperature and humidity conditions found in Benue State [3]. For these reasons farming using hand power is arduous, inefficient and is characterized by low rate of work. They further stated that an average peasant farmer in Nigeria owns a farm less than two hectares, which is barely enough to produce what is needed to feed his family most especially that fertilizer and other inputs are expensive and not easily accessible to the peasant farmers.

[9]; [10] reported that engine powered technology (EPT) was introduced in the early sixties through the farm settlement schemes in Nigeria. The level of EPT use in Benue State is relatively very low [6]. The tractorization intensity is about 17 w/ha and about 90 % of tractors and implements in Benue State are not functional. This is further evidenced from the Benue State Agricultural Development Programme (BSADP) and Farm Mechanization Agency (FAMA) that are supposed to hire out tractors and implements to farmers for their farm operations but do not have even a single functional tractor on ground now. What can be seen are obsolete and non-functional tractor and implement scrap frames. It is clear that the extent of field machinery use in Benue State Agriculture is Non-Mechanized (77.97 %) as reported by [6]. In critical situation where tractors must be used, the farmers negotiate with the handful private owners and with neighbouring States like Nasarawa, Cross-river and Enugu for hiring. The situation went so bad in 2014 and 2015 when none of the Tractor Hiring Units (THU) in the state could boost of a viable and functional tractor.

Strategies for Enhancing Sustainable Agricultural Mechanization in Benue State

Engine powered technology (EPT) has helped the developed countries of Europe and America and the fast developing South and South East Asian countries to develop their agriculture such that only a very small percentage of their population is involved in direct food and fibre production. The small percentage has been able to provide enough food for the population with surplus for export, principally, because of the use of machines. Use of appropriate machines has also resulted in the production of abundant

raw materials for their numerous agro-based industries which provide employment for a lot of people. Benue State should emulate this model in preparing for its agricultural industry in the years ahead.

Table 1. Average Utilization of Draught Animal Power (DAP) in Indian Farms

S/No	Location	Average Annual Utilization (Hrs)	Maximum Utilization in
1	North	660	Transport
2	South	230	Tillage and Seeding
3	East	450	Tillage and Seeding
4	West	500	-DO-
5	Central	280	-DO-

Source: [11]

According to [11] the most preferred work rest cycles for the draught Animals were noticed as follows:

(i)Bullocks: 3hr work + 1hr rest + 3hr work or 4hr work + 2hr rest + 3hr work

(ii)Buffaloes: 4 hr in the morning + 7 hr rest + 4 hr work in the evening.

(iii)Camels: 2 hr work + 1hr rest + 2 hr work + 1 hr rest + 2 hr work

(iv)Donkeys: 1 hr work + 1 hr rest + 1 hr work + 1 hr rest and so on up to 6 hr work/day.

Table 2. Availability of Tractors, Draught Animals and Agricultural Workers in India [15]

S/No	State	Tractors 1994	Power tiller 1994	DAP 1987	Agricultural workers 19991
1	All India	10.56	0.669	467	1,312

Note: Agricultural workers: Cultivator + Agricultural Labourers. During 1997, there were 2.10 million tractors on India farms.

For doing proper tillage in time, ideally the farm power availability should be as under:

-Tractors (24 kW) 66/1000ha @ 15 ha/tractor

-Draught Animals 1000/1000ha @ 2 ha/pair

Table 3. System and Component Technology Change Occurring in Asian Agriculture

Function or Operation	Hand tool	Draft animals	Mechanical power
Land Clearing	Brush hook, hand saw, motor chain saw	Buffalo and elephant for skidding and loading	Track-type tractor for clearing, skidders for log transport
Land development	Spade, hoe, basket, wheelbarrow	Earth scoop, levelling scraper, bund former	Wheel tractor, track-type dozer, motor scraper
Land preparation	Hoe, spade	Wooden plow, steel plow, spike harrow, disk harrow	Single-axle tractor, power tiller, two-axle tractor with various implements
Planting and seeding	Seed distribution by hand, plant stick, jabber, row marker, hand-pushedseeder	Furrow opener, marker wheel for dibbling, seed drill, seed-cum-fertilizer drill	Tractor seed drill, seeding with aircraft
Transplanting	Hand-operated paddy transplanter		Motorized paddy transplanter
Harvesting	Finger-held knife, sickle, scythe, threshing table, pedal thresher	Peanut lifter, cutter-bar mower, reaper, reaper-binder, treading (threshing)	Power reaper, power reaper-binder, power thresher, combine harvester
Crop husbandry	Hoe, weeding hoe, hand sprayer, water can, irrigation scoop	Wooden interrow weeder, walking-type tool, carrier, riding-type tool, carrier, spraying machine, Persian water wheel	Interrow weeder, motor knapsack sprayer, tractor boom sprayer spraying with aircraft, diesel of electric irrigation pumps.
On-farm processing	Mortar and pestle, flour-grinding stone, hand-operated paddy husker	Animal powered sugar-cane crusher, power gear for driving processing machinery	Single-pass rice mill, rubber-roll rice mill hammer mill
Crop storage	Sun-drying, bag storage		Artificial drying, bulk storage, elevator, fork lift
Handing	Carrying, wheelbarrow, push cart.		
Rural transport	Porter, push cart, rickshaw	Sled pack harness, bullock cart trailer, track	Power tiller with trailer, two-axle tractor with trailer

*within each operation the level of sophistication increases vertically
Source: [12]

According to [13], in Europe, China, India, etc their methods of farming is more scientific, therefore more productive. In these countries, mechanization brought about growth in the use of agricultural chemicals (herbicides, insecticides, fungicides and fertilizers) though along with their hazards. They also develop high yielding species that leads to intensive farming on land with sufficient rearing of cattle and poultry. They went further into genetic engineering method for hybridization and embarked on pests control by use of chemicals.

These can not happen in Benue State until the

government begins to realise/resolve the following issues:

-Ensuring internal peace and security of the rural communities from external threats and attacks by destructive persons or group of persons in whatsoever disguise.

-Construction of small dams for electricity and irrigation water provision including the construction of dams across large erosion gullies.

-Declaration of vocational/technical education (that will produce technicians) a top priority and transformation from theoretical education to practical training of its youth, through variety of programmes.

-Encouragement and attraction of foreign based farm machinery manufacturers to establish factories in the state.

-The rural farmers and their communities must be placed at the centres of strategies and policies geared towards agricultural development, and thus economic advancement of the state.

-Promotion of exploitational and management conglomeration or consolidation of land holdings and discouragement of land fragmentation into very small scattered holdings that can make mechanization, irrigation and drainage works difficult.

- Conscientious building of an efficient farm gates purchase of farm outputs at economic prices from farmers, value addition, strategic storage and marketing to give both farmers and consumers the economic leverage that can promote rise in production as well as consumption.

-Encouragement of foreign experts to establish draught animals farm and training centre in the state, and this should include the production of the machines/implements attachment kits.

-Energetic education to conservation agriculture awareness to farmers, including the encouragement of use of organic manure, green manure and mulching in soil management.

-Creation of leadership by example by the top hierarchy of government that will re-orientate the workforce from greed and avarice to states manship and awkening of societal development consciousness. This must lead to:

a.Reduction of corruption to barest minimum.

b.Abolition of flagrant display of stolen wealth.

c.Payment of workers as at when due.

d.Promotion of workers as at when due.

e.Provision of working tools for the workforce.

f.Merit and competence as the yardstick for engagement, most especially in all the technical areas as well as policies/plans/strategies development areas.

g.General improvement in the education sector, currently value/standard must change positively and quick too.

h.Proper monitoring and coordination of the implementation of projects, policies and strategies adopted for socio-economic progress of the state.

CONCLUSIONS

Benue State agricultural production can be classified into hand tool technology and epileptic engine powered technology. For Benue State to achieve its main objective of being self-sufficient in food production and production of abundant raw materials for the agro-industries, the use of engine-powered technology and introduction of Draught Animal Technology is very essential. Also very essential is the attraction of foreign Tractor and Machinery manufacturers to establish factories in the State as was done in I ndia after the separation of Pakistan in 1947.

The strategies so far implemented by the State Government has not produced the desired results, hence the need for change of the strategies, following the footsteps of emerging great economic powers in Asia.

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GEOGRAPHIC AND BIO-LITHOGENIC FEATURES OF GENESIS AND DISSEMINATION OF RENDZINAS IN THE WESTERN UKRAINIAN REGION

Andriy KYRYLCHUK

Ivan Franko National University of Lviv, Department of Soil Science and Soil Geography, Doroshenka St. 41/104, Lviv, 79000, Ukraine, Mobile: +380673672698, E-mail: kyrylandrij@gmail.com

Corresponding author: kyrylandrij@gmail.com

Abstract

Investigations of geographic and bio-lithogenic features of genesis and dissemination of rendzinas in Western region of Ukraine have been conducted. Given soils are intrazonal bio-lithological soils, formed in periodical wash and wash type water regimes, mainly under mixed and broad-leaved forests canopy, with well-developed herbaceous cover on eluvium-diluvium products of chalk, cretaceous marl, and marl, and Upper Baden limestone weathering. It has been stated that the largest overall extension areas of Rendzinas are concentrated in Turiys'k-Rorzhyshchens'k natural area, Volynian Polisya region, Polisya territory. It has been found that rendzinas lie on elevated relief elements (denudation plains, floodplain rivers, watersheds, limestone and chalky remnants, steep and declivous river sloping) where quaternary deposits are washed out and eluvium-diluvium crust of cretaceous marl weathering appear on the surface. Complexity and mosaic of rendzinas bedding in soil cover structure determine optimization character of given soils rational usage in Western Ukrainian region.

Key words: *Rendzinas (Rendzic Leptosols, WRB), relief elements, soil carbonate parent rocks, morphogenic properties*

INTRODUCTION

Ukraine occupies a leading place among the Central-Eastern European countries, the territories of which are rich in rendzinas. Rendzic Leptosols and carbonate chernozems on eluvium carbonate bedrock, which at the beginning of the 60s of the last century were called shallow and deep humus-carbonate soils, respectively, as well as rendzinas, occupy more than 12 000 km^2 in Ukraine, which is 2.2% of the Ukrainian areas under cultivation. According to the profile capacity, they are divided into carbonate chernozems with the horizons Aca + ACca > 50 cm, and rendzinas Aca + ACca < 50 cm. [8]

Rendzinas on eluvium carbonate bedrock have shallow properly humus profile with the capacity of 30–70 cm, humus content and deposit of which instantly decreases downwards. They are characterized by slightly alkaline and alkaline soil reactions, persistent to external influence and favourable for growth of agricultural crops, by agrophysical and agrochemical properties, comparably high gross content of the most important elements of root plant nutrition (N, P, K), thus, being of high potential fertility. Parent rock fragments, the number and diameter of which grow downwards, are available on the surface of or in the humus-accumulating horizon. This is connected with the name "rendzinas", which comes from the Polish word "rend-zyk", meaning "to clank", i.e., while cultivating the land, rock materials broke against agricultural implements and produced that sound. In Ukraine, these soils are named "hromyshi", originating from the words "to rattle", "to thunder" [5].

Taking into account soil classifications turf-carbonate soils (Ukraine, 1977), Petrozems and Litozems (Russian Federation, 2004), Rendzic Leptosols (WRB) are considered to be the analogue of rendzinas. According to the International Union of Soil Sciences Working Group WRB (2007, 2014), the soil is classified as Rendzic Leptosols developed on straight-bedded limestone and marls. Soil profiles are thin, developed on weathered parent rock enclosing approximately 45% of

gravel and stones. Soils having continuous hard rock within 25 cm from the soil surface; or a mollic horizon with a thickness between 10 and 25 cm directly overlying material with a calcium carbonate equivalent of more than 40 percent, or less than 10 percent (by weight) fine earth from the soil surface down to a depth of 75 cm; no diagnostic horizons other than a mollic, ochric, umbric, or yermic horizon [16].

In Western region of Ukraine both rendzinas and carbonate chernozems, formed on eluvium carbonate bedrocks, occupy the area of 1 622 km^2 or 13.5% of corresponding soils area in Ukraine. 83.2% are arable lands. The given soils are the most cultivated ones and there are practically no potential sources of arable land area extension [13].

The territory of Western Ukraine administratively is divided into eight regions: Volyn', Rivne, Lviv, Ternopil', Khmel'nytsk, Ivano-Frankivsk, Chernivtsi and Transcarpathian (Figure 1). The total area is 128,900 km^2 that makes 21.4% of the total area of Ukraine. Considerable extension of Western Ukrainian territory from north to south and from east to west favoured the formation of natural conditions peculiarities and their spatial differentiation. According to physic-geographic scheme of Ukraine regionalization, the given territory is allocated within such azonic regional landscape units as the territory of Polisya, Western Ukrainian territory and Ukrainian Carpathians [10].

Natural factors with spatial heterogeneity and contrast range caused by geographic position, geological structure, geomorphologic and bioclimatic peculiarities play an important role in soil cover functioning, intensive development of soil processes and regimes, formation of soil properties and conditions of their usage. In different regional landscapes, different factors are predominating in soil forming processes. In Polisya territory, the most sufficient soil formation factors are parent rock lithology, vegetation, and surface and soil humidification conditions.

In Western Ukrainian territory, with uniform less loam cover, the soil formation is influenced, primarily, by climatic peculiarities and vegetation, and the relief, as the major factor of different level of erosion processes display.

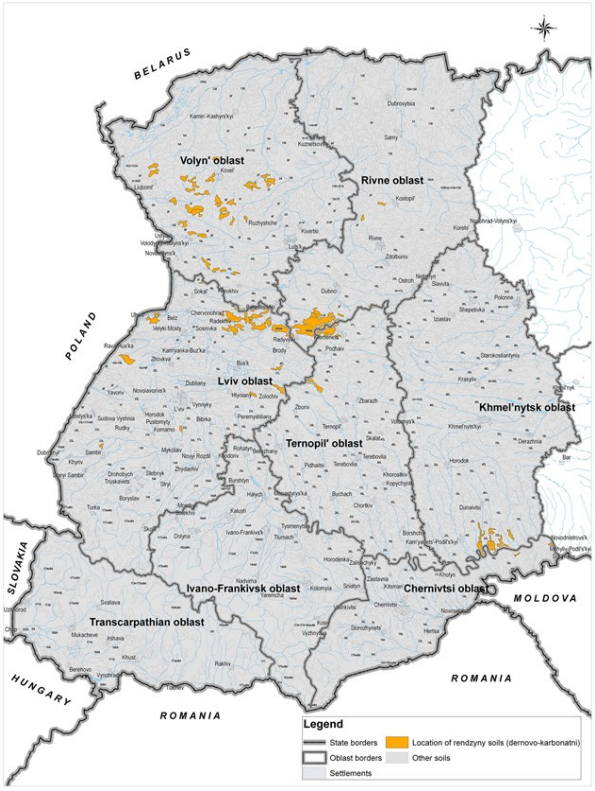

Fig. 1. Map of administrative districts and Rendzinas distribution
Source: Author's map

In Ukrainian Carpathians the character and direction of soil forming macro-process are largely caused by absolute altitude, relief, slope exposition and the character of soil parent rocks.

According to agricultural aspect, the given territory occupies the zones of mixed and broad-leaved forests, forest-steppe and the Carpathian province with vertical soil-vegetative cover belt [18].

Rendzinas reclamation and their long-term intensive use as arable lands lead to agro degradation lying in humus content decrease (dehumification), considerable nutritive balance disturbance (depletion), internal soil weathering intensification and decarbonation (chemical degradation), considerable deterioration of water-air regime, over-condensation and disaggregation (physical degradation), erosive outwash of upper humus horizons (profile degradation), soil cover structure complication at the expense of dimensional uneven growth of the given

processes (geographic degradation) [8].
The investigation of geographic regularities of Rendzinas distribution, their composition and property change under intensification of agricultural production, which led to acceleration of soil degradation processes, is an urgent problem allowing the elaboration of modern adaptive nature-oriented and environmentally friendly systems and methods of land management which are of vital importance during the present agrarian reform.

MATERIALS AND METHODS

For the analysis of peculiarities of Rendzic Leptosols distribution in Western region of Ukraine we used comparative-geographical, cartographical and morphologo-genetical methods. Expedition and semi stationary methods were used in field investigations.
In order to study geographic peculiarities of rendzinas in Western region of Ukraine we analysed soil maps 1:200 000 scale of Volyn' (1969, 2007), Rivne (1970), Lviv (1967), Ternopil' (1969), Khmel'nytsk (1968), Ivano-Frankivsk (1969), Chernivtsi (1969), and Transcarpathian (1969) regions, Western Ukrainian region soil map (2010) 1:200 000 scale, Malyi Polisya (2010) soil map scheme 1:10000 scale, partly materials of large-scale soil investigations and further updatings conducted in 1957–1961, 1965–1966, and 1985–1986 by researchers of Lviv branch of Ukrzemproekt Institute (UAAN) and Ivan Franko National University of Lviv Laboratory of soil geographic investigations.
Scientific publications of H. Mahov [9], S. Miclashevski [11], F. Terlikovski [17], A. Musierovich and A. Vondraush [12], I. Gogolev [4], H. Andrushchenko [1], A. Humenyuk [15], N. Lisovyj [7], N. Vernander [18], B. Dobrzanski et al. [2], D. Kovalyshyn [15], Z. Zagorski [19] and others have been analysed.
Primary investigations of rendzinas in Western region of Ukraine, within the boundaries of Volynian Polisya in particular, were carried out at the beginning of the 20s of the last century by the well-known Ukrainian soil scientist professor H. Mahov (1930). The results of these investigations are presented in the monograph "Soils of Ukraine". During the 30s fragmentary investigations of rendzinas in Western region of Ukraine have been conducted mostly by the Polish scientists, especially by S. Miclashevski (1930), F. Terlikovski (1932), A. Musierovich and A. Vondraush (1936) and others. Major attention was paid to the role of natural factors and, primarily, to the properties of parent rock in the formation of rendzinas agricultural qualities and characteristic of some varieties of these soils as to their agricultural use.
A. Musierovich and A. Vondraush (1936) claimed that the most wide-spread rocks on which rendzinas were formed are upper cretaceous marls of grey-white colouring, locally named "opoka". The scientists stated that "…in the areas, where cretaceous marl bedrocks appear on the surface, prevalent type of surface strata has emerged on the territory under investigation. This type of strata is eluvium-diluvium weathering crust of these bedrocks. It has been proved that in the upper part of the rocks (5−10 cm) cretaceous marl is softened. Density and size of cretaceous marl fragments increase with depth". According to the scientists, this causes the formation of relatively low-capacity rendzinas profile, high content of detritus and unfavourable physical-mechanical and agronomical properties of these soils.
The main achievements made by I. Gogolev include the study of soil formation factors and dominant processes resulting in formation of the given soils in Western Ukraine. The scientist stated that "… within the boundaries of the investigated territory the main factors of "dark-coloured" soils formation are forest vegetation (broad-leaved forests) and lithological composition of parent rock, represented by eluvium genesis cretaceous marl products with admixture of fluvioglacial material in Verhnjo-Bus'k Polisya and limestone of Upper Baden in Rostochchya. Simultaneously, the turf soil forming process is considered dominant. This causes the formation of low-capacity profile, availability of considerable humus content (7.61–9.23%) and reserves, weak acid reaction in the upper horizon (pH_{KCl} 6.3) persistent to the external

influence and favourable agrochemical properties for agricultural crops growth and development, high gross content of root plant main nutritious elements and comparably high potential fertility". The works of Gogolev contained the most detailed description of "dark-coloured" soils (rendzinas). The scientist distinguished relatively powerful transitory humus horizon (8–10 cm) in the profile lower part, he also gave a detailed description of its formation. The author claimed that "… because of the flat territory and weak surface waters flow, intensive soil leaching takes place. This causes soil parent rock acceleration leaching processes and formation of more powerful humus rendzinas profile" [5].

Rendzinas on cretaceous marls are morphologically very similar to Malyi Polisya chernozems and those of the southern part of Volynian Polisya, that is why they are called "polisyan chernozems" [1]. Soils that have been formed from marly opoka are described in the monograph by Zagorski (2003) and named according to the soil systematization in Poland – chernozem rendzinas. [19]

The investigations of Gogolev proved that genetic development of the so-called "polisyan chernozems" considerably differs from that of common chernozems. As soil forming process occurs on dense carbonaceous rocks under the forest canopy, humus accumulation occurs in soil profile, which makes rendzinas similar to chernozems. Their similarity is only morphologic, though, and there is no sufficient grounds to place rendzinas in one type with chernozems. Similar conclusions were found in publications of Ponomaryova and Maslenikova investigating rendzinas humus state on Syluriysk plateau [15].

In his monograph "Soils in Western region of URSR" H. Andrushchenko (1970) characterised rendzinas as "… intrazonal biolithological soils, formed on eluvium weathering crust of cretaceous marls under the simultaneous action of arboraceous and herbaceous vegetation of water regime wash type". The author gave detailed characteristics of rendzinas morphogenetic peculiarities and persuasively proves their "forest" origin based on a detailed analysis of one and a half oxides redistribution in the given soil profile. He stated that "… the connection of different elementary soil forming processes under sufficient humidity leads to undifferentiated profile formation, characterised by humus accumulating horizon rich in colloids and one and a half oxides and their gradual decrease down the profile, with the exception of calcium, which increases in the same direction. Such redistribution of one and a half oxides and calcium is typical for soil forming processes under arboraceous vegetation, occurring in the direction of podsolization. At the same time, distinct phosphorus (P) accumulation takes place in the upper horizons, being the most essential characteristics of soil formation" [1].

Generalized results of soil ecological and soil genetic investigations of rendzinas in Western region of Ukraine are presented in monographs by A. A. Kyrylchuk, S. P. Pozniak "Turf-carbonate soils (rendzinas) of Malyi Polisya" [8], O. V. Haskevych, S. P. Pozniak "Soil Cover Structure of Holohory-Kremenets Highlands" [3] and O. M. Pidkova, M. H. Kit "Lithological-Genetic Conditionality of Soil Cover Formation in Rostochchya" [14].

Soil genetic investigations of initial rendzinas in different geomorphogenic–phytocoenotic conditions of Bila Hora tract and anthropogenically disturbed rendzinas of artificially formed terraced complexes in Voronyaky and Berezhany Opilya were conducted in recent years. It has been found out that ontogenetic rendzinas reproduction occurs under the influence of biogenetic accumulative soil forming processes, bedding and turf processes being of major importance. At the same time, anthropogenic processes are dominant soil-forming processes in anthropogenically disturbed rendzinas of artificially formed terraced complexes [7].

RESULTS AND DISCUSSIONS

Rendzinas of Western Ukrainian region are intrazonal bio-lithological soils, formed in periodically wash and wash type water

regimes, mainly under mixed and broad-leaved forests canopy with well-developed herbaceous cover on eluvium-diluvium products of chalk, cretaceous marl, marl, and Upper Baden limestone weathering.

In Western Ukrainian region the most wide spread rendzinas subtype is typical rendzinas with undeveloped and normal (modal) types of structure profile (Нк (Ahpca) – НРк (Ah/Cca) – Phk (A/Cca) (Designation of genetic horizons of investigated rendzinas is given according to Sokolovsky (1956), and in brackets − according to WRB (2007)) [6]. Weak washed off and average washed off rendzinas occupy fewer areas. Podzolic rendzinas were not found [8].

On the basis of generalization and analyses of morphologic structure data of representative soil profile laid within the investigated area and shown on photos 1-4, a number of macromorphologic peculiarities of investigated soils are given:

− the capacity of humus (organic matter) containing rendzinas profile within watersheds is about 66 cm;

− a sufficient part of humus containing profile falls on humus-accumulative (mollic) horizon Нк (Ahpca): agroheterogenic, residually-carbonaceous (MO-2-10%, $CaCO_3$), content of organic matter - 2-5%, the capacity is about 35 cm, dark-grey with brown colouring (10YR6/1). Texture dribnozem – SL. It has been stated that 80-90% of cretaceous marl detritus are of effective diameter (d) from 20 to 7 mm; 20-10% falls on detritus with d < 7 mm.

Fig. 2. Rendzinas developed from chalk, Volynian Polisya region

Fig. 3. Rendzinas developed from cretaceous marl, Malyi Polisya region

Fig. 4. Rendzinas developed from marly opoka, Western Podolia region

Fig. 5. Rendzinas developed from Upper Baden limestone of Rostochchya region

Well-developed structure (usually angular blocky or fine sub- to angular blocky structure), pH_{H2O} 7.62-7.73. Balk density – 1.45-1.52 Mg/m^3. In the lower part of the horizon (depth 20-25 cm) balk density – 1.48-1.63 Mg/m^3;

− transitional humus horizon НРк (Ah/Cca), residually-carbonaceous (ST-10-25%, $CaCO_3$), content of organic matter – 1.5-3.5%, is of ≈17 cm capacity. Grey with brown and white colouring (10YR6/1-7/1). Texture dribnozem – SL. It is characterized by a

sufficient increase in quantity and size of cretaceous marl detritus, 70-80% have the diameter (d) more than 20 mm, 30-20% - from 20 to 7 mm and less. The structure of the dribnozem part is cloddy (SB).

− transitional humus horizon Phk (A/Cca) consists of two thirds of coarse-detritus eluvium-skeletal material (diameter of cretaceous marl detritus is from 30-50 to 70 mm) and of a third – dribnozem, being clay-organic matter − material mixed with amorphous products of cretaceous marl weathering. Its capacity is usually about 14 cm. The dribnozem part is unstructured.

− according to rubbly surface, rendzinas belong to surface weak rubbly (<10%) and surface medium rubbly (10-20% of projective cover). In "Manual to the soil description" (2012) the quantity of detrital material on the surface of investigated soils is described as average (C) – 5-15% and more (M) - 15-40%. Medium gravel predominates (M) - 0.6-2 cm.

The total area of Rendzinas in Western region of Ukraine, calculated according to large-scale soil investigations data in different years, makes 1,019 km^2, 810 km^2 of which are arable lands. Ploughed land – 79.5% (Table). The overall rendzinas area of Western Ukraine was calculated based on digitized Soil Map of Western Ukraine 1:200 000 scale and ArcGIS 9 programme is 1 466 km^2. Different areas size was determined by their specification during further corrections of soil investigations and inclusion into total rendzinas area soil complexes, in which given soils are considered dominant. It has been found that there are 77 continuous rendzinas outlines in Western Ukraine; the area of the biggest is 315 km^2, the smallest 2 km^2. The average area of rendzinas is 18 km^2.

The largest Rendzinas area is found in Volyn' region, which is 415 km^2 or 40.7% of the total regional rendzinas area, 359 km^2 of which are arable lands or 44.3% of the total arable rendzinas area (Table 1).

Table 1. The areas of Rendzinas in Western Ukrainian region, km^2 (the numerator – total, denominator – arable lands)

Soils	Administrative districts						Total	Ploughed, %
	Volyn'	Rivne	Lviv	Ternopil'	Khmel'nytsk	Chernivtsi		
Rendzinas on eluvium carbonate bedrock (map code 165)	415/359	231/189	227/192	27/24	36/2	83/44	1019/810	79.5
Carbonate chernozems on eluvium carbonate bedrock (map code 78)	-	111/107	312/296	118/79	62/58	-	603/540	89.6
Total	415/359	342/296	539/488	145/103	98/60	83/44	1622/1350	83.2

Source: Own calculation.

It has been stated that the largest overall areas of rendzinas extension are concentrated in Turiys'k-Rorzhyshchens'k natural area, Volynian Polisya region, Polisya territory, or within such administrative districts as: Turiys'k, Lyuboml', Kovel', Volodymyr-Volyns'k, Ivanychykivs'k, less − in Horohiv and Rorshyshche. Rendzinas are mostly allocated on the elevated relief elements, where quaternary deposits covering eluvium-diluvium chalks are washed out. The given soils are found as separate lots among podzolic soils (Fig. 1 and 2). Depending on bedding conditions, rendzinas differ by the profile structure, grain-metric composition and other properties.

On the chalky hills and slopes, they are characterized by heavy broken stone humus horizon. Broken stone consists of parent rock, sometimes with a substantial admixture of flint. Solid chalk or cretaceous marl plate lies on the depth of 35–50 cm. On the upland lots

of watersheds, rendzinas have somewhat more powerful upper humus horizon (25–30 cm), and the depth of solid chalk plate is 50–70 cm.

Within the inter-watershed lowlands, rendzinas profile capacity can reach 1 m and its underneath is usually clayish.

Extensive arrays of continuous rendzinas are found in Radehiv-Brody and Kulykiv-Bus'k areas of Malyi Polisya region of Polisya territory, Voronyaky area of Western Podils'k upland region and Holohory area of Roztochchya-Opilya upland region of Western Ukrainian territory.

Concerning rendzinas area, Rivne and Lviv regions take the second and the third place – 231 km^2 (or 22.7% of all rendzinas area, 189 km^2 of which are arable or 23.3% of all region arable rendzinas) and 227 km^2 (or 22.3% of the region area, 192 km^2 of which are arable or 23.7% of all region arable rendzinas), respectively (Table 1, Fig. 1 and 3-5).

In Rivne, region rendzinas are mostly concentrated in Radyvyliv and Ostroh districts and in Kostopil denudation plain. They are spread in floodplain rivers, in small spots, where parent rock is meadow marl.

According to administrative division, rendzinas in Lviv region are concentrated in Radekhiv, Brody, Zolochiv, Busk and Rava-Rus'ka districts. Extensive arrays of these soils are found within boundaries of Bug-Styr wavy denudation plain, where they occupy upper lots of interfluve areas with absolute altitude of 240–260 m, and in the watershed of Raty and Solokia rivers near Uhniv. They are formed in conditions of plain-hill relief on eluvium-diluvium crust of cretaceous marl weathering, under arboraceous and herbaceous vegetation, in water regime washing type. Most widespread are deep humus type rendzinas with a chernozem profile structure. The allocation of these soils on the upper interfluve lots causes genetic profile formation without any traces of claying.

In Ternopil' (Zboriv, Pochaiv, Kremenets districts), Khmelnyts'k (Volochys'k, Horodok, Dunaiv districts) and in Chernivtsi (Zastavniv and Sokyryany districts) regions rendzinas areas make 27, 36 and 83 km^2 or 2.6, 3.5 and 8.2% of all region rendzinas area, correspondingly. A distinctive feature of rendzinas massive areas in Ternopil' region is that they are close to limestone hills of Malyi Polisya, where less thickness is washed off and the products of limestone and cretaceous marl weathering, which become soil parent rocks, appear on the surface (Table 1, Fig. 1, 4).

In Khmel'nytsk region continuous rendzinas areas lie on the steep and declivous river sloping of the Dniester, Zbruch, Smotrych, Ternava, Ushytsya, Kalyus, where eluvium of cretaceous marl and Upper Baden limestone is the soil parent rock (Table 1, Fig. 1, 5).

The characteristic feature of continuous rendzinas areas in Chernivtsi region is that they are disposed in a narrow stripe form along the Dniester valley, on steep slopes of different exposition (Fig. 1).

CONCLUSIONS

The analysis of rendzinas geographic dissemination in Western region of Ukraine allows to make the following conclusions:

(i)Rendzic Leptosols (rendzinas) of Western Ukrainian region are intrazonal bio-lithological soils, formed in periodical wash and wash type water regimes, mainly under mixed and broad-leaved forests canopy, with well-developed herbaceous cover on eluvium-diluvium products of chalk, cretaceous marl, marl, and Upper Baden limestone weathering.

(ii)The most widespread rendzinas subtype in Western Ukrainian region is typical rendzinas with undeveloped and normal (modal) types of structure profile. Weak washed off and average washed off rendzinas occupy fewer areas.

(iii)It has been stated that the largest overall extension areas of Rendzic Leptosols (rendzinas) are concentrated in Turiys'k-Rorzhyshchens'k natural area, Volynian Polisya region, Polisya territory.

(iv)It has been found that Rendzic Leptosols (rendzinas) lie on elevated relief elements (denudation plains, floodplain rivers, watersheds, limestone and chalky remnants, steep and declivous river sloping) where quaternary deposits are washed out and

eluvium-diluvium crust of cretaceous marl weathering appears on the surface.

(v)Complexity and mosaic of Rendzic Leptosols (rendzinas) bedding in soil cover structure determine the optimization character of rational usage and soil safe infrastructure establishment in Western Ukrainian region.

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ASPECTS REGARDING THE HOUSE, EDUCATION AND HEALTH INFRASTRUCTURE IN SOUTH-MUNTENIA REGION

Elena LASCĂR

University of Agricultural Sciences and Veterinary Medicine Bucharest – The Faculty of Management, Economic Engineering in Agriculture and Rural Development, Calarasi Branch, Romania, Phone/Fax: 00 40 745 17 15 83, Email: elenalascar@yahoo.co.uk

Corresponding author: elenalascar@yahoo.co.uk

Abstract

The infrastructure contains a supporting element, with a special importance to support all economic, social and cultural activities in the rural area. The infrastructure covers both structural area giving unity to the system and space area, thus creating a viable territorial configuration, which is reflected by different levels of accessibility. It is actually the circulatory framework of the economic and social system, individualized in a well determined space, as the regional one. South Muntenia region is characterized by a well defined infrastructure as a result of its advantageous geographical position. Its location in a peripheral area of Romania favored the emergence of major road ways, which allowed the development of its relations not only with neighboring national regions, but also with neighboring country Bulgaria. The present paper analyses the educational and medical infrastructure in the region, showing thus the discrepancies in the education and medical system and equipment across the region. It is pertinent analysis allowing the make improvements in this area.

Key words**:** *region, development, infrastructure, area*

INTRODUCTION

South-Muntenia Region is situated in the South-East part of Romania, bordering to the North, Centre Region, to the east South-East Region, to the South, Bulgaria, the limit being given by the natural border – the Danube river. The presence in the South of the region of the Danube river provides it the opportunity to have communications with the eight countries that border the Danube, and through the Danube-the Back Sea channel it has access to Constanta Harbor – the main maritime gate of the country. [1]

The variety of the forms of relief and the geological complexity of the region makes its natural resources to be very varied. The mountain and hilly area in the North part of the region focus on the natural resources of the subsoil (petroleum, natural gases, coal, radioactive mining, salt, sulphur, accumulations of gypsum for the energy, chemical industry and construction materials.

Along the subsoil resources, a remarkable importance with direct influences in the development of certain economic sector, have the soil resources. Thus, the agricultural surface concentrated mainly in the South counties of the region has 71% of the total surface of the region, of which 80,2% represents arable land.

The region has important and rich water resources (3.4% of the region surface), resources which by their use in various sectors, have a remarkable role in the economic development of the region.

The wildlife of a great variety provides another natural wealth of the region. The lands occupied with forests and wood vegetation have 19.3% of the region surface, representing an importance source of wood mass and an appropriate area for the hunting fauna.

The economic sectors with tradition in South Muntenia Region are: production of chemical and petroleum equipment, production of chemicals, production of Dacia vehicles, agricultural production and mountain tourism. [2]

MATERIALS AND METHODS

In this paper, there were used and processed the data made available from the National

Institution of Statistics and Romania Yearbook 2010 and Regional Statistics regarding South-Muntenia Region regarding its economic sector. The analysis is made both at the regional and national macro-economic level.

The data regarding the economic sector of the region are statistical data processed from the period 2013-2015.

RESULTS AND DISCUSSIONS

An important issue for the region development is infrastructure related to the system of education and health and housing. A house represents one of the basic needs of the population and access to it is an important factor to maintain and improve the quality of life and an essential component of the society. Housing of South Muntenia region was estimated at the end of 2012 to 1,295,755 houses.

Of the total number of dwellings, more than half (60.19%) were in the rural area, confirming the typology predominantly rural of the region, the only exception being in Prahova county where the share of houses in urban areas was 51.14%

The dynamics of housing in the period 2013-2015 at the national and regional level, by ownership and by residence, is shown in Table 1. From the existing houses, private houses privately owned mostly were 98.48%, and the remaining 1.52% were in majority state ownership.

Table 1. Dynamics of dwellings (urban and rural) in South Muntenia Region in the period 2013-2015

	2013		2015	
Residential area	Number	%	Number	%
TOTAL Romania of which:	8,427,941	*100.0*	8,467,832	*100.0*
Urban	4,607,796	*54.7*	4,585,420	*54.2*
Rural	3,820,145	*45.3*	3,882,412	*45.8*
Total South Muntenia Region of which:	1,295,755	*100,0*	1,301,029	*100.0*
Urban	515,970	*39,8*	517,359	*39.8*
Rural	779,785	*60,2*	783,670	*60.2*

Processed according to Romania Yearbook, 2012, INS

The data in the table regarding the houses, highlight a variable dynamics in the analyzed period, but extremely low, both at national level and in South Muntenia Region.

Infrastructure for education

At the level of South Muntenia region the education infrastructure is well developed. The educational system, both nationally and in South-Muntenia region includes infrastructure for education, represented by the buildings in which take place the educational activities, respectively schools, kindergartens, colleges, universities and vocational education and locations for special education. It can be said that education infrastructure is well represented in the region and thus it can support the development in good conditions of the education, noting that in the rural area, this type of infrastructure can be considered inadequate for the rural development process, requiring a restructuring of school structures and investment projects related to the local needs and requirements.

The data concerning the education infrastructure at national level and for South Muntenia region in 2013 with different levels of education both in the rural and in the urban area are showed in table 2.

Table 2. Structure of the education units by county, in South Muntenia region in 2013

Develop. region/ County	Kindergartens	Schools	Vocational schools	High schools	Post high schools	Faculty
Romania	1,367	4,022	6	1,615	86	108
South Muntenia Region	145	684	1	210	12	4
Argeş	25	128	-	45	2	2
Călăraşi	16	65	-	17	1	-
Dâmboviţa	18	106	-	31	-	1
Giurgiu	6	66	-	13	1	-
Ialomiţa	20	75	-	27	1	-
Prahova	41	137	1	54	6	1
Teleorman	19	107	-	23	1	-

Processed according to*:* Romania Yearbook, 2012, INS

The percent of schools in the region is represented as follows: 0.15% for primary education and 99.85% for secondary education compared to the national level where the rate was 1.29% respectively 98.71%.

Prahova County is remarked with the highest number of 41 kindergarten, most schools of

secondary education - 137 schools, and with most high schools across the region, respectively 54 high schools and 6 post high schools. Arges county is remarked by the largest number of faculties respectively 2 higher education institutions.

South Muntenia region is characterized by an average level of training and qualification of the population. The school population is continuously decreasing almost to all levels of training. The most significant decrease was registered in the university population.

The highest training level is registered in the counties in the North part of the region – Arges and Prahova where most universities from South Muntenia region are concentrated.[3]

Health infrastructure is represented by health and care facilities, respectively hospitals, polyclinics, diagnostic and treatment centers, medical clinics and rural health centers and other public and private facilities. These are showed in Table 3.

The healthcare infrastructure recorded in the South-Muntenia region in 2013, a percent of 14.19% at the national level for hospitals and a percent of 16.65% for general medical units, while for the polyclinics the percent is 7.06% and a relatively low percent of 10.55% was recorded for other heath units. The highest values on the number of health units by county with health profile were in the North part of the region, Prahova, Arges, and Dambovita counties. South Muntenia region had the least developed medical system (4.8 hospital beds to 1,000 inhabitants at the end of 2013 compared to the national level of 6.4 beds to 1,000 inhabitants, registering high variations from a county to another.

According to the statistical data, South Muntenia region had in 2013 a network of health units composed of a total number of 64 hospitals (48 in the urban area and 16 in the rural area), 17 clinics (16 in the urban area and 1 in the rural area) 44 dispensaries (32 in the urban area and 12 in the rural area), 1,670 general medicine and family medicine units (782 in the urban area and 888 in the rural area), 1,081 dental units (830 in the urban area and 251 in the rural area), 885 medical specialty (841 in the urban area and 44 in the rural area) 1,100 pharmacies and pharmaceutical points (659 in the urban area and 441 in the rural area) and 377 medical laboratories (324 in the urban area and 53 in the rural area).

Table 3. Structure of health units in South Muntenia Region, 2013

Development region/county	Hospitals	policlinics	General medicine union	Family medicine units	Dentist units	Pharmacies
Romania	458	269	1.033	11,279	11.025	919
South Muntenia	65	19	172	1,571	1.017	184
Argeş	19	1	57	374	295	61
Călăraşi	6	0	20	118	62	171
Dâmboviţa	7	14	18	249	205	96
Giurgiu	5	0	15	122	57	83
Ialomiţa	4	3	0	122	51	235
Prahova	16	1	62	365	307	89
Teleorman	8	0	0	221	40	

Processed according to*:* Romania Yearbook, 2012, INS

At the county level, the most medical units were in Arges and Prahova counties, and the least in Giurgiu and Ialomita counties.

Regarding the number of doctors per 1,000 inhabitants, the region ranks the last place at national level with 1.41 doctors.

At county level, the region average was exceeded only by Arges (2.11 doctors per 1,000 inhabitants) and Prahova counties (1.45 doctors per 1,000 inhabitants), the last place is occupied by Calarasi County (1 doctor per 1,000 inhabitants).

CONCLUSIONS

The main characteristics of the house infrastructure of South Muntenia Region were that it had a higher percent in the rural

area of the region a number of 783,670 (60.2% of total) which 99.32% is privately owned; from the total number of houses more than half (60.19%) were in the rural area confirming a predominantly rural typology of the region. From the existing house stock, privately owned houses were 98.48%, and the remaining 1.52% were in the state ownership. The infrastructure relating to education was appropriate at the regional level, but for the rural area it did not provide the necessary, therefore it is required a restructuring of the school infrastructure and the implementation of investment projects in correlation with the local needs.

The health infrastructure was characterized by a weak health system compared to the national level and in the rural area it was extremely weak. A more favorable situation was recorded in the counties in the North part of the region. In the region, there are places with difficult access to primary health care (Bughea de Sus commune in Argeș county, Plătărești commune in Călărași county, Perișani, Răscăeți, Râu Alb, Vlădeni and Vulcana Pandele in Dâmbovița county, Cosoba in Giurgiu county, Alexeni, Bărbulești, Bueşti, Ciocârlia, Colelia, Drăgoești, Giurgeni, Rădulești and Sărățeni communes in Ialomița county, Cosminele, Lapoș, Podenii Noi and Talea communes in Prahova county and Beciu, Fântânele, Frăsinet and Purani communes in Teleorman county).

At the regional level, it was recorded an increase of the number of medical staff.

The region occupied the last place at the national level in the number of doctors per 1,000 inhabitants, with only 1.41 doctors.

The region occupied the last place also in the number of beds in the hospitals at 1,000 inhabitants with only 4,8 beds.

The conclusion is that for the improvement of the educational and health infrastructure in South Muntenia region investments area needed correlated to the local needs, especially in the rural area.

Under the community programmes, funds can be granted for the improvements of the schools, especially in the rural area.

Also, there is a major discrepancy between the counties in the North part of the region, which are more developed and the counties in the South part of the region, which are less developed. This discrepancy can also be solved by adequate investments in the respective area.

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STUDY REGARDING SUPPLY AND DEMAND OF TOMATOES IN ROMANIA (2009-2011)

Dragoş Mihai MEDELETE, Radu Lucian PÂNZARU

University of Craiova, Faculty of Agronomy, 19 Liberty Street, 200421, Craiova, Romania, Phone: +40 072 712 967, Fax: + 40 251 418 475, E-mail: medelete@yahoo.com

Corresponding author: rlp1967craiova@yahoo.com

Abstract

Tomatoes are one of the most important vegetable crops in Romania, at least through the related areas (about 47,000 hectares). In these circumstances Romania has a high production potential (over 700,000 t), which potentially can be improved by applying appropriate measures conducive to productive performance increase per unit - hectare. Regarding the period 2009-2011 it is clear that national food balance sheet is uniform (supply equals demand). Within total supply, it is noted that imports exceed exports significantly and is no mention of stocks. At the level of total demand, is distinguished as components only the human food and losses.

Key words**:** *import, export, supply, food, losses, total demand*

INTRODUCTION

Vegetables grown in the open, industrial greenhouses, solar and other shelters, are important for food, industrial, factor of intensifying land use and utilization of labor resources, fodder, export and source of profit [1].

On the tomato fruit is consumed harvested at physiological maturity, and before full ripening, so-called green tomatoes, but in very limited extent and only in some countries, especially in the Balkan [7].

Agricultural commodity demand is dispersed and irregular quantitatively. The demand for first necessity food is less elastic in relation to prevailing market prices [2].

When referring to the constitution of the production, we should note the influences of areas planted and average yields. In Romania the average yields per hectare of vegetables was worth around half the yields of Western European countries. As a result, the total vegetable production followed the same trend as the area under cultivation. The surface cultivated with vegetables is fluctuating, among others marked the perishability of those products that prevent and stabilization of cultivated areas [9].

Consumer Act can be considered as a measure of destruction (in the category "sustainable fungible good or good"), or purchase of property. As the general form is best time to purchase a commodity and it is less important whether the purchased product is used or not [8].

Eating tomatoes is under the influence of the phenomenon perishable items. Knowing the demand is considered a necessity for farmers and processors through this process may be schedule submitted quantitative and qualitative production, and a rhythm that can partially mitigate the seasonality [3].

MATERIALS AND METHODS

In order to highlight the specific situation relating to the supply and demand of tomatoes were used information extracted from the FAO website [10].

Formation of total supply, has gone from data for domestic production, imports and stocks while the total demand was carried summing quantities relating to food and losses. For Romania, unlike other state or regional entities, not included data on stocks, food consumption the seeds, raw materials and other non-food uses.

The research supply can be achieved both in profile static (looking at the situation at a given time) and in profile dynamic (this date being investigated mutations that occur in size

and physiognomy tender, its distribution space and links trade) [6].
In a certain period of time, the demand for a good can reduce or increase [4].
Following the above issues related to supply and demand, the analysis method used is the comparison while pursuing the dynamic evolution of the phenomenon for some time, and highlights the deviations to the terms of reference being operated [5]. In addition to the years 2009, 2010 and 2011 series includes dynamic the average period to give a more comprehensive of the study published.

RESULTS AND DISCUSSIONS

Table 1 presents the components of total supply and total demand nationwide for 2009-2011.
For 2009 it can be seen that the balance sheet was a balanced supply with demand being equal - 907,468 t. Offer is based on the following components: production 755,596 t (83.26%), imports 156,557 t (17.26%), 4,685 t exports (-0.52%). Total demand contributed to the establishment: losses - 24,000 t (2.64%) and food consumption - 883,468 t (97.36%).

Table 1. National balance sheet structure (t)

No.	Specification	YEAR						Average 2009-2011	
		2009		2010		2011			
		Eff*	Str. %**	Eff*	Str. %**	Eff*	Str. %**	Eff*	Str. %**
1	Production	755,596	83.26	768,532	79.31	910,978	85.47	811,702	82.76
2	Import	156,557	17.26	203,550	21.00	158,275	14.85	172,794	17.62
3	Export	4,685	-0.52	3,000	-0.31	3,427	-0.32	3,704	-0.38
4	Total offer	907,468	100	969,082	100	1,065,826	100	980,792	100
5	Food	883,468	97.36	944,082	97.42	1,036,826	97.28	954,792	97.35
6	Loses	24,000	2.64	25,000	2.58	29,000	2.72	26,000	2.65
7	Total demand	907,468	100	969,082	100	1,065,826	100	980,792	100
8	Balance sheet	0	-	0	-	0	-	0	-

*http://faostat3.fao.org/download/FB/BC/F
** own calculation

In 2010, the total supply was 969,082 t at which components had the following percentage rates of participation: 79.31% production (768,532 t), 21.0% imports (203,550 t) -0.31% exports (3,000 t). Total demand was equal to the offer presenting as components the following: losses - 25,000 t (2.58%), and food consumption - 944,082 t (97.42%).
In the case of 2011 appears an equilibrium between total supply and total demand, each indicator reaching 1,065,826 t. In order to establish total supply, acted: production - 910,978 t (85.47%), import - 158,275 t (14.85%) and exports - 3,427 t (-0.32%). Formation of total demand for tomatoes is based on, variable quantities of product used as: loss - 29,000 t (2.72%) and food consumption - 1,036,826 t (97.28%).
Determining the average period analyzed, there is an equal balance of tomatoes. This offer starts from a total of 980,792 t, which had the following structure (Fig. 1): 82.76% production (811,702 t), 17.62% imports (172,794 t), -0.38% exports (3,704 t).
Total demand reached 980,792 t, thus presenting its structure (Fig. 2) 2.65% loss (26,000 t), 97.35% food (954,792 t).

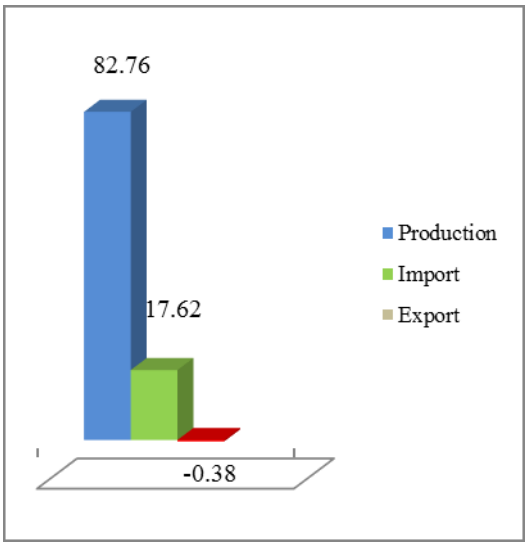

Fig. 1. National total supply - structure, period average (%)

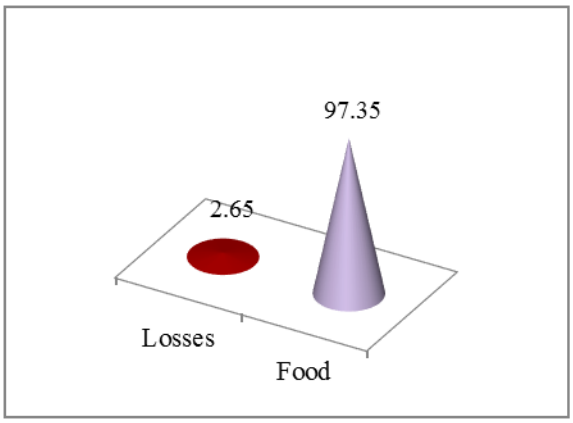

Fig. 2. National total demand - structure, period average (%)

Table 2 shows the dynamics of balance sheet components for tomatoes.

Production increased by 1.71% in 2010 compared with 2009, a trend that was maintained in 2011 (+20.56 and +18.53% respectively reporting to the bases). Average period was superior the first base of reporting 7.42%, but was lower than the second with 10.90%.

Regarding the imports can be observed their progress uneven. Thus, there are increases in 2010 compared to 2009 (+30.02%), and decreases in 2011 (-22.24%) compared to the previous period of dynamic series. The average of the period surpasses both reporting bases of 1.10 and 1.09 times respectively.

Romanian exports of tomatoes evolved somewhat similarly to imports. It decreased in 2010 compared with 2009 by 35.97%, after which in 2011 exceeded the previous term of the dynamic series by 14.23%. For the average period reveals levels of the indices above par on mobile base (1.08 outrunning the reporting base) and subunit levels for those with fixed base (-20.94%).

In the case of total supply, there is an upward trend, specific increases in 2010 (+6.79%) compared to 2009, being followed by other increases in 2011 (+17.45 and +9.98% against the terms of reference). In these circumstances, period average has been above par compared to 2009 (+8.08%) and below par compared to 2011 (-7.98%).

Table 2. Dynamics of the national balance sheet (2009-2011) *

No.	Specification	YEAR						Average 2009-2011	
		2009		2010		2011			
		I_{bf}	I_{bm}	I_{bf}	I_{bm}	I_{bf}	I_{bm}	I_{bf}	I_{bm}
1	Production	100	100	101.71	101.71	120.56	118.53	107.42	89.10
2	Import	100	100	130.02	130.02	101.10	77.76	110.37	109.17
3	Export	100	100	64.03	64.03	73.15	114.23	79.06	108.08
4	Total offer	100	100	106.79	106.79	117.45	109.98	108.08	92.02
5	Food	100	100	106.86	106.86	117.36	109.82	108.07	92.09
6	Loses	100	100	104.17	104.17	120.83	116.0	108.33	89.66
7	Total demand	100	100	106.79	106.79	117.45	109.98	108.08	92.02

* own calculations

At the level of consumption it is worth mentioning ascendant trend and successive annual increases of 1.06 times recorded in 2010 and 1.09 times in 2011.

Regarding of losses, is pointed the strictly upward evolving. In the years 2010 and 2011 occurred exceedances of the reporting bases of 1.04, 1.20 and 1.16 times respectively. The average period has known values above for indications with fixed base (108.33%) and subunit values for mobile base indications (89.66%).

Regarding the total demand dynamics reveals similar trend of total supply, this being determined by the similarity between the values of two indicators - for all the terms of dynamic series.

CONCLUSIONS

The study led to the following conclusions:

- in terms of components of balance it is worth to mention the different situation from that global one, but closer to the European one. Within total production, supply predominates (82.76%), but it is worth also the share of imports (17.62%). The total supply (980,792 t) is 4.28% compared to European indicator and 0.65% of the indicator in the world;

- total demand keeps weights contribution to global also continental, as in the total supply. Like global and continental, also in Romania the demand structure is dominated by food consumption (97.35% - outweigh the retrieved globally and continental);
- the vast majority of balance sheet items have a strictly upward trend (production, total supply, food consumption, losses and total demand), while others show uneven developments (import and export);
- for Romania would need the superior noted the existing potential for growing tomatoes and better management components of total demand.

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THE EFFECT OF *Trichoderma viridae* USAGE OF NUTRITIONAL VALUE ON *Goroho* BANANA STEM (*Musa acuminafe, sp*)

Marie NAJOAN, Fenim WOLAYAN, Betty BAGAU, Nerry SOMPIE

Universitas Sam Ratulangi, Faculty of Animal Husbandry, Manado, Indonesia, Jl. Kampus Unsrat Bahu, Kleak, Malalayang, Manado 95115, Indonesia, E-mail: najoanmarie@yahoo.com

Corresponding author: najoanmarie@yahoo.com

Abstract

Research on the nutritional value of goroho banana stem (Musa acuminafe, sp) fermented by Trichoderma viridae has been carried out in the Laboratory of Technology and Animal Feed Industry of the Faculty of Animal Husbandry at Universitas Sam Ratulangi, Manado. The purpose of this study was to evaluate the effect of Trichoderma viridae inoculum dose and fermentation time to changes in nutritional value (Ash, Crude Protein, Crude Fibers and Crude Lipid) of the fermentation goroho banana stem flour products. This study was designed using completely randomized design with nested pattern. Factor A is the inoculum dose of the Trichoderma viridae fungi of 0.3, 0.6 and 0.9 percent, and factor B is the fermentation time of 4, 8 and 12 days; each treatment was repeated 3 times. Factor B is nested in factor A. Statistical tests with analysis of variance and differences between treatments using Duncan's multiple range test. The results obtained are fermented goroho banana stem flour (Musa acuminafe, sp) with Trichoderma viridae dose of 0.6 percent for 8 days produced the best nutritional content changes (Ash 20.17%, Crude Protein 21.69%, Crude Fiber 14.94%, and Crude Fat 20.17%).

Key words: *Goroho banana flour, Trichoderma viridae, ash, crude protein, crude fiber, crude fat*

INTRODUCTION

Efforts to locate and utilize other materials, including waste materials or whose primary purpose is not to be used as food, is a right step, enabling to increase the diversity of feed ingredients making up the ration, and rising the materials economic value and, even further, reduce the environmental pollution.

Goroho banana *(Musa acuminafe, sp)* is a unique type of banana that only grow in this area; is highly favored by consumers, particularly in the city of Manado and Minahasa region. The favor is marked by so many fried snack outlets that offer fried *goroho* banana, because it has a distinctive taste and is could be consumed by diabetics. *Goroho* banana has special characteristic, where its skin color remains green despite being overharvested [21]. The largest component of the banana plant is the stem (60%), compared to the leaves (10%) and fruit (10%) [11]. When the fruit is being harvested, the stem of bananas will be discarded and left to rot unused. The nutrient content of banana stem are as follows: crude protein (4.81%), crude fibers (27.73%), crude fats (11.23), lignin (9.92) and ash (23.12%) [9]. Another research also reported that the banana stems nutrient compositions are, 2.4 to 8.30% crude protein, crude fiber 13.40 to 31.70%, crude fat from 3.20 to 8.10% and ash from 18.24 to 24.76% [23]. Banana stems contain lignin and tannin which act as inhibitors in reducing dry and organic materials [15][25]. The tannin, as a phenol compound, may degrade organic material digestibility, mostly protein, to form a complex bond of tannin-protein [22]. The tannins may cause decrease the protein digestibility and nitrogen retention on poultry [17].

The weakness of banana stem as feed ingredients for livestock directly in its natural form is the high palatability value and high crude fiber content. Besides, the existence of tannin as a phenol compound that will affect the organic material digestibility, particularly protein, with the formation of protein-tannin complex bond that is hard to be digested in the digestive system, and high fiber content. One technology that can be used to overcome the constraints of banana stem utilization as a ration component is by using microorganisms through a fermentation

process. This is due to the enzyme activity produced by the microorganism which may cause changes in the nutrient composition of the media, covering changes of complex molecules such as protein, carbohydrate and fat, into simple molecules.

One of microorganisms that can be used is *Trichoderma viridae.* Fungus is well known as cellulolytic organisms and produce cellulolytic enzymes, including cellobiohydrolase, endoglucanase and ß-glucosidase [5]. In the process of fermentation factors that must be considered, namely, inoculum dose, temperature, substrate, pH and nutrients, as well as the time required by the microbes to grow and multiply. Through the process of fermentation flour made from the *goroho* banana stem is expected to have increased nutritional value, so it can be used as feed material of better quality than the original material. There are any changes made in the substrate through the fermentation process [24]. Coconut cake fermentation with *Trichoderma viridae* on inoculum dose of 0.6% and 6-days fermentation time may increase the protein content and lower crude fiber.

Nutrition supplied by the *goroho* banana stems is not yet sufficient, but when it is being related to the nature of carbohydrates contained in plants and the use of fermentation technology, it is expected that the quality can be increased and later allowed this waste to be used as the ration. The use of *goroho* banana stem in the ration of broiler without fermented resulted in limited role, replacing only 5 percent of the corn in the ration measured by feed intake, weight gain, feed conversion, carcass percentage and abdominal fat [13].

MATERIALS AND METHODS

This research was conducted at the Laboratory of Technology and Animal Feed Industry of the Faculty of Animal Husbandry at Universitas Sam Ratulangi, Manado. The method used was a laboratory experiment using a completely randomized design with nested pattern. Treatment at this stage of research: factor A is the dose of *Trichoderma viridae* fungi consisted of: D1 = 0.3%; D2 = 0.6%; D3 = 0.9%. Factor B is the fermentation duration, comprised of: W1 = 4 hours; W2 = 8 days; and W3 = 12 days. Each treatment combination was repeated three times, thus obtained 27 experimental units. During the fermentation process of *goroho* banana stem flour, *pocari sweat* was added as much as 50 percent in the *autoclave* for 15 minutes. The substrate is cooled, then the inoculation and incubation process is carried out in accordance with the treatment on each factor. After that, the substrate is dried and the nutrients content is analyzed using Proximate Analysis Method according to *AOAC (1995)* [1].

Data were statistically analyzed according to completely randomized design with nested pattern [10]. The real difference between treatments were being tested further by *Duncan's Multi Range Test* [19].

RESULTS AND DISCUSSIONS

Effect of inoculum dose and fermentation time to change Ash Content

Results showed that changes in the content of Ash depend on inoculum dose and the duration of fermentation. The average of change in Ash content can be seen in Table 1.

Table 1. Average of Ash Content Reduction in Fermentation Products on each Treatment

Treatment		Repetition			Amount	Average
Dose	Time	1	2	3		
		----------%----------				
D1	W1	3.24	3.23	4.01	10.48	3.49
	W2	5.06	4.95	5.02	15.03	5.01
	W3	5.10	6.12	6.33	17.55	5.85
Average						4..78[a]
D2	W1	8.54	7.69	8.40	24.63	8.21
	W2	11.57	12.33	11.03	34.93	11.64
	W3	12.10	11.56	12.90	36.56	12.21
Average						10.68[b]
D3	W1	12.00	11.10	10.70	33.80	11.27
	W2	13.25	12.90	11.23	37.38	12.46
	W3	12.50	11.10	13.00	36.60	12.20
Average						11.98[b]

Notes: D1= 0.3 %; D2 = 0.6%; D3= 0.9%; W1 = 4 days; W2= 8 days; W3 = 12 days

The data on Table 1 show the reduction in Ash content; with the most reduction happened on treatment D2W3 *(T.viridae* 0.6 per cent, 12 days) and the least reduction on treatment D1W1 *(T.viridae* 0.3 percent, 4 days). Results of variance analysis showed that the treatment of inoculum dose and the

fermentation duration have significant influence (P> 0.05) to the decrease of ash content. Decrease in ash content identified an increase in the number of organic material substrates. Organic materials contained important nutrients, such as proteins, fats and carbohydrates as well as vitamins. Therefore, loss of organic material means it will also lose nutrient substances which are quite important. In terms of nutrients, the amount of ash is not so important, but in the proximate analysis the ash is necessary to calculate or measure the NPF value (extract ingredients without N) [4]. This study is in line with research on rice straw fermentation using *Trichoderma viridae*, in which the ash content also happened to decrease, which showed an increase of organic material during the fermentation process [20]. Increase of organic material content is allegedly because after fermentation, the substrates experienced nutrient contents recast by microorganic enzymes so that the percentage of nutrients that can be utilized was increased, which was reflected by the increased protein value and reduced level of ash [14].

The treatment combination of 0.9 percent inoculum dose and fermentation duration of 12 days resulted in higher rate of ash content reduction compared to the treatment combination of 0.3 per cent inoculum dose with fermentation duration of 4 days and the treatment combination of 0.6 per cent with fermentation duration of 8 days. Regardless of the results, statistically there is no significant difference (P>0.05) between the treatment combination of 0.6 percent inoculum dose with fermentation duration of 8 days and the treatment combination of 0.9 percent inoculum dose with fermentation duration of 12 days. This means that inoculum dose of 0.6 percent combined with fermentation duration of 8 days is more effective in increasing the percentage of the ash content reduction of the *goroho* banana stems fermentation products.

This is in accordance with the opinion of Fardiaz, which states that an increase in the reduction percentage on ash content during the fermentation process is caused by the increase in fungi body cell mass and the increase in the product concentration due to various changes in organic material resulted by the bioconversion processes that produced H_2O and CO_2 [7].

The Effect of Inoculum Dose and the Fermentation Duration on Crude Protein Content Changes

The results showed that an increase in the reduction percentage on crude protein content depend on inoculum dose and the duration of fermentation. The average of the increasing crude protein content level can be seen in Table 2.

Table 2. Average of the Increasing Crude Protein Content Level of Fermentation Products of each Treatment

Treatment		Repetition			Amount	Average
Dose	Time	1	2	3		
		----------%----------				
D1	W1	17.59	16.08	19.85	53.52	17.84
	W2	16.83	18.09	17.21	52.13	17.38
	W3	18.40	19.33	20.88	58.61	19.54
Average						18.25[a]
D2	W1	18.79	20.50	20.55	59.84	19.95
	W2	20.34	21.86	22.88	65.08	21.69
	W3	21.12	24.38	23.04	62.14	20.72
Average						21.50[b]
D3	W1	21.60	20.44	21.34	63.38	21.13
	W2	21.87	22.61	23.13	67.61	22.54
	W3	20.35	20.85	22.99	64.19	21.40
Average						21.69[b]

Notes: D1 = 0.3%; D2 = 0.6%; D3 = 0.9%; W1 = 4 days; W2 = 8 days; W3 = 12 days

The data on Table 2 show the crude protein content increase; with the most happened on treatment D2W2 *(T.viridae* 0.6 percent, 8 days) and the least happened on treatment D1W1 *(T.viridae* 0.3 percent, 4 days). Variance analysis test showed that the treatment of inoculum dose and the duration of fermentation have significant influence (P> 0.05) to increase the protein content. Furthermore, the Duncan's multiple range test was done to determine the effect between treatments.

Treatment D2 *(T.viridae 0.6 percent)* did not differ significantly (P> 0.05) from treatment D3 *(T.viridae 0.9 percent)* against the crude protein content of the *goroho* banana stem flour obtained from fermented products. Table 2 shows that the highest crude protein content was obtained on treatment D3 (fermentation with 0.9% inoculum dose), but statistically it did not differ significant with treatment D2 (fermentation with 0.6% inoculum dose). This is due to the fungus *Trichoderma viridae* capability of utilizing organic materials contained in the substrate to be converted to

crude protein. During the fermentation process the growth of crude protein level causes an increase in the number of microbial biomass [3]. The fungus, which has the ability to produce the enzyme protease, will remodel the protein. Protein changed into polypeptides, then into small peptides which ultimately further recasted into amino acids, which will be used by microbes to proliferate. The growth on the number of microbe colonies, which is a single cell protein, during fermentation indirectly increased the crude protein substrate content [2][3]. Afterwards, the Duncan's multiple range test was done to determine the fermentation duration on treatment D2 (fermentation with 0.6% inoculum dose) on the reduction in the crude protein content level of the flour banana stems fermented products.

Treatment with fermentation time of 8 days had no significant influence (P> 0.05) with the treatment with fermentation period of 12 days on the crude protein content level of the *goroho* banana stem flour. The longer the fermentation time, the higher is the growth of the crude protein content level of the fermented banana stem flour products. This is due to fungus *Trichoderma viridae* will always take advantage of organic material on the substrate. In this study, the best treatment duration is 8 days, because statistically there are no significant difference between 8-days treatment and the 12-days treatment.

It is in accordance with the four principal stages of the microbe growth, namely: *lag phase* (adaptation phase), which at this time the growth happened slowly and microbes tend to adapt with the new environment; *exponential / logarithmic phase* (growth phase); *stationary phase* (phase where the death level is balanced with the growth level); and *death phase*, where mortality is greater than growth [6].

The Effect of Inoculum Dose and the Fermentation Duration on Crude Fiber Content Changes

Results showed that changes in the content of crude fibers depend on inoculum dose and the duration of fermentation. The average change in the content of crude fibers can be seen in Table 3.

Table 3. Average Reduction of Crude Fiber Content of Fermentation Products of each Treatment

Treatment		Repetition			Amount	Average
Dose	Time	1	2	3		
		----------%----------				
D1	W1	8.83	9.24	9.60	27.67	9.22
	W2	10.22	10.77	11.63	32.62	10.87
	W3	11.76	11.99	10.65	34.40	11.47
Average						10.52[a]
D2	W1	11.55	12.22	13.01	36.78	12.26
	W2	14.41	14.41	15.01	43.43	14.48
	W3	15.00	14.99	15.32	45.31	15.10
Average						13.99[b]
D3	W1	13.09	14.01	13.90	41.00	13.67
	W2	15.01	15.23	14.99	45.32	15.11
	W3	16.01	15.09	16.31	47.41	15.80
Average						14.27[b]

Notes: D1 = 0.3%; D2 = 0.6%; D3 = 0.9%; W1 = 4 days; W2 = 8 days; W3 = 12 days

The data on Table 3 show the reduction in crude fiber content; with the most reduction happened on treatment D3W3 *(T.viridae* 0.9 per cent, 12 days) and the least happened on treatment D1W1 *(T. viridae* 0.3 percent, 4 days). Variance analysis tests showed that the treatment dose and the duration of fermentation inoculum have significant influence (P> 0.05) in reducing the content of crude fiber. Furthermore, the Duncan's multiple range test was done to determine the effect between treatments.

The result showed that the treatment using dose of 0.6% (D2) did not differ significantly (P> 0.05) with treatment using dose of 0.9% (D3) but significantly different (P <0.05) with treatment using dose of 0.3% (D1). It showed that the treatment D2 (with dose of 0.6%) is the most effective treatment to reduce the percentage of crude fiber of the *goroho* banana stem fermented products flour. It is proved that, as lignocellulolytic microbes, fungi *Trichoderma viridae* were able to remodel the high-fiber feed so as to reduce the percentage of crude fiber on the coconut substrate [24].

The reduction of crude fiber percentage is related with the cellulase enzymes produced by *Trichoderma viridae*. Cellulase is a group of fibrolitic enzymes capable of hydrolyzing fibers on plant cell walls into glucose [12]. Furthermore, the fermentation time on the treatment dose inoculum 0.6 percent (D2) to the decrease of the content of crude fiber decline in crude fiber in the treatment of D1, D2, and D3, W3 treatment (12 days) had no significant (P.0.05) with treatment W2 (8 days) but clearly different to the treatment D1

(4 days). That is a long fermentation period of 8 days to more effectively reduce the percentage of coarse flour banana stem fiber product goroho fermentation.The decreased percentages of crude fiber, to do the role of microbes in this fungus *Trichoderma viridae,* these fungi produce cellulase enzymes. Cellulase enzyme would degrade cellulose into simpler carbohydrate compounds that can be utilized by fungi as a source of energy, it will reduce the proportion of coarse fiber content of the *goroho* banana stem flour [16].

The Effect of Inoculum Dose and the Fermentation Duration on Crude Fat Content Changes

Results showed that changes in crude fat content depend on inoculum dose and the duration of fermentation. Average changes in crude fat content can be seen in Table 4.

Table 4. Average Reduction of Crude Fat Content of Fermentation Products of Each Treatment

Treatment		Repetition			Amount	Average
Dose	Time	1	2	3		
		----------%----------				
D1	W1	14.88	14.45	15.70	45.03	15.01
	W2	17.62	19.01	18.18	54.81	18.27
	W3	18.18	18.79	19.01	55.98	18.66
Average						17.31[a]
D2	W1	18.78	17.27	18.04	54.09	18.03
	W2	20.49	21.01	19.01	60.51	20.17
	W3	20.33	20.55	19.90	60.78	20.26
Average						19.49[b]
D3	W1	19.18	20.49	20.62	60.29	20.97
	W2	21.18	22.88	21.09	65.09	21.70
	W3	20.33	25.56	23.06	65.95	21.98
Average						21.26[b]

Notes: D1 = 0.3%; D2 = 0.6%; D3 = 0.9%; W1 = 4 days; W2 = 8 days; W3 = 12 days

The data on Table 4 show the reduction in crude fat content; with the most reduction happened on treatment D3W3 *(T.viridae* 0.9 per cent, 12 days) and the least reduction happened on treatment D1W1 *(T.viridae* 0.3 percent, 4 days). Variance analysis tests showed that the treatment of inoculum dose and the duration of fermentation have significant influence (P> 0.05) in lowering the crude fat content. Furthermore, the Duncan's multiple range test was done to determine the effect between treatments.

The result showed that the treatment using dose of 0.6% (D2) did not differ significantly (P> 0.05) with treatment using dose of 0.9% (D3) but significantly different (P <0.05) with treatment using dose of 0.3% (D1). It showed that the treatment D2 (with dose of 0.6%) is the most effective treatment to reduce the percentage of crude fat content of the *goroho* banana stem fermented products flour. In the fermentation process, *Trichoderma viridae* used fat as the energy source for breeding [8].

Time fermentation inoculum dose treatment D1, D2, and D3, W3 treatment (12 days) had no significant (P> 0.05) with treatment W2 (8 days) but clearly different to the treatment D1 (4 days). That is a long fermentation period of 8 days to more effectively reduce fat percentage of coarse flour banana stem goroho fermentation products. The changes that occur during the process of fermentation can occur in fat in the substrate, a neutral fat will be hydrolyzed into free fatty acids, which are used for the growth of fungi [18]. This occurs in flour banana stem inoculation with the fungi *Trichoderma sp* goroho looks rough can decrease the fat content of the substrate.

CONCLUSIONS

Based on the results of this study, it can be concluded that the best value of the inoculum dose for *Trichoderma viridae* is 0.6% with a fermentation time of 8 days resulted in changes to the content of ash, crude protein, crude fiber, and crude fat content of the *goroho* banana stem flour *(Musa acuminafe, sp),* respectively Ash 20.17%, Crude Protein 21.69%,Crude Fiber 14.94% and Crude Fat 20.17%.

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QUALITATIVE CHARACTERISATION OF THE WHITE WINES OBTAINED IN THE COMPANY S.C. MURFATLAR ROMANIA S.A. IN THE PERIOD 2013-2015

Cecilia NEAGU

University of Agricultural Sciences and Veterinary Medicine Bucharest – Călăraşi Faculty Branch, 1 Nicolae Titulescu, Călăraşi, Romania, Phone/Fax: +40242332077, E-mail: cecilianeagu2005@yahoo.com

Corresponding author: cecilianeagu2005@yahoo.com

Abstract

SC Murfatlar SA, in a country with a long tradition in wine production, is proving to be one of the oldest, largest and innovative vineyards, with a location that gives a particular microclimate, favorable for the achievement of a wide variety of wines, of high quality. The purpose of the paper is to establish the dynamic quality of the white wines produced in S.C. Murfatlar Romania SA, by analyzing the main physical-chemical parameters responsible for the wine quality (alcoholic strength%, free sugar g/l, total acidity g/ l $C_4H_6O_6$, its no-reducing dry extract g/ l, total SO_2 mg/ l), for 12 samples analyzed. The main physical-chemical parameters, namely alcoholic strength, free sugar and total acidity recorded a significant increase in the analyzed period, for the two types of white wines from the four analyzed. All analyzed parameters were within the limits imposed by the International Organization of Vine and Wine (OIV) during the studied period.

Key words**:** *quality, physical-chemical parameters, white wines*

INTRODUCTION

Wine is an alcoholic beverage obtained exclusively by full or partial fermentation of fresh grapes crushed or subject to authorized processing or fresh grapes [9].

The wines that have controlled origin name and quality levels (D.O.C.) represent the highest category of quality [5]. Quality level award is motivated by several factors, such as the sugar content, the proportion of raisin berries, the attack of noble mold, which are determined primarily by the harvest time [2].

The total wine production recorded in 2015 in our country was of 3.6 million hectoliters, representing 65% of the total production of white wines, slightly in contradiction to the global trend, preferring red wine, this having only 30% of the production and rosé wine, 5% [12].

The title of the largest wine producer in Romania belongs to the company SC Murfatlar Romania SA, both based on the turnover recorded in 2015 (25.41 million euros), the vines area owned (over 3100 ha) and the production capacity (over 29 million liters annually of wine) and storage capacity (over 43 million liters of wine) [11].

The company owns the largest growing area in Romania, near the localities Basarabi, Valul lui Traian, Poarta Albă, Siminoc and Valea Dacilor. The company has the largest wine cellar in Romania, with a huge storage capacity of over 43 million liters of wine [10].

The wines produced by SC Murfatlar Romania S.A. participate annually in most international wine competitions and annually win medals (over 55 medals), contests like Chardonnay du Monde, Decanter World Wine Awards IWSC, Japan Wine Challenge etc. - all these medals strengthening the reputation of Murfatlar wine, an authentic product, with undoubted qualities [10].

The variety structure contains at present about 200 wines, in proportion of 65% white wines (Chardonnay, Sauvignon Blanc, Muscat Ottonel, Riesling Italian, etc.), 30% red varieties (Fetească Neagră, Cabernet Sauvignon, Merlot, Pinot Noir, etc) and 5% rosé varieties.

MATERIALS AND METHODS

The present study aims at analyzing the dynamics of qualitative parameters of white wines produced in the company Murfatlar Romania S.A. in the period 2013-2015. To this end, I conducted an analysis of the main physical-chemical characteristics, based on the data collected from the analysis report of the company S.C. Murfatlar Romania S.A. The analyzed physical - chemical characteristics for each wine were alcohol concentration (%), sugar free (g/l), total acidity $C_4H_6O_6$ (g/l), no-reducing dry extract (g/l), and total SO_2 (mg/l).
I analyzed also if the qualitative parameters of the four types of wines were within the limits imposed by the International Organization of Vine and Wine (OIV) during the studied period [9].

RESULTS AND DISCUSSIONS

The values of the main physical-chemical parameters responsible for white wine quality had in the period 2013-2015 the following values [8]:

Table 1. Physical-chemical parameters of white wines produced by S.C. Murfatlar Romania S.A. in the period 2013-2015

No	Year	Alcohol vol (%)	No-reducing dry extract (g/l)	Total acidity (g/l $C_4H_6O_6$)	Sugar free (g/l)	SO_2 total mg/l
White wine Sauvignon Blanc Collection Leat 6500 The Origin						
1	2013	12.00	18.70	5.70	9.70	169
2	2014	12.50	21.70	7.30	8.30	156
3	2015	12.70	19.60	6.02	8.30	184
White wine Chardonney -Collection Leat 6500 The Origin						
4	2013	12.80	20.80	7.10	2.50	143
5	2014	13.15	20.20	6.50	2.50	164
6	2015	13.20	20.40	6.09	2.80	164
White wine Muscat Ottonel - Collection Zestrea Murfatlar						
7	2013	11.70	20.80	5.91	35.8	164
8	2014	11.80	22.10	6.53	34.0	207
9	2015	12.10	22.70	5.82	38.4	207
White wine Riesling Italian - Collection Premiat						
10	2013	12.50	17.80	5.77	7.40	153
11	2014	12.80	18.20	6.57	7.40	189
12	2015	13.00	21.00	6.50	6.00	192

Regarding the sugar free, we see in figure 1 that for white wines Chardonney and Muscat Ottonel, its values had an increase in 2015 compared to the first year studied, up to 12% and 7.3%. Contrary to it, Sauvignon Blanc and Riesling Italian wines decreased by 14.4% respectively, 18%.

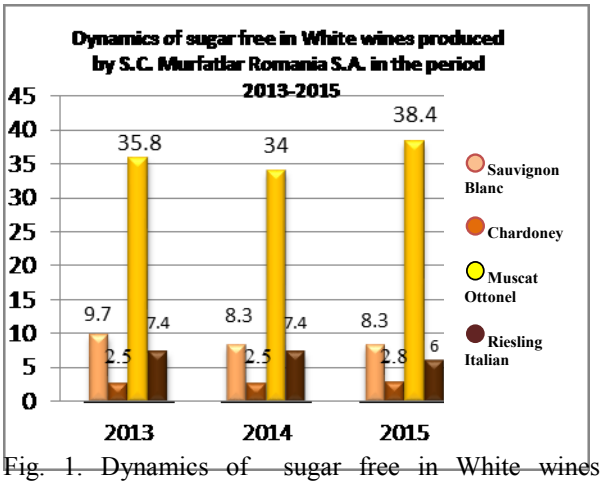

Fig. 1. Dynamics of sugar free in White wines produced by S.C. Murfatlar România S.A. in the period 2013-2015

These differences regarding the evolution of the 4 sugar free wines can be caused by the technology and features of grapes from which the wine was produced.
We see also that out of the 4 wines, Muscat Ottonel is the wine with the highest sugar free quantity accumulated, mainly due to the fact that the variety from which the wine was made had good weather conditions in 2015. The grapes were sweet, with intense honey flavors, with a crispy ad vegetal skin, some of them nearly dried, with some traces of noble mold, ideal conditions for the wine with a high concentration of sugar.
In contrast, Chardonney wine recorded the lowest values of free sugar, because a specific wine-making technology was chosen to obtain a dry wine. Must extracted carefully and clarified, an inoculation with selected yeasts was also made, following fermentation in new Romanian oak barrels. The wine left for maturation for 14 months, with periodic homogenization of fermentation yeast.
Depending on the content of sugars accumulated, the 4 studied wines are included in types of wine as follows: white wine Sauvignon Blanc - semi-dry wine, white wine Chardonney - dry wine, white wine Muscat Ottonel - semi-sweet wine and white wine Riesling Italian semi-dry wine.
Another parameter which plays an important role in the wine quality is represented by

alcoholic strength [1], influencing the flavor perception, taste, viscosity, sweetness, astringency and wine type. Also, it has an important role in wines preservation [3].

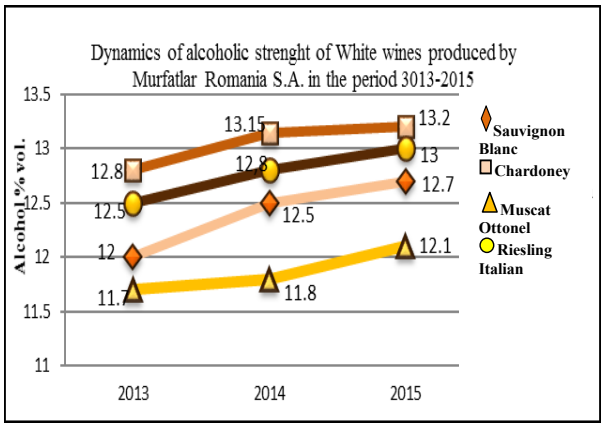

Fig. 2. Dynamics of alcoholic strength of White wines produced by S.C. Murfatlar Romania S.A. in the period 2013-2015

During the period 2013-2015, all 4 white wines studied had an increased trend in terms of alcoholic strength, recording on an average increases of over 4%. The highest values of the alcoholic strength were recorded in Chardonney white wines and Italian Riesling.
Alcoholic strength differences between the four types of wine can be explained by distinct duration of fermentation processes and the sugar content, these two factors largely influenced the alcoholic strength.
The total acidity gives wines the characteristic taste, lively, slightly sour [4].
In terms of dynamics of total acidity, we note the following variation in the analyzed period:

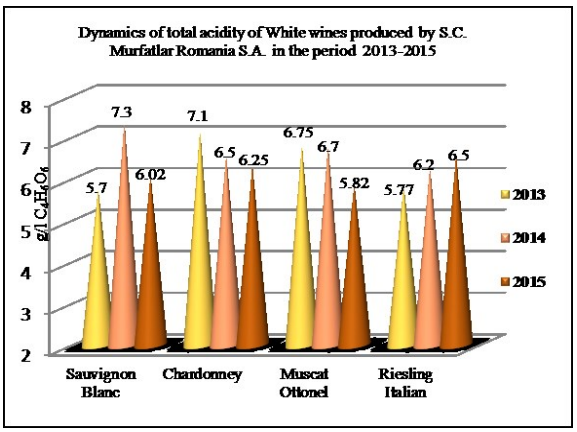

Fig. 3. Dynamics of total acidity of White wines produced by S.C. Murfatlar Romania S.A. in the period 2013-2015

Figure 3 shows that Sauvignon Blanc and Italian Riesling wines have recorded increases in acidity, with 12.65% respectively 5.61%. Contrary to them, Muscat Ottonel and Chardonney wines suffered a decline in total acidity values up to 14.23% respectively 1.52%, decrease which correlates with simultaneous increase of the sugar free content and alcoholic strength, previously analyzed, because the alcohol and sugar content moderate the wine acidity, giving them a balance [6].

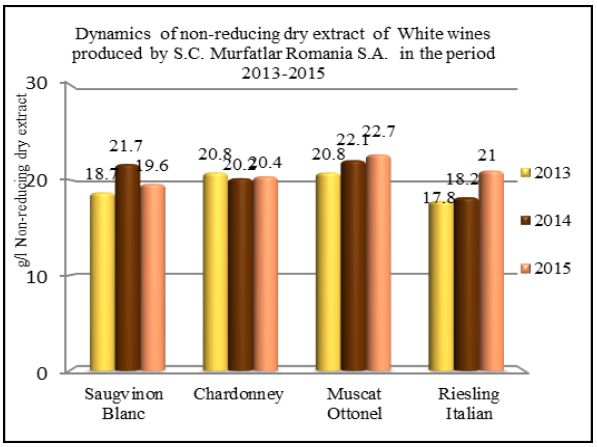

Fig. 4. – Dynamics of non-reducing dry extract of White wines produced by S.C. Murfatlar Romania S.A. in the period 2013-2015

No-reducing dry extract is a criterion for assessing the authenticity and naturalness of wines and from the 4 studied white wines, we note that the most extractive wines throughout the period Muscat Ottonel wines, with values over 20 g/l. The different level of no-reducing dry extract of the 4 wines is due to various processing technologies used, practices and treatments performed on wines and the features of used grapes.
In the case of Muscat Ottonel wine, in order to obtain a bigger extract, it was decided that the grapes Muscat Ottonel variety to be harvested when full ripening and immediately subject to a maceration in cold for 10 hours, following the fermentation in tanks of small dimensions.
The total sulphur dioxide plays an important role in determining the wine quality, helping preserving the flavor and freshness of color, participating in the bouquet formation, preventing illness of wine [7].

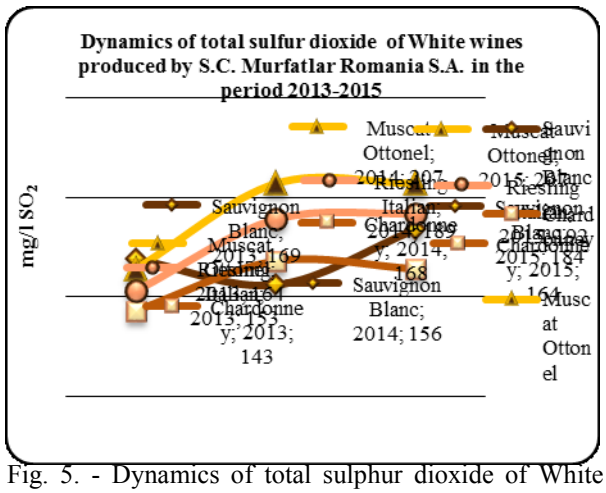

Fig. 5. - Dynamics of total sulphur dioxide of White wines produced by S.C. Murfatlar Romania S.A. in the period 2013-2015

In 2015, compared to the first year studied, we see that all white wines analyzed recorded increases of total sulfur dioxide content, the highest growth having Italian Riesling wine, with over 25.49%.

CONCLUSIONS

Based on the analyses made, I concluded the following:

From the point of view of the physical-chemical composition, the analyzed wines belonged to the following quality categories and types of wines depending on sugar:

♦ Saugvinon Blanc corresponded to the quality category DOC CMD and semi-dry wine type;

♦ Chardonney – quality category DOC CMD and dry wine type;

♦ Muscat Ottonel – quality category DOC CT and demi-sweet wine type;

♦ Riesling Italian – quality category DOC CMD and demi-dry wine type;

In the case of Chardonney and Muscat Ottonel wines, it was also noted an important increase trend of the main physical-chemical parameters responsible for the wine quality, respectively the alcoholic strength, sugar free and total acidity.

The qualitative parameters of four wine were within the limits imposed by the International Organization of Vine and Wine [9].

For the future, I propose the achievement of winemaking of the white wine varieties in cement amphorae instead of the current steel tanks (method applied to red wines at present) to obtain a superior type of these wines.

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EFFECTS OF ENZYME SUPPLEMENTATION OF CASSAVA FLOUR-BASED DIETS ON PERFORMANCE AND ECONOMIC EFFICIENCY OF BROILER CHICKEN

Gbolagunte S. OJEWOLA[1], Uzodinma L. OKEKE[1], Adeyemi O. OLOJEDE[2]

[1]Michael Okpara University of Agriculture, Umudike. College of Animal Science and Animal Production, Department of Animal Nutrition and Forage Science. P.M.B 7276, Umuahia, Abia State Nigeria, Email: gsojewola@gmail.com, uzolouisokeke@gmail.com
[2]National Root Crops Research Institute, Umudike, P.M.B 7006, Umuahia, Abia State, Nigeria. Email: yemi@gmail.com

Corresponding author: gsojewola@gmail.com

Abstract

Two hundred and forty three day-old early strain (Abor acre) broiler chicks were randomly assigned to nine treatment diets, replicated thrice in a Completely Randomized Design (CRD) to evaluate the substitutional effects of enzymes supplemented and non-supplemented dietary cassava flour for maize in broiler nutrition. The experiment lasted 49days (7weeks). Growth performance, feed and economic efficiency, carcass and organ proportions, serum chemistry and hematological parameters were significantly (P<0.05) influenced. Birds fed diet 1 gave a superior (P<0.05) performance over and above all the other diets in terms of the mean final weight (1885.18g), body weight gain (1,834.19g), revenue (₦1,100.20) and gross margin (₦125.33) realizable, hematology and serum chemistry values. This was closely followed by birds fed diets 2, 3, 4 and 5. The results further showed that substitution of maize with enzymes supplemented and non-supplemented cassava flour beyond 50% in the broiler diets reduced revenue (₦) realizable and gross margin (₦), an indication that the diets did not optimize economic returns nor enhance biological values. In conclusion, diets 1 on one hand and 2, 3, 4 and 5 on the other are hereby recommended for optimal performance and economic returns.

Keywords**:** *cassava flour, enzyme, performance, economics and broiler chicken*

INTRODUCTION

There is the need for food production to increase as the human population increases. This becomes necessary because the economy of the nation is inextricably linked to the health of his populace. A healthy and well-motivated populace is the bedrock of wealth creation. Among the various food nutrients required by man, animal protein is the most important, followed by energy. Poultry provides the easiest, fastest and cheapest means of meeting such demand. Despite its potentiality in bridging the protein intake gaps of the nation, it is bedeviled with diverse problems which affect its population in diverse ways. Among such is the ever-increasing cost of grains, inadequate production, unavailability and stiff competition between man, animal and the industry for these grains and unstable Government policies. Inclusion of maize, a major conventional dietary energy source in poultry ration ranged from 60% to 70% of the cost of the feed [22]. The demand pressure for maize has not abated despite efforts made over the years to stem the trend. There is therefore the need to look for locally available and cheaper sources of alternative dietary energy for poultry if human demand for animal protein would be met at affordable cost. According to [11] cassava flour and cassava by-products (fiber, peels, chips) have proven to be very appropriate for this purpose. Cassava floor has 80-90% carbohydrate content which consists of starch, sugar, small amounts of pectins, hemicelluloses and cellulose [12]. Cassava production, food and job security, rural household income and foreign exchange earnings are inter related. In addition, investment in cassava research for livestock is an imperative that must now be given serious attention. Efforts had been made in the past to replace cereals with cassava in

poultry diets [11, 16] with attendant wide variability of results. Diverse processing methods had also been engaged to enhance the nutritive value of cassava products, while enzyme supplementation was used to mitigate the limitation placed on cassava products by the high fiber content [19].

The objective of this study therefore is to evaluate the efficiency of cassava flour with or without enzyme supplementation on the performance, organ and carcass characteristics, hematology and serum chemistry and cost efficiency of broiler chicken reared in a warm humid tropical condition.

MATERIALS AND METHODS

Experimental site

This study was carried out at the poultry unit of the Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike; Abia State, Nigeria. Umudike is located at $05^0$29 and $07^0$33 which is approximately 122m above the sea level and has maximum and minimum temperature of 36^0C and 27^0C respectively, with a relative humidity of 57-91%.

Test Material

The test material (cassava root) was obtained from a local market in Nigeria. It was peeled, washed, grated, milled, dried and grounded into a gritty form, which was generally referred to as the "cassava flour". Smart choice enzyme respectively produced and distributed by smart choice Agriculture INC, USA and Farm Associates, Nig. LTD, Enugu State, Nigeria was used for the supplementation of some of the cassava-based flour diets. The enzyme is of multiple origin which includes bacterial, yeast and fungal.

Experiment diets

A total of nine experimental diets were formulated with diets 1 serving as the control. The diets were divided into two different groups namely 1, which consists of diets 2, 4, 6 and 8 which had their maize substituted for cassava flour at 25%, 50%, 75% and 100% respectively without enzyme supplementation. The second group consists of diets 3, 5, 7, and 9 which had their maize substituted for cassava flour at 25%, 50%, 75% and 100% respectively but supplemented with enzyme at 0.10% (Table 1).

Table 1. Composition of experimental Diets fed broiler chickens from (0-7 weeks)

INGREDIENT	DIET 1	DIET 2	DIET 3	DIET 4	DIET 5	DIET 6	DIET 7	DIET 8	DIET 8
Maize	60.30	45.23	45.23	30.15	30.15	15.08	15.08	-	-
Soybean meal	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30,00	30,00
Cassava flour	-	15.08	15.08	30.15	30.15	45.23	45.23	60.30	60.30
Fishmeal (imported)	5.00	5.00	5.00	5.00	5.00	5.00	5,00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Oyster shell	1.0	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Vit. Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.1	0.10	0.10	0.10	0.10	0.10	0.10	0.10
- /+enzyme	-	-	0.10	-	0.10	-	0.10	-	0.10
Total	100	100	100	100	100	100	100	100	100
Calculated composition:									
Crude protein	22.03	21.12	21.12	20.22	20.22	19.49	19.49	18.40	18.40
ME (kcal/kg)	2,907.13	2,864.92	2,864.92	2,822.71	2,822.71	2,788.94	2,788.94	2,738.29	2,738.29
Calorie: Protein ratio	1:132	1:136	1:136	1:140	1:140	1:143	1:143	1:149	1:149

Vit. Premix Composition: Vit A,10000 IU; Vit D,28000 IU; Vit E, 35000 IU; Vit K,1900 mg;VitB_{12} 19_{mg}; Riboflavin, 7000 mg; Pyridoxine, 3800 mg; Thiamine, 2200 mg; D-Pantothenic acid, 11000 mg; Folic acid, 1400 mg; Biotin,113 mg; Cu, 8000 mg; M, 64000 mg; Choline, 475000 mg; Methionine, 50000 mg; BHT, 5000 mg; Spiramyin, 5000 MG

Experimental animal, management and experimental design

Two hundred and forty three (243) day-old early strain (Abor acre) broiler chicks were individually weighed and randomly assigned to nine (9) dietary treatments replicated thrice. Each treatment comprised of twenty seven (27) birds, with nine birds per replicate in a Completely Randomized Design (CRD). The birds were fed and watered ad libitum, while routine health management were religiously and appropriately observed according to standard and internationally acceptable procedures. The birds were weighed weekly, and data on feed intake, weight changes, and feed-to-gain ratio were obtained and or calculated. The cost efficiency was also evaluated according to the procedure of [5].

Evaluation of carcass characteristics

At the end of the experimental period, a total of 27 birds closest to the mean in each group, with three from each treatment were randomly selected, fasted of feed overnight to empty their crops, slaughtered by complete severing of the head, defeathered with hot water (60^0C) and then eviscerated according to the procedure of [20].

Evaluation of the blood parameters

The blood were collected through the jugular vein and taken to the laboratory for analysis. The parameters considered include the red blood cell count (RBC), white blood cells count (WBC), packed cell volume (PVC) and hemoglobin (HB).

Serum chemistry of the blood collected was also evaluated such include total protein, Globulin, glucose, albumin, serum aspartate amino transferase, alanine amino transferase, creatinine and alkaline phosphate.

Statistical analysis

Data collected were statistically evaluated using the analysis of variance (ANOVA) according to [12]. Duncan Multiple Range Test (8) was used to detect differences among means.

RESULTS AND DISCUSSIONS

Table 2 presents the performance characteristics of broiler chickens fed varying levels of cassava flour meal with or without enzyme supplementation. The mean final body weight, body weight gain, total feed intake and feed-to-gain ratio were significantly (P<0.05) influenced.

Nevertheless, the difference observed followed no definite pattern, though growth and feed intake were depressed as the level of cassava substitution for maize increased with or without enzyme supplementation. The mean daily weight gain for birds fed diets 1, 2, 3 and 5 were comparable and ranged from 32.21 (D5) to 37.80 (D1).

Table 2. The Performance characteristics of Broiler chickens fed varying levels of cassava flour meal with or without enzyme supplementation

Parameters	Tx1	Tx2	Tx3	Tx4	Tx5	Tx6	Tx7	Tx8	Tx9	SEM
Initial body weight (g)	51.00	51.33	51.67	50.67	51.67	52.00	50.67	53.67	50.667	1.111
Final body weight (g)	1885.18^{b}	1688.89^{b}	1666.66^{b}	1355.55^{a}	1629.63^{b}	1255.55^{a}	1203.70^{a}	1133.33^{a}	1231.48^{a}	90.79
Average body weight gain (g)	1834.19^{b}	1639.5^{b}	1615.00^{b}	1304.89^{a}	1578.30^{b}	1203.55^{a}	1153.04^{a}	1082.66^{a}	1180.66^{a}	90.62
Daily body weight gain (g)	37.80^{b}	33.42^{b}	32.96^{b}	26.63^{a}	32.21^{b}	24.56^{a}	23.53^{a}	22.10^{a}	24.10^{a}	1.85
Total feed intake (g)	1134.98^{d}	961.83^{bc}	939.53^{bc}	1079.36^{cd}	1064.25^{cd}	915.34^{bc}	694.63^{a}	789.12^{ab}	720.33^{a}	43.58
Daily feed intake (g)	23.16^{f}	19.53^{de}	19.18^{cd}	22.03^{ef}	21.54^{def}	18.68^{bc}	14.17^{a}	16.10^{ab}	14.70^{a}	0.87
Feed conversion ratio	1.62^{bc}	1.73^{c}	1.73^{c}	1.21^{a}	1.49^{abc}	1.32^{ab}	1.64^{bc}	1.38^{abc}	1.64^{bc}	0.12

^{abcd} Mean values in a row with different superscripts are significantly different (P<0.05). SEM-standard error of mean.

They are also significantly (P<0.05) higher than those fed diets 4, 6, 7, 8 and 9 which are also comparable and ranged from 22.09g (Diet 8) to 26.63g (Diet 4). The mean final body weight and body weight gain exhibited same response as the mean daily weight gain.

The result obtained in this trial does not agree with the findings of [3] and [11] which stated that enzyme supplementation brings about better growth and improved nutrient utilization. But according to [18, 19, 14], the inclusion of exogenous enzymes in broilers chicks diet do not necessarily translate to improved body weight and or feed efficiency. This is in agreement with the findings obtained in this trial. This may be due to the increasing bulkiness fiber content and lowering of nutrient concentration of the diets as the level of dietary cassava flour increased in the diets. The inability of the birds to efficiently digest the fiber, which would then create a gut fill sensation and subsequent depression of appetite is also a possibility [7]. The ambient temperature, breeds of chickens used for the experiment and other intrinsic factors could have influenced the results obtained in the trial.

Table 3 shows the economics of production of broiler chickens fed varying levels of cassava flour meal with or without enzyme supplementation. The result shows that cost per weight gain (₦), cost of production (₦), revenue (₦) and gross margin (₦) were significantly (P<0.05) depressed as the levels of maize substituted with cassava flour increased, with or without enzyme supplementation. Birds fed diets 1 proved superior to others because energy from dietary maize has better nutrient and energy availability when compared with cassava products [17]. The dietary substitution of maize with cassava flour beyond 50% did not optimized monetary returns with or without enzyme supplementation. This is in agreement with the findings of [11] and [16]. The reductions of growth due to a lower density of digestible nutrients in cassava products compared to maize may be related to the depression of productive performance of the broiler chickens as the level of maize substitution for cassava increased. This also effects the possible economic gain. Therefore, this goes to prove the fact that inclusion of a particular nutrient in the diet of an animal must not only be considered on the basis of its nutritive content, cheapness and availability alone but also on the economic efficiency.

Table 3.Economics of Production of Broiler chickens fed varying levels of cassava flour meal with or without enzyme supplementation

Parameter	Tx1	Tx2	Tx3	Tx4	Tx5	Tx6	Tx7	Tx8	Tx9	SEM
Cost/kg feed (N)	110.26	108.46	111.26	106.64	109.44	104.84	107.64	103.02	105.82	13.09
cost of wt gain (N)	178.95^{bc}	188.01^{c}	192.47^{c}	130.33^{a}	162.68^{ab}	138.04^{ab}	176.89^{bc}	142.17^{ab}	173.19^{ab}	5.67
Cost of production(N)	280.24^{cd}	273.30^{cd}	274.40^{cd}	285.17^{d}	286.41^{d}	265.89^{bc}	244.74	251.25^{ab}	246.19^{a}	600.00
Revenue (N)	1100.20^{b}	982.40^{b}	969.00^{b}	783.00^{a}	947.00^{b}	722.00^{a}	691.70^{a}	649.57^{a}	708.50^{a}	54.349
Gross margin (N)	125.33^{d}	104.30^{bc}	104.40^{bc}	115.17^{bc}	116.41^{cd}	95.89^{b}	74.74^{a}	81.25^{a}	76.19^{a}	4.718

^{abcd} Mean values in a row with different superscripts are significantly different (P<0.05). SEM-standard error of mean

The percent dressed weight (Table 3) was significantly (P<0.05) influenced by the dietary treatments. The values ranged from 43.16 (D6) to 67.59 (D9). The drumstick, neck and back-cut showed no significant (P<0.05) difference and followed no definite pattern that could be attributed to either the increasing substitutional level of cassava flour for maize nor enzyme supplementation of the diets. The percent gizzard, proventriculus, spleen, crop, kidney, large and small intestine were significantly (P<0.05) influenced but the lungs were not. The result showed that some of the cut-parts bore a relationship with the carcass weight, supporting the view of [16] that weight, volumes and dimensions of broiler parts were directly related to the carcass weight.

Among the hematological parameters considered, only the mean packed cell volume was significantly (P<0.05) influenced, and the values ranged from 23.33 (D5) to 29.67 (Diet 1). The mean hemoglobin concentration, red blood cell and corpuscular volume respectively ranged from 8.28 (D3) to 9.72 (D8), 1.57 (D5) to 2.83 (D1) and 125.16 (D8)

to 169.86 (D4). The birds fed diet 7 and 5 respectively gave the least (30.33) and highest (39.40) mean corpuscular hemoglobin concentration values while mean corpuscular hemoglobin and white blood cells respectively ranged from 3635 (D1) to 60.85 (D5) and 8.68 (D7) to 9.67 (D2). The various values obtained in this trial are generally higher than range of values presented by [6, 9, 15]. This could be due to the balancing for dietary protein deficiencies associated with cassava products with fish meal (72% cp), synthetic methionine and lysine. The place of enzyme in improving nutrient utilization should also not be downplayed in a situation like this.

The mean total protein, globulin, glucose, albumin and creatinine showed significant ($P<0.05$) difference, while serum aspartate amino transferase, alanine amino transferase, and alkaline phosphate were not. The various values obtained in this trial are generally lower than the range of standard values presented by [4, 6, 13]. From the foregoing, it is possible that the hydrogen cyanide and some other anti-nutritional factors that are generally associated with cassava products had not been completely eliminated by the processing method used in this trial thus, leading to lowering of serum metabolites. The serum aspartate, amino transferase, alanine amino transferase and alkaline phosphate showed positive correlation with the quality of diet and the form of feed [1, 2].

CONCLUSIONS

Birds fed diet 1 gave a superior performance over and above all the other 8 diets in terms of the mean final weight gain, percent dressed carcass, serum chemistry and hematological values. This was closely followed by birds fed diets 2, 3, 4, and 5. Substitution of maize with enzyme supplemented and non-supplemented dietary cassava flour should not exceed 50% in the broiler diet. This is because, as the levels of dietary cassava flour substitution for maize increased from 50% to 100%, revenue realizable and gross margin (₦) values also dropped, an indication that the diets (6, 7, 8 and 9) did not optimize economic returns nor enhanced biological performance.

Table 4. Carcass Characteristics of the Broiler chickens fed varying levels of cassava flour meal with or without enzyme supplementation

Parameters	Tx1	Tx2	Tx3	Tx4	Tx5	Tx6	Tx7	Tx8	Tx9	SEM
Live wt (g)	1846.67^{d}	1673.33^{cd}	1666.67^{cd}	1243.33^{ab}	1400.00^{bc}	1233.33^{ab}	1226.67^{ab}	1046.67^{a}	1333.33^{ab}	89.66
Dressed wt carcass)%	86.45^{b}	88.16^{b}	87.76^{b}	88.01^{b}	87.69^{b}	75.73^{a}	87.97^{b}	85.84^{b}	84.31^{b}	2.59
Dressed wt (%)	62.08^{cd}	63.33^{cd}	61.16^{cd}	63.52^{cd}	59.40^{c}	43.16^{a}	51.79^{b}	59.41^{c}	67.59^{d}	2.22
Thigh %	16.84^{ab}	16.99^{ab}	17.60^{ab}	15.62^{a}	15.67^{a}	19.39^{b}	18.35^{ab}	17.08^{ab}	16.18^{ab}	0.98
Breast muscle%	19.41^{ab}	25.49^{abcd}	26.62^{bcd}	23.55^{abcd}	27.41^{cd}	30.45^{d}	18.93^{a}	22.23^{abc}	29.17^{cd}	2.27
Drum stick %	14.46	15.40	15.82	14.68	15.18	19.01	15.52	15.62	15.30	1.34
Wings%	15.25^{a}	14.27^{a}	14.30^{a}	15.34^{a}	14.78^{a}	18.25^{b}	13.69^{a}	14.79^{a}	13.84^{a}	0.94
Heart%	0.63^{a}	0.62^{a}	0.59^{a}	0.61^{a}	1.19^{c}	0.93^{bc}	0.92^{bc}	1.09^{cd}	0.82^{ab}	0.09
Liver%	3.19^{a}	3.05^{a}	3.34^{a}	3.60^{a}	3.83^{ab}	4.487^{c}	3.88^{ab}	4.67^{bc}	3.45^{a}	0.31
Head%	3.80^{a}	4.07^{ab}	4.32^{ab}	4.38^{ab}	4.57^{ab}	6.81^{a}	4.87^{abc}	5.88^{cc}	5.25^{bc}	0.38
Neck %	7.56	7.59	7.17	7.20	7.49	8.82	7.51	8.17	7.40	0.64
Gizzard	2.79^{a}	3.71^{ab}	3.33^{ab}	2.97^{a}	3.32^{a}	4.03^{ab}	3.16^{a}	4.88^{b}	3.46	0.38
Shank	6.11^{a}	6.24^{a}	6.47^{a}	6.87^{a}	6.64^{a}	11.30^{c}	7.98^{ab}	9.22^{b}	8.08^{ab}	0.69
Back-cut	16.86	15.69	23.68	20.86	18.16	24.33	28.36	18.36	24.68	4.45
Proventriculus	0.54^{a}	0.58^{ab}	0.76^{bc}	0.59^{ab}	0.69^{abc}	0.85^{c}	0.72^{abc}	0.85^{c}	0.57^{ab}	0.06
Spleen	0.17a	0.25^{ab}	0.16^{a}	0.29^{ab}	0.22^{ab}	0.34^{b}	0.22^{ab}	0.15^{a}	0.20^{ab}	0.04
Crop	0.92^{ab}	0.84^{ab}	0.79^{ab}	0.69^{ab}	1.05^{ab}	1.30^{b}	0.78^{ab}	1.04^{ab}	0.48^{a}	0.19
Kidney	0.95^{ab}	1.06^{bc}	1.21^{bcd}	1.10^{bc}	1.2bc	1.54^{d}	1.33^{bcd}	1.37^{cd}	0.61^{a}	0.12
Hung	0.88	0.89	0.90	0.95	0.91	1.07	0.91	0.98	0.84	0.12
Large intestine	0.81^{a}	0.66^{a}	0.96^{a}	0.81^{a}	1.01^{a}	1.73^{b}	0.94^{a}	1.05^{a}	0.95^{a}	0.13
Small intestine	2.25^{a}	3.63^{ab}	4.36^{abc}	4.95^{abc}	5.14^{bc}	7.89^{d}	4.78^{abc}	5.53^{c}	3.58^{ab}	0.56

^{abcd} Mean values in a row with different superscripts are significantly different ($P<0.05$). SEM-standard error of mean

Table 5. Haematology value of birds fed varying levels of cassava flour meal with or without enzyme supplementation

Parameters	Tx1	Tx2	Tx3	Tx4	Tx5	Tx6	Tx7	Tx8	Tx9	SEM
Haemoglobin concentration (g/dl)	9.10	9.32	8.28	9.69	9.18	8.30	8.35	9.72	8.80	0.28
Packed cell volume 1%	29.67^{b}	26.33^{ab}	25.33_{ab}	30.67^{b}	23.33^{a}	26.17^{ab}	27.50^{ab}	27.50^{ab}	27.33^{ab}	0.65
Red blood cell (x 106/ul)	2.83	2.54	1.98	2.03	1.57	2.12	1.70	2.65	1.90	0.16
Mean corpuscular volume (fl)	126.66	119.29	130.80	169.86	155.07	130.33	171.16	125.16	147.89	9.24
Mean corpuscular haemoglobin concentration (g/dl)	31.40	35.18	34.72	32.00	39.40	32.11	30.33	35.34	32.33	1.30
Mean corpuscular haemoglobin (pg)	36.35	41.52	46.73	51.39	60.85	40.65	51.69	40.88	47.96	2.83
White blood cell (x103/u)	9.31	9.67	8.88	9.41	9.31	8.81	8.68	9.75	8.92	0.30

^{abcd} Mean values in a row with different superscripts are significantly different (P<0.05). SEM-standard error of mean

Table 6. Serum Biochemistry of birds fed varying levels of cassava flour meal with or without enzyme supplementation

Parameters	Tx1	Tx2	Tx3	Tx4	Tx5	Tx6	Tx7	Tx8	Tx9	SEM
Total protein (g/dl)	2.69^{ab}	2.93^{b}	2.52^{ab}	2.20^{ab}	2.36^{ab}	2.12^{a}	2.60^{ab}	2.68^{ab}	2.36^{ab}	0.80
Globulin (mg/dl)	1.04^{ab}	1.45^{b}	1.13^{ab}	0.93^{ab}	1.23^{ab}	0.38^{a}	1.00^{ab}	1.12^{ab}	0.96^{ab}	0.93
Glucose (mg/dl)	232.65^{b}	148.30^{a}	164.63^{a}	238.10^{b}	194.56^{ab}	243.54^{a}	206.80^{ab}	187.76^{ab}	197.28^{ab}	8.00
Albumin (mg/dl)	1.65^{b}	1.48^{ab}	1.39^{ab}	1.27^{ab}	1.14_{a}	1.73^{b}	1.60^{ab}	1.56^{ab}	1.39^{ab}	0.05
Serum aspartate amino transferase (uld)	94.05	85.67	101.35	93.00	85.88	81.71	99.78	99.44	99.78	2.39
Alanine amino transferase (uld)	10.93	5.69	7.93	11.69	7.98	7.55	10.39	7.87	7.00	0.64
Creatinine (mg/dl)	0.27^{ab}	0.17^{a}	0.22^{ab}	0.44^{6}	0.27^{ab}	0.25^{ab}	0.37^{ab}	0.32^{ab}	0.36^{ab}	0.03
Alkaline phosphate	188.29	217.65	114.28	149.00	173.50	152.04	176.56	175.94	177.92	11.00

^{abcd} Mean values in a row with different superscripts are significantly different (P<0.05). SEM-standard error of mean

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EFFECTS OF LIQUIDITY STATUS AND PERFORMANCE ON FARMING AND NON-FARMING ENTERPRISES OF HOUSEHOLDS IN ABIA STATE, NIGERIA

Joseph Chimere ONWUMERE, Chinonso Henry ENE, Esther Chioma ACHILIHU

Michael Okpara University of Agriculture Umudike, P.M.B 7267 Umuahia Abia State, Nigeria, Department of Agribusiness and Management, Phones: +2348066004895, +23839193563 +2348107151465, Email: joeofchrist@gmail.com,enechinonsohenry@gmail.com, achilihuester@gmail.com

Corresponding author: joeofchrist@gmail.com

Abstract

This research work was carried out to identify and analyze the liquidity status and performance of farming and non-farming enterprises of rural households in Abia State. A multi-stage sampling technique was adopted to select 100 household enterprises comprising of farming, non-farming and a combination of the both. Simple descriptive statistics, profitability ratios and multiple regression models were employed in the data analysis. The profitability and liquidity results showed that farming and non-farming enterprise households respectively made a Return on Equity such that 14.2% and 16.5% returns were obtained from equity investments. The result on Return on Assets shows that 3.1% and 7.1% returns were made on assets by farming and non-farming enterprises respectively implying that assets were efficiently used by non-faming enterprises. The current ratio stood at 1.562 and 1.722 for farming and non-farming enterprises. Similarly, the quick ratio was 1.091 and 1.100. The enterprises were able to cover short-term liabilities. The savings, income and investment variables were majorly influenced by the operators' individual characteristics such as age, education, level of experience while macroeconomic variables like disposable income also exerted significant influence. It was therefore recommended that government pursues relevant monetary policies that will reduce interest rates paid on long-term debts as well as tame high inflationary pressures prevalent in the country. Firms must be take serious care in ensuring that the limit to which they can incur debts so as to avoid running into deficits and bankruptcy. As a rule, the enterprises must allow debts provided their solvency is not jeopardized. Government should pursue policies that will make these enterprises optimize available liquidity in the domestic economy as well as increase their return on equity.

***Key words*:** liquidity status, performance, farming and non-farming, households

INTRODUCTION

In the past two decades, economic crisis and reforms have affected both rural and urban population. The African household consists of both extended and nuclear families with individual population and consumption units embedded in it [5]. Farming and non-farming enterprises are common in rural Africa. Around 42 percent of rural households in a recent survey in Africa operated non-farming enterprises [9] and between 40 and 50 percent of rural household income in Africa are estimated to be from rural farming and non-farming enterprises [11]; [6]. Farming and non-farming enterprises provide a survival strategy used by rural households in developing countries [2], [3]. The authors noted that rural households are occupationally flexible, spatially mobile and increasingly dependent on non-agricultural income generating activities.

Agriculture led growth played an important role in reducing poverty and transforming the economies of rural communities of rural households in Abia State [8]. Rural households can diversify occupation in different ways. However, non-farm employments are common diversification strategies for rural households [7] and [3]. It has been observed that non-farming enterprises represent an important element in the livelihood of the poor [1]. In addition to livelihood sustenance, the non-farming enterprise stimulates inter-sectoral linkage, reduces rural-urban migration, promotes equitable distribution of income, broadens economic participation and enables the poor

to smoothen inter-year seasonal fluctuation of agricultural labour demand and income [4]. Participation in non-farming enterprises has been popular among inhabitants of south-eastern Nigeria as such jobs have contributed additional income to farm families.

The performance and liquidity status of farming enterprises is one that is considered to have attracted a lot of attention and these enterprises have the capacity to reduce poverty, disease and hunger through wealth creation and employment generation.

Thus, in this work, liquidity ratios were used as a tool of analysis or assessment of financial performance of the farming and non-farming enterprises of rural households in Abia State.

Literature review

In the literature on the liquidity status and performance of farming and non-farming enterprise of rural households, and Africa, most attention has been on measures of firms' sales and employment growth [10]. These enterprises have undoubtedly become an important component of livelihood strategies and diversification among households [1]. The rural economy largely depends on agriculture and it is the principal occupation of the rural people. The government has identified agriculture and rural development as the topmost priority sector for rapid poverty reduction. The performance in terms of productivity of non-farm enterprises in rural households may be associated with and determined by the productivity of the spatially proximate farm and non-farm enterprises. In the remainder of this paper, a more rigorous investigation of the factors that influence rural farming and non-farming enterprises, as well as the liquidity status and performance of these enterprises are studied and discussed.

Liquidity is the ability of business to meet its financial obligations as they come due. The more cash and near-cash assets that a firm has, in comparison to its debts and business obligations, the more liquid, and thus, the more solvent it is said to be [12]. Firm performance in developing countries and specifically Africa has been measured based on the firm's sale and employment growth [10]. Relatively fewer studies have dealt with productivity as a measure of performance. Productivity is however one of the most important measure of performance as it reflects how efficiently the firm turns inputs into outputs [13]; [14].

Household is defined as a small group of people who share the same living accommodation, who pull some, or all of the income and wealth and who consume certain types of goods and services collectively, mainly housing and food .In any work on household resource management, there should be understanding of a particular rural or urban culture especially in the way they share income and expenditure activities [14]. This can be found in the degree of establishment of economic entity based on interest. A household may be both consumption and production unit.

Agriculture is an important economic sector of the African countries. It has been variously described as 'the main stay' or 'the backbone' of the economy, contributing significantly to the gross domestic product (GDP) and export earnings and employing the vast majority of the working populations.

Several studies have shown that farmers particularly the families usually engage in different non-farm or off-farm income generating activities too ostensibly to obviate the seasonality of primary agricultural production and create a continuous stream of income to cater for the starring exigencies of life. Secondary or non-farm income generating activities refers to those incomes earned by the farmer from non-farm income generating activities at different times of the year. Multiple motives prompt households and individuals to diversify assets, incomes, and activities. The types of off-farm income generating or non-farm activities vary across geo-political locations and countries.

MATERIALS AND METHODS

This study was carried out in Abia State, Nigeria. This research work was carried out to identify and analyze the liquidity status and performance of farming and non-farming enterprises of rural households in Abia State. A multi-stage sampling technique was

adopted to select 100 household enterprises comprising of farming, non-farming and a combination of the both. Simple descriptive statistics, profitability ratios and multiple regression models were employed in the data analysis.
In specifying the model,

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e_i \text{.....(1)}$$

where,
Y=Farm income of the respondents (Naira),
X_1= Age of the respondents (years),
X_2= Household size (number),
X_3= Education level (number of years spent in school),
X_4= Farm size (hectare),
X_5= Farming experience (years),
X_6= Membership of farm association (Yes = 1, No =0),
X_7= Amount of credit accessed (naira),
e_i= Error term,
b_0=Intercept (or constant),
$b_1, b_2 \ldots b_{10}$= ith coefficient corresponding to $X_1, X_2 .. X_{10}$.

RESULTS AND DISCUSSIONS

Socio-economic Characteristics of Respondents

Age distribution of respondents.

The result indicates that respondent within the age bracket of 20-29, 30-39, 40-49, 50-59 and 60-69 years constitutes 20%, 42%, 26%, 10% and 2% respectively of total population.

Table 1. Age distribution

Age (years)	Frequency	Percentage (%)
25-34	20	20
35-44	46	46
45-54	24	24
55-64	6	6
65-74	4	4
Total	100	100
Mean	42 years	

Source: Field Survey, 2016.

The mean age is 42 years, indicating that the farmers were moderately young, energetic and innovative. The risk bearing abilities and innovativeness of farmers, his mental capacity to cope with daily challenges and demand of farm production activities and his ability to do manual work decrease with advancing age.

Distribution of respondents by gender

Table 2.Distribution of respondents by gender

Sex	Frequency	Percentage (%)
Female	32	32
Male	68	68
Total	100	100

Source: Field Survey, 2016.

From the result, it can be observed that majority (56%) of the samples respondents in the study area were males, while the rest (44%) were females. This result implies that agro-industry activities are dominated by males in the study area.

Distribution of respondents by marital status

Table 3. Distribution of Respondents based on marital status

Marital status	Frequency	Percentage (%)
Married	72	72
Single	22	22
Widowed	6	6
Total	100	100

Source: Field Survey, 2016.

From the distribution of the respondents according to their marital status, it can be observed that 10% of the respondents were widowed, 54% where married and 36% where single. This implies that a greater percentage of the population had family members. Farmers are better positioned to practice serious agro-industry business when they are more stable.

Distribution of respondents by household size

Table 4. Distribution of Respondents based by household size

Household size	Frequency	Percentage (%)
1-3	10	10
4-6	68	68
7-9	22	22
Total	100	100
Mean	5 persons	

Source: Field Survey, 2016.

The result shows that 66% and 34% of respondent had a household size of 1-5 and 6-

10 persons respectively. The mean is 5 persons. This is desirable, consistence and of great importance in farm production as farm household may rely more on their members than hired workers for labour on their farms.

Distribution of respondents by education level

Table 5. Distribution of Respondents based by education level

Education	Frequency	Percentage (%)
No formal education	4	4
Primary Education	4	4
Secondary education	54	54
Tertiary Education	26	26
Post tertiary education	12	12
Total	100	100

Source: Field Survey, 2016.

Majority (88%) of the respondents have formal education while the remaining (12%) have no formal education. Improved education level brings about positive changes in the knowledge, attitude and skills through research and extension. The implication is that these respondents are better positioned to take advantage of new technique and innovation that could improve agricultural productivity and boost food security.

Distribution of respondent based by Farming Experience

Table 6. Distribution of Respondents based by farming experience

Experience (years)	Frequency	Percentage (%)
1-10	68	10
11-20	22	32
21-30	8	40
31-40	2	18
Total	100	100
Mean		

Source: Field Survey, 2016.

Distribution of the respondents according to their farming experience shows that 10%, 32%, 40% and 18% of the respondents had farming experience between 1-5, 6-10, 11-15 and 16-20 years respectively. It is shown that on average, the farming household head has spent about 7 years in farming. The result has some positive implications on increased productivity because the number of years a farmer has spent in farming business may give an indication of the practical knowledge he has acquired on how he can overcome certain inherent farm production problems.

Performance of farming enterprises

For the farming enterprises, seedlings contributed about 31.8% of the Total Cost, followed by rent (25.45%), while the least was water (0.51%).

For the non-farming enterprises, average cost of items purchased contributed about 55.92% of the Total Cost, followed by other fixed inputs (27.13%), while the least was equipment (16.95%). For the combination of both, seedlings contributed about 34.46% of the Total Cost of the farming enterprises, followed by rent (14.56%), while the least was water (0.35%).

Whereas, average cost of items purchased contributed about 59.26% of the Total Cost of non-farming enterprises, followed by other fixed inputs (24.69%), while the least was equipment (16.05%).However, the combination of both was the most profitable of all with the highest net return of ₦410,600.

Profitability status of the farming and non-farming enterprises

The result shows that farming enterprise households made a ROE of 0.142 while non-farming enterprise households had a higher ROE of 0.165. This implies that the enterprises performed well relative to their equity. However, 14.2% and 16.5% returns were obtained from equity investments. The result on Return on assets shows that 3.1% and 7.1% returns were made on assets by farming and non-farming enterprises respectively. This implies that assets were efficiently used by non-faming enterprises. The gross margin ratio looks at gross profit (net sales – cost of goods sold) for the net sales that a company generates and the result shows that 23% and 26% gross profits were generated for the farming and non-farming enterprises respectively showing that the enterprises are profitable though non-farming enterprises were more profitable. From this assertion, it can be seen that 11% and 12%

profits were generated in proportion to the total returns made by the enterprises although non-farming enterprises made a slightly higher profits.

Table 7. Performance of household enterprises

		Farming (₦)	(%)	Non farming (₦)	(%)	Combined	(%)
A	**Variable inputs**						
i	Seedlings	156,250	31.86			73,950	34.46
ii	Fertilizer, pesticides, herbicides	28,750	5.86			15,075	7.02
iii	Casual labour	22,475	4.58			10,375	4.83
iv	Annual production stock	62,500	12.74			28,950	13.49
v	Feeding	29,250	5.96			14,930	6.96
vi	Vaccines/ drugs	8,750	1.78			4,475	2.09
vii	Water	2,500	0.51			750	0.35
	Total Variable Cost (TVC)	310,475				148,505	
B	**Fixed inputs**						
i	Rent	125,500	25.49			31,250	14.56
ii	Taxes	12,500	2.55			7,000	3.26
iii	Insurance	6,250	1.27			2,750	1.28
iv	Interest	5,000	1.02			3,125	1.46
v	Depreciation on equipment	31,250	6.37			21,995	10.25
	Total Fixed Cost (TFC	180,000				66,120	
	Total Cost (TC)	490,475				214,625	
	Total Revenue (TR)	690,700				356,475	
	Net Revenue (TR-TC)	200,225				141,850	
	NONFARMING						
	Equipment (trading, carpentry, etc.)			125,000	16.95	81,250	16.05
	Other fixed inputs			200,125	27.13	125,000	24.69
	Variable Cost						
	Average Cost of Items Purchased			412,500	55.92	300,000	59.26
	Total Cost			737,625		506,250	
	Total Return on Sales/ Total Income			1,062,500		775,000	
	Net Return (TR-TC)			325,000		268,750 TNR=410,600	

Table 8.Profitability status of the farming and non-farming enterprises

Financial ratios	Farming enterprises	Non-farming enterprises
a.Profitability ratios		
i.Return on equity	0.142	0.165
ii.Return on assets	0.031	0.071
iii.Gross margin ratio	0.231	0.265
iv.Profit margin ratio	0.110	0.122
b.Liquidity ratios		
i.Current ratio	1.562	1.722
ii.Quick ratio	1.091	1.100
c.Solvency ratios		
i.Debt to asset ratio	0.552	0.442
ii.Long term debt to asset ratio	0.233	0.198
iii.Asset to equity ratio	1.431	1.651

The current ratio stood at 1.562 and 1.722 for farming and non-farming enterprises. Similarly, the quick ratio was 1.091 and 1.100. Given that the current ratio acceptable ranges differ across firm types, these results show adequate liquidity. The current ratio is a measure of the company's short-term financial strength. Acceptable current ratios ranges differ from industry to industry, but ratios above 1 indicate ability to cover short-term liabilities. An increase in the non-farming enterprises quick ratio indicates higher inventories above farming enterprises.

The solvency ratios showed that farming enterprises had less debt than non-farming enterprises. This is understandable because of the size and volume of goods exchanges, borrowing behaviour and exchange rate.

The result shows that the F-ratios were all significant at 1% indicating a good regression line while 57.7%, 76.2% and 70% changes in the income of farming, non-farming and a combination of farming and non-farming household enterprises respectively were accounted by changes in the explanatory variables included in the model while the remaining 42.3%, 23.8% and 30% were accounted for by disturbances (error) in the model.

Table 9. Factors affecting the income of the various household enterprises

Variables	Farming enterprises			Non Farming enterprises			Farming and NFE		
	Coeff.	S.E	T	Coeff.	S.E	T	Coeff.	S.E	T
Intercept	.534	.112	4.768***	.872	.321	2.717***	.243	.102	2.382***
Age	-.342	.100	-3.420**	-.210	.089	2.360*	.104	.099	1.051
Education	-.553	.210	-2.633**	.352	.101	3.485**	.200	.200	1.000
Household size	6.87	2.00	3.43**	-1.83	0.40	-4.58***	3.871	1.00	3.871***
Farm size	2.78	1.09	2.550**	2.22	1.89	1.175	.078	0.435	0.179
Experience	1.09	0.42	2.58**	3.14	2.00	1.57**	.314	.087	3.609***
Coop. membership	3.63	1.28	2.83**	1.09	0.29	3.760***	.063	.016	3.938***
Credit	2.44	1.31	1.86*	.098	2.71	.036	.664	.544	1.221
Adj. R^2			.534			.663			.632
R^2			.577			.762			.700
F-ratio			5.431***			7.243***			12.421***

Source: Field survey, 2016
***, ** and * are significant at 1%, 5% and 10% respectively.

The results shows that age and education of the respondents were negative for farming enterprises, negative for NFE, and not significant for both FNFE. Household size was negative while experience and co-operative membership were positive for all enterprises. Credit was positive for FE and insignificant for others.

Table 10.Factors affecting the investment of the various household enterprises

Variables	Farming enterprises			Non Farming enterprises			Farming and NFE		
	Coeff.	S.E	T	Coeff.	S.E	T	Coeff.	S.E	T
Intercept	-6.52	1.600	-4.075***	1.264	.334	3.784***	-1.255	.521	2.351*
Age	-7.14	3.122	-2.286*	.325	.121	2.685**	-1.981	.657	-3.015**
Education	1.047	0.532	1.968*	.600	.500	1.200	.645	.437	1.476
Household size	-1.030	0.453	-2.273*	-.611	.400	-1.528*	4.231	.252	16.790***
Farm size	.735	.213	3.451**	.900	.660	1.364	.625	.546	1.145
Experience	.435	.101	4.306***	.201	.097	2.073*	.112	.040	2.800**
Coop. membership	.435	.342	1.127	.122	.190	.642	.198	.331	.058
Credit	2.22	1.89	1.175	.104	.099	1.051	2.001	1.581	1.266
Adj. R^2	3.14	2.00	1.57*	.209	.070	2.986**	.534	.211	2.531**
R^2			.435			.533			.600
F-ratio			.425			.625			.652
			6.421***			5.221***			8.162***

Source: Field survey, 2016
***, ** and * are significant at 1%, 5% and 10% respectively.

The result shows that the F-ratios were all significant at 1% indicating a good regression line while 42.5%, 62.5% and 65.2% changes in the investment in farming, non-farming and a combination of farming and non-farming household enterprises respectively were accounted by changes in the explanatory variables included in the model while the remaining 57.5%, 37.5% and 34.8% were accounted for by disturbances (error) in the model. The result shows that age was negatively related to farming and a combination of farming and non-farming enterprise holders at 10% and 5% each and positively related to non-farm activities at 5%. Education was negatively related to the investment of farming enterprise holders at 10%. Household size was negative for all the enterprises at 5%, 5% and 1% significant levels respectively. While farm size was positively related to farmers' investment at 5%, experience was positively related to the three enterprises' investment at 1%, 5% and 10% significant levels respectively. Savings had a positive relationship with the enterprises' investment at 10%, 5% and 5% levels respectively.

The result shows that the F-ratios were all significant at 1% indicating a good regression line while 68.8%, 71.2% and 77.2% changes in the savings from farming, non-farming and a combina tion of farming and non-farming household enterprises respectively were accounted by changes in the explanatory

variables included in the model while the remaining 31.2%, 28.8% and 32.8% were accounted for by disturbances (error) in the model.

Table 11. Factors affecting the financial savings of the various household enterprises

Variables	Farming enterprises			Non Farming enterprises			Farming and NFE		
	Coeff.	S.E	T	Coeff.	S.E	T	Coeff.	S.E	T
Intercept	1.352	.640	2.113*	.632	.663	15.80***	-2.635	.964	-2.733**
Age	2.034	.942	2.159*	2.662	.311	8.559***	.334	.163	2.049*
Education	2.991	.622	4.809***	2.301	.534	4.309***	.743	.645	1.152
Household size	.144	.131	1.099	.399	.286	1.400	.578	.545	1.061
Farm size	-.813	.109	7.459***	-1.223	.443	2.761**	-.241	.091	-2.648**
Experience	-.771	.500	1.542	-.554	.492	1.126	-.345	.239	-1.443
Coop. membership	.942	.349	2.699**	.998	.331	3.015**	.442	.249	1.775*
Credit	.690	.332	2.070*	.901	.473	1.900*	.390	.082	4.756***
Adj. R^2			.652			.699			.709
R^2			.688			.712			.772
F-ratio			7.114***			8.172***			8.899***

Source: Field survey, 2016
***, ** and * are significant at 1%, 5% and 10% respectively.

The result shows that income, age, cooperative membership and credit use increased the volume of savings across the various enterprises while household size negatively influenced savings for all the enterprises.

CONCLUSIONS

The study showed a positive value for all profitability, liquidity and solvency ratios across the various enterprises studied.
However, non-farming enterprises were most profitable and better positioned in terms of solvency. The ability of the enterprises to cover their short-term loan was a highly commended effort given the continuous financial challenge faced by the Nigerian economy. The savings, income and investment variables were majorly influenced by the operators' individual characteristics such as age, education, level of experience while macroeconomic variables like disposable income also exerted significant influence.

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GOVERNMENT CREDIT, BANKS' CREDIT AND AGRIBUSINESS SECTOR PERFORMANCE UNDER CONSOLIDATON POLICY IN NIGERIAN BANKING INSTITUTIONS (1995-2014): A TREND ANALYSIS

Joseph Chimere ONWUMERE, Chinonso Henry ENE,
Gideon Chukwunyere NNAMERENWA

Michael Okpara University of Agriculture, Department of Agribusiness and Management, Department of Agribusiness and Management, Department of Agricultural Economics, Umudike. Abia State, Nigeria, Phones: +2348066004895, +2348039193563, +2348063822998, Emails: joeofchrist@gmail.com; enechinonsohenry@gmail.com; gideonnnamerenwa@gmail.com

Corresponding author: joeofchrist@gmail.com

Abstract

Consolidation policy in the Nigerian banking institution is a reform strategy recently adopted by CBN to reposition the banking sector. Consolidation gave birth to merger and acquisition of banks. These were done to achieve improved financial efficiency, forestall operational hardships and expansion bottlenecks. It is against this backdrop that the paper made a trend analysis in government credit to agribusiness, banks' credit to agribusiness, agribusiness output and number of agribusiness enterprises that accessed the credit through Agricultural Credit Guaranteed Scheme Fund (ACGSF). Data were collected from the published annual reports and accounts of the CBN and were subsequently analyzed applying trend analyses such as exponential trend analysis and quadratic trend analysis through Eview (Econometrical view) packages for management sciences. It was found that government credit allocation, value of banks' credit allocation to agribusiness, agribusiness output and number of agribusinesses that accessed the credit was higher during the post- merger and acquisitions consolidation policy era than the pre-mergers and acquisitions consolidation policy era. The study concluded that post-merger and acquisition consolidation policy in the Nigerian banking institutions was higher than the pre-merger and acquisition consolidation policy era. The study recommends that banks should be more aggressive in their profit drive for improved financial position to reap the benefit of post- merger and acquisition consolidation bid.

Key words**:** *government credit, banks' credit, agribusiness sector performance, consolidation policy, Nigerian banking institutions*

INTRODUCTION

As confirmed by [3], agriculture is the first and most thriven occupation of mankind. [4] posits that agriculture has been the main source of gainful employment from which Nigeria nation can feed its feeding population. Agriculture occupies a priority status in Nigeria as the sector serves as the key driver of growth, wealth creation and poverty reduction for a large portion of the population. It accounts for about 70% of employment, and in spite of this, [1] opined that it has not been able to achieve the major objectives of agricultural development which the [15] indentified to include: increase in food production and farm income; make household food, water and energy secure and maintain the natural resources. They stated further that the failure of agriculture to meet these objectives is due to limited credit allocation.

Over the years, there have been efforts by various governments to diversify the economy. Policies have been initiated, committees set up but the seemingly good initiatives have been marred by little commitment from government. For the agricultural sector, successive governments have made serious efforts at making good agricultural policies through schemes, programmes and institutions, they however, have not been able to back them up with adequate budgetary allocation and financing coupled with corruption in the execution of the policies.

Banks play a crucial role in propelling the

entire economy of any nation, of which there is need to reposition it for efficient financial performance through a reform process geared towards forestalling bank distress. [14] opines that the Central Bank of Nigeria (CBN) choose to begin the Nigerian banking sector reform process with the consolidation policy through mergers and acquisitions. This is done in order to arrest systems decay, restoration of public confidence, building of strong, competent and competitive players in the global arena, ensuring longevity and higher returns to investors.

Nigerian agricultural policy provides, among others, for adequate financing of agriculture. The role of finance in agriculture, just like in the industrial and service sectors, cannot be over-emphasized, given that it is the oil that lubricates production. [7] states his position most plainly by arguing that the only means to a cumulative improvement in agricultural productivity is a public policy designed to move to large-scale agriculture and encouraging a rapid rate of industrialization. Public expenditure on agriculture has, however, been shown not to

be substantial enough to meet the objective of the Government agricultural policies [5]. The objective of agricultural financing policies in Nigeria is to establish an effective system of sustainable agricultural financing schemes, programmes and institutions that could provide micro and macro credit facilities for agriculture to thrive.

Literature review.

According to [8], the policies of banks that were of relevance to agriculture are: direct credit to the agricultural sector on concessionary terms; the launching of a Rural Banking Scheme in 1977 under which designated commercial banks were required to open a specified numbers of rural branches in different parts of the country and with at least 40% of the total deposit in these rural banks lent to borrowers within those rural areas; ACGSF launched in 1977 to reduce the risk borne by commercial banks in extending credit to farmers. Under this scheme, the Central Bank of Nigeria guaranteed up to about 75%. One of the broad policy frameworks for achieving this goal is the Financial System Strategy 2020, launched by the Central Bank of Nigeria in 2007. The FSS 2020 seeks to enhance Nigeria's economic growth through robust policy reforms in the financial sector including: consolidation of banking sector reforms; recapitalization and consolidation in the insurance sector and capital markets; creation of microfinance banks and the conversion of community banks; establishment of the African Finance Corporation; pension reforms to generate long term investible funds and solve the pension crisis; monetary policy reforms; and restructuring of the Nigeria Security Printing and Minting Company

The Central Bank of Nigeria (CBN) also issued new guidelines on bank mergers and acquisitions that are primarily directed towards regulating mergers and acquisitions and forestalling hostile bids that the CBN considers as damaging to the banking industry.

Since independence in 1960, successive Nigerian governments have made efforts to address the problem of lack of access to credit to the rural poor. In recognition of the vital role of small-scale farmers in wealth creation, the federal government has experimented with various financing initiatives. These are largely subsidized, targeted credit programs to promote agricultural production and improve the lives of smallholders. It was in recognition of the downward trend observed in agricultural productivity that the Federal Government of Nigeria at various periods put in place credit polices and established credit institutions and schemes that could facilitate the flow of agricultural credit to farmers [12]

MATERIALS AND METHODS

There are 25 consolidated Nigerian banking institutions studied, precisely commercial banks operating in the country some of which were merged and acquired as a result of the consolidation policy by CBN in order to strengthen the financial system of the banks. The study used secondary data, mostly time series. Data on bank's credit allocation to agribusiness sector, agribusiness output, number of agribusiness enterprises and

government credit allocation in agribusiness sector of the economy, merger and acquisition consolidation policy in the Nigerian banking institutions were collected from the publications of development finance and research department of the CBN, National Bureau of Statistics (NBS). Trend analysis such as exponential and quadratic trend analysis were employed in analyzing the data. The various models that were used to analyze the data for the study are specified below.

The exponential trend model for examining the trend in growth rate of government credit allocation to agribusiness activities, agribusiness output, number and value of bank's credit allocation, merger and acquisition consolidation policy in the Nigerian banking institutions within 1995 - 2014 is specified in line with [13] and [7] as:

$$Y_{it}=\exp^{(\beta o+\beta i+ei)} \quad (1)$$

when Linearized, becomes

$$\text{Log}Y_{it} =\beta_o + \beta_1 \text{Log}T_i + ei \quad (2)$$

where,

Log = natural Logarithm

Y_{it} = Government credit allocation to agribusiness activities in period t, or agribusiness output in period t, or number of bank's credit allocation in period t and value of bank's credit allocation in period t, all in pre and post-merger and acquisition consolidation policy in the Nigerian banking institutions.

T = time trend variable (years).

β_o and β_i= parameters to be estimated.

e_i = error term.

The annual exponential compound growth rate in government credit allocation to agribusiness activities, agribusiness output, number and value of bank's credit allocation in the pre and post-merger and acquisition consolidation policy in the Nigerian banking institutions is given in line with Onyenweaku, (2004) as:

$$r = (e^{\beta i}-1)x\ 100 \quad (3)$$

where,

e_i = Euler exponential constant (e =2.71828)

β_i = estimated coefficient in equation (2).

The log quadratic trend equation was used to measure the acceleration (increase at increasing rate), deceleration (increase at a decreasing rate) or stagnation (sameness) in the growth rate of government capital investment to agribusiness activities, agribusiness output, number and value of bank's credit allocation in the pre and post-merger and acquisition consolidation policy in the Nigerian banking institutions and is fitted as:

$$\text{In}Y_{it} = \beta_o + \beta_{it} + \beta_2 t^2 + e_i \quad (4)$$

where,

β_2 = estimated parameter

All variables as previously defined.

A positive significant value of β_2 will indicate acceleration while a negative significant value of β_2 entails a deceleration. Stagnation in the growth rate, explained by a non-significant value of β_2.

RESULTS AND DISCUSSIONS

Trend in government credit allocation to agribusiness activities, aggregate banks' credit allocation for agribusinesses and agribusiness output pre (1995- 2004) merger and acquisition consolidation policy in the Nigerian banking institutions.

Table 1 shows that between 1995 and 2004, a total of 504.86 billion grain equivalent of aggregate agribusiness output was domestically produced in Nigeria. Quantity of aggregate agribusiness output in Nigeria varied from a minimum of 43.88 billion grain equivalent in 1995 to a maximum of 57.71 billion grain equivalent in 2004. Aggregate agribusiness output increased from 43.88 billion grain equivalent in 1995 to 54.71 billion grain equivalent in 2000 and subsequently decline to 49.85 billion grain equivalent in 2001. It again increased from 51.68 billion grain equivalent in 2002 to 57.71 billion grain equivalent in 2004. The mean quantity of aggregate agribusiness output in Nigeria between 1995 and 2004 was 50.49 billion grain equivalent.

Table 1. Trend in government credit allocation to agribusiness activities, aggregate banks' credit allocation for agribusinesses and agribusiness output pre (1995- 2004) merger and acquisition consolidation policy in the Nigerian banking institutions.

Years	Government capital investment to agribusiness (₦Billion)	Agribusiness output (Grain Equivalent)	Number of bank's credit allocation to agribusiness	Value of bank's credit allocation to agribusiness (₦ Billion)	Percentage change in Government capital investment to agribusiness (%)	Percentage change in Agribusiness output (Grain Equivalent) (%)	Percentage change in Number of bank's credit allocation to agribusiness (%)	Percentage change in Value of bank's credit allocation to agribusiness (%)
1995	5.7	43.88	1809	164.13	-	-	-	-
1996	5.9	45.62	2014	225.52	3.39	3.81	10.18	27.22
1997	6.2	47.03	1784	242.03	4.84	3.00	-12.89	6.82
1998	6.1	48.82	1464	219.14	-1.64	3.67	-21.86	-10.45
1999	6.9	50.13	1288	241.84	11.59	2.61	-13.66	9.39
2000	8.8	54.71	2001	361.45	21.59	8.37	35.63	33.09
2001	57.9	49.85	1995	728.55	84.80	-9.75	-0.30	50.39
2002	32.4	51.68	2368	1050.98	-78.70	3.54	15.75	30.68
2003	8.5	55.43	2430	1151.02	-281.18	6.77	2.55	8.69
2004	38.7	57.71	3379	2083.74	78.04	3.95	28.09	44.76
Total	177.1	504.86	20531	6468.40				
Mean	17.7	50.49	2053	646.84	-17.47	2.89	4.83	22.29

Source: CBN statistical bulletin and annual statement of accounts, various issues (1995 -2004). Percentage changes in government capital investment to agribusiness activities, banks' credit allocation for agribusinesses and agribusiness output pre-merger and acquisition consolidation policy in the Nigerian banking institutions were researcher's computation.

The result further indicated that aggregate agribusiness output showed heterogeneity in growth between 1995 and 2004. The growth rate of aggregate agribusiness output varied from a minimum of -9.75 in 2001 to a maximum of 8.37percent in 2000. The overall average growth rate of aggregate agribusiness output between the year 1995 and 2004 was 2.89percent. The growth rate of aggregate agribusiness output in Nigeria between 1995 and 2004 is relatively low. Prevalence of favourable weather conditions across the country's ecological zones and implementation of the various intervention programmes are imperative for the growth of aggregate agribusiness output in Nigeria economy [14]. It is possible that the inconsistency in the growth rate of aggregate agribusiness output in some of those years could be due to inadequate financing of the agribusiness sector and the lack of implementation of the various intervention programmes targeted at developing aggregate agribusiness output. The result generally showed inadequate allocation of government spending to agricultural sector for production purposes. These results agreed with the findings of [6] who observed continuous neglect of agricultural development in Nigeria by the government. This result suggested that the slow rate of increase in government spending to agricultural sector for agribusiness production probably slowed down the rate of increase in the output of agriculture in the country and the productivity of the sector, especially, where farmers lacked personal savings for investment purposes and/or found it difficult to obtain loans from informal credit sources to purchase better production inputs due to the uneconomical interest rate charged by these informal credit lenders.

Table 1 also showed that between 1995 and 2004, a total of 177.1 billion naira of was

invested in agribusinesses in Nigeria by the government. Government capital investment in agribusinesses in Nigeria varied from a minimum of 5.7 billion naira in 1995 to a maximum of 57.9 billion naira in 2001. Government capital investment in agribusinesses in Nigeria increased steadily from 5.7 billion naira in 1995 to 6.2 billion naira in 1997 and subsequently declined to 6.1 billion naira in 1998. The value of government capital investment in agribusinesses in Nigeria fluctuated between 1999 and 2001. It thereafter decreased from 57.9 billion naira in 2001 to 8.5 billion naira in 2003 before increasing again to 38.7 billion naira in 2004. The mean value of government capital investment in agribusinesses in Nigeria between 1995 and 2004 was 17.7 billion naira. The result further indicated that government capital investment in agribusinesses in Nigeria showed heterogeneity in growth between 1995 and 2004. The growth rate of government capital investment in agribusinesses in Nigeria varied from a minimum of -281.18 in 2003 to a maximum of 84.80 percent in 2001. The overall average growth rate of government capital investment in agribusinesses in Nigeria between the year 1995 and 2004 was -17.47 percent. The growth rate of government capital investment in agribusinesses in Nigeria between 1995 and 2004 was relatively low. This amount of government spending in the agricultural sector is insufficient to drive a meaningful agribusiness transformation from a subsistence orientation to a market orientation [10] The result further shows that there was no consistency and continuity of programmes of action by the successive Governments towards agribusiness development in Nigeria. The expectation is to see a pattern that will show an increasing trend over the period as an indication of a growing agribusiness sector investment. The inconsistency in the pattern of the Federal Government capital spending in agribusiness sector would account for the inconsistency in the pattern of growth of agribusiness output in the economy.

Table 1 further showed that between 1995and 2004, a total of 6468.40 billion naira of was the value of bank's credit allocation to agribusinesses in Nigeria. Value of bank's credit allocation to agribusinesses in Nigeria varied from a minimum of 164.13 billion naira in 1995 to a maximum of 2083.74 billion naira in 2004. Value of bank's credit allocation to agribusinesses in Nigeria increased steadily from 164.13 billion naira in 1995 to 242.03 billion naira in 1997 and subsequently decline to 219.14 billion naira in 1998. It again increased from 241.84 billion naira in 1999 to 2083.74 billion naira in 2004. The mean value of bank's credit allocation to agribusinesses in Nigeria between 1995 and 2004 was 646.84 billion naira. The result further indicated that value of bank's credit allocation to agribusinesses in Nigeria showed heterogeneity in growth between 1995 and 2004. The growth rate of value of bank's credit allocation to agribusinesses in Nigeria varied from a minimum of -10.45 in 1998 to a maximum of 50.39 percent in 2001. The overall average growth rate of value of bank's credit allocation to agribusinesses in Nigeria between the year 1995 and 2004 was 22.29 percent. The growth rate of value of bank's credit allocation to agribusinesses in Nigeria between 1995 and 2004 was relatively low. This result suggested that under the scheme, credit was extensively rationed. In credit schemes with extensive rationing, a large number of beneficiaries are targeted but with each beneficiary receiving a small amount [11]. Access to credit is the motive for implementing extensive credit rationing. Increase in access to credit with limited availability of credit will culminate into small loan sizing. According to [11], extensive credit rationing is indicative of poor loan sizing.

Evidence from Table 1 also showed that between 1995 and 2004, there was variation in the number of loans granted to different agribusiness enterprises by banks in Nigeria. A cumulative number of 20,531 farmers of different categories benefited from bank's credit allocation in Nigeria from 1995-2004. The number of loans granted to different agribusiness enterprises by banks in Nigeria varied from a minimum of 1,288 farmers in 1999 to a maximum 3,379 farmers in 2004.

The number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria increased between 1995 and 1996 from 1,809 farmers to 2014 farmers respectively and subsequently decline to 1,288 farmers in 1999. It again increased to 2,001farmers in 2000 and declined to 1,995 farmers in 2001. A steady increased in the number of loans granted to agribusiness farmers was record between 2002 and 2004. The number of farmers increased from 2,368 in 2002 to 3,379 in 2004. The mean number of loans granted to farmers within the period in different agribusiness enterprises by banks in Nigeria was 2,053. The result further indicated that number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria showed heterogeneity in growth between 1995 and 2004. The growth rate of number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria varied from a minimum of -21.86 in 1997 to a maximum of 35.63 percent in 2001. The overall average growth rate of number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria between the year 1995 and 2004 was 4.82 percent. The growth rate in number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria between 1995 and 2004 was relatively low. This suggests that bank's credit allocation to agribusiness entrepreneurs in Nigeria is restrictive, stringent conditions of the banks for granting loans to farmers may not be easy for farmers to fulfil and as such cause most farmers to lose interest in accessing loan from banks in Nigeria.

Table 2 below shows the pattern of growth in government capital investment to agribusiness activities, aggregate banks' credit allocation for agribusinesses and agribusiness output, during the post-merger and acquisition consolidation policy in the Nigerian banking institutions (2005-2014).

Table 2 showed that between 2005 and 2014, a total of 810.3 billion naira was invested in agribusinesses in Nigeria by the government. Government capital investment varied from a minimum of 56.4 billion naira in 2013 to a maximum of 138.9 billion naira in 2009. Government capital investment in agribusinesses increased steadily from 60.3 billion naira in 2005 to 138.9 billion naira in 2009 and subsequently declined to 62.9 billion naira in 2011. The value of government capital investment fluctuated between 2012 and 2014. The mean value of government capital investment in agribusinesses in Nigeria between 2005 and 2014 was 81.0 billion naira. The result further indicated that government capital investment showed heterogeneity in growth between 2005 and 2014. The growth rate of government capital investment varied from a minimum of -78.08 in 2010 to a maximum of 32.63 percent in 2006. The overall average growth rate of government capital investment between the year 2005 and 2014 was -3.78 percent. The growth rate of government capital investment in agribusinesses in Nigeria between 2005 and 2014 was relatively low. However, the mean value of government capital investment during the post-merger and acquisition consolidation policy in the Nigerian banking institutions (2005-2014) was more than in pre-merger and acquisition consolidation policy in the Nigerian banking institutions (1995-2004).

Table 2 showed that between 2005 and 2014, a total of 831.95 billion grain equivalent of aggregate agribusiness output was domestically produced in Nigeria. Quantity of aggregate agribusiness output in Nigeria maintained a steady growth between 2005 and 2014 and varied from a minimum of 61.75 billion grain equivalent in 2005 to a maximum of 107.06 billion grain equivalent in 2014. The mean quantity of aggregate agribusiness output in Nigeria between 2005 and 2014 was 83.20 billion grain equivalent.

The result further indicated that aggregate agribusiness output showed heterogeneity in growth between 2005 and 2014.

Table 2. Trend in government capital investment to agribusiness activities, aggregate banks' credit allocation for agribusinesses and agribusiness output, post-merger and acquisition consolidation policy in the Nigerian banking institutions (2005-2014)

Years	Government capital investment to agribusiness (₦'Billion)	Agribusiness output (Grain Equivalent)	Number of agribusiness farmers	Value of bank's credit allocation to agribusiness (₦'Billion)	Percentage change in Government capital investment to agribusiness (%)	Percentage change in Agribusiness output (Grain Equivalent) (%)	Percentage change in Number of agribusiness farmers (%)	Percentage change in Value of bank's credit allocation to agribusiness (%)
2005	60.3	61.75	4624	9366.39	-	-	-	-
2006	89.5	66.16	4295	4195.10	32.63	6.67	-7.66	-123.27
2007	94.1	70.51	4323	4087.45	4.89	6.17	0.65	-2.63
2008	106.0	75.47	5279	6497.96	11.23	6.57	18.11	37.10
2009	138.9	80.00	5364	8328.57	23.69	5.66	1.58	21.98
2010	78.0	84.80	5089	7840.50	-78.08	5.66	-5.40	-6.22
2011	62.9	89.89	5633	10028.99	-24.01	5.66	9.66	21.82
2012	63.4	95.28	4874	9332.48	0.79	5.66	-15.57	-7.46
2013	56.4	101.00	5766	9256.68	-12.41	5.66	15.47	-0.82
2014	60.8	107.06	7232	12456.25	7.24	5.66	20.27	25.69
Total	810.3	831.95	52479	81390.36	-	-	-	-
Mean	81.0	83.20	5247.9	8139.036	-3.78	5.93	4.12	-3.76

Source: CBN statistical bulletin and annual statement of accounts, various issues (2005 -2014). Percentage changes in government capital investment to agribusiness activities, banks' credit allocation for agribusinesses and agribusiness output pre and post-merger and acquisition consolidation policy in the Nigerian banking institutions were researcher's computation.

The overall average growth rate of aggregate agribusiness output between the year 2005 and 2014 was 5.93 percent. The growth rate of aggregate agribusiness output in Nigeria between 2005 and 2014 is relatively low. The slow rate of increase in government spending to agricultural sector for agribusiness production probably slowed down the rate of increase in the output of agriculture in the country and the productivity of the sector, especially, where farmers lacked personal savings for investment purposes and/or found it difficult to obtain loans from informal credit sources to purchase better production inputs due to the uneconomical interest rate charged by these informal credit lenders. The mean quantity of aggregate agribusiness output during the post-merger and acquisition policy in the Nigerian banking institutions (2005-2014) was more than in pre-merger and acquisition consolidation policy in the Nigerian banking institutions (1995-2004).

Table 2 further showed that between 2005and 2014, a total of 81,390.36 billion naira was the value of bank's credit allocation to agribusinesses in Nigeria. Value of bank's credit allocation varied from a minimum of 4,087.45 billion naira in 2007 to a maximum of 12,456.25 billion naira in 2014. Value of bank's credit allocation decreased steadily from 9,366.39 billion naira in 2005 to 4,087.45 billion naira in 2007 and subsequently increased to 8,328.57 billion naira in 2009. The value of bank's credit allocation fluctuated between 2010 and 2014. The mean value of bank's credit allocation between 2005 and 2014 was 14,798.25 billion naira. The result further indicated that value of bank's credit allocation showed heterogeneity in growth between 2005 and 2014. The growth rate of value of bank's credit allocation varied from a minimum of -123.27 in 2006 to a maximum of 37.10 percent in 2008. The overall average growth

rate of value of bank's credit allocation between the year 2005 and 2014 was -3.76 percent. The growth rate of value of bank's credit allocation to agribusinesses in Nigeria between 2005 and 2014 was relatively low. The mean value of bank's credit allocation during the post-merger and acquisition consolidation policy in the Nigerian banking institutions (2005-2014) was more than in the pre-merger and acquisition consolidation policy in the Nigerian banking institutions (1995-2004).

Table 3. Pre-merger and post-merger acquisition consolidation policy in Nigerian banking institutions(1995-2004)

Pre-merger and acquisition consolidation policy in Nigerian banking institutions(1995-2004)						
GCEA	1.543 (2.747)**	0.182 (0.628)	0.003 (0.107)	0.511	0.371	3.656*
AGOUT	3.789 (130.326)***	0.032 (2.159)*	-0.001(-0.381)	0.863	0.824	22.017***
NBCAA	7.583 (60.358)***	-0.132 (-2.263)**	0.021 (3.553)***	0.799	0.742	13.933***
VBCAA	5.197 (33.122)***	0.021 (0.626)	0.028 (3.625)***	0.960	0.949	84.528***
Post-merger and acquisition consolidation policy in the Nigerian banking institutions(2005-2014)						
GCEA	4.279 (23.584)***	0.160 (1.700)	-0.023(-2.254)*	0.536	0.404	4.046*
AGOUT	4.125 (2036.4227)***	0.067 (63.537)***	-0.001(-5.930)***	0.999	0.999	22851.35**
NBCAA	8.415 (109.504)***	0.006 (0.162)	0.004 (0.913)*	0.691	0602	7.814**
VBCAA	9.718 (37.141)	-0.020(-0.169)	0.011 (0.882)	0.508	0.368	3.617*

2014. and * represent 1%, 5% and 10% significance levels respectively. Figures ibrackets are t-values. GCEA = Government capital investment in agribusinesses; AGOUT = Agribusiness output; NBCAA = Number of bank's credit allocation to agribusinesses; VBCAA = Value of bank's credit allocation to agribusinesses

Evidence from Table 2 also showed that between 2005 and 2014, there was variation in the number of loans granted to different agribusiness enterprises by banks in Nigeria. A cumulative number of 52,479 farmers of different categories benefited from bank's credit allocation in Nigeria from 2005-2014. The number of loans granted to different agribusiness enterprises by banks in Nigeria varied from a minimum of 4,295 farmers in 2006 to a maximum 7,232 farmers in 2014. The number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria fluctuated between 2005 and 2014. A steady increase in the number of loans granted to agribusiness farmers was record between 2012 and 2014. The farmers increased from 4,874 in 2012 to 7,232 in 2014. The mean number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria was 9,542. The result further indicated that number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria showed heterogeneity in growth between 2005 and 2014. The growth rate of number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria varied from a minimum of -15.57 in 2012 to a maximum of 20.27 percent in 2014. The overall average growth rate in number of loans granted to farmers in different agribusiness enterprises by banks in Nigeria between the year 2005 and 2014 was 4.12 percent.

The statistical positive value of the coefficients of time variables for number and value of bank credit allocation to agribusinesses in Nigeria revealed acceleration in the growth rate of those variables in the pre-merger and acquisition consolidation policy. This indicated that these variables increased at an increasing rate within the period under review, while the non-significant negative and positive values of the coefficient of time variable for government capital investment in agribusinesses and agribusiness output respectively were an indication of stagnation in the growth rate of these variables.

During the post-merger and acquisition consolidation policy in the Nigerian banking institution, the statistically significant negative value of the coefficient of time variable for government capital investment in agribusiness and agribusiness output revealed deceleration in growth rate of those variables, while the statistically significant positive value of the coefficient of time variable for number of banks credit allocation to agribusinesses indicated acceleration in the

growth rate of the variable. Likewise, the non-significant positive value of the coefficient of time variable for value of banks credit allocation for agribusinesses was an establishment of stagnation in the growth rate in the variable. The result generally showed inadequate allocation of credit for production purposes to agribusiness enterprises as well as government capital support to agribusiness. Thus, the merger and acquisition consolidation policy have not translated into increasing government credit support as well as bank loan advances for agribusiness development in Nigeria.

CONCLUSIONS

Number and value of loans allocation to agribusiness operators changed in trend over time. Similarly agribusiness output as well changed in trend over time. Value of bank's credit allocation to agribusinesses in Nigeria showed heterogeneity in growth during the post-merger and acquisition consolidation policy of the banking institutions in Nigeria. The rate of growth in the quantity produced of agribusiness output in Nigeria is not keeping pace with credits from the banking institutions in Nigeria and government capital expenditure, an indication that some funds that were meant for agriculture production were diverted or siphoned by some individuals in possession of the funds. Merger and acquisition consolidation policy in the Nigerian banking institutions did not translate into increase neither capital investment from government nor credit supports from banking institutions in Nigeria granted to agribusiness enterprise operators. The merger and acquisition consolidation policy in the Nigerian banking institutions may have led to disfranchisement of most agribusiness enterprise operators from accessing loan from most banks due to the inability of these operators to meet the stringent requirement stipulated by some of the banking institutions. Number and value of bank credit allocation to agribusinesses in Nigeria acceleration in growth rate while government capital investment in agribusinesses and agribusiness output stagnation in growth rate in the pre-merger and acquisition consolidation policy in the Nigerian banking institutions. Government capital investment in agribusiness and agribusiness output decelerated in growth rate while number of banks credit allocation to agribusinesses accelerated in growth rate, value of banks credit allocation for agribusinesses stagnated in growth rate in the variable during the post-merger and acquisition consolidation policy in the Nigerian banking institutions. Agribusiness output and value of credit allocation by banking institutions in Nigeria significantly accelerated in growth during post-merger and acquisition consolidation policy of the Nigerian banking institutions than in the pre-merger and acquisition consolidation policy of the Nigerian banking institutions.

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AGRICULTURAL LAND AVAILABILITY AND RURAL FARMERS' OUTPUT IN ABIA STATE, NIGERIA

Chigozirim Ndubuisi ONWUSIRIBE, Daniel Chinedu NWAOGU

Michael Okpara University of Agriculture Umudike, Abia state, Nigeria. Department of Agribusiness and Management, Department of Agricultural Economics. Phone: +2348063425721, Email: danielchinedu32@gmail.com

Corresponding author: danielchinedu32@gmail.com

Abstract

This study examined the effect of agricultural land availability on the performance of rural farmers in Abia State. The study showed that 55% of the respondents practiced inheritance as the prevalent land tenure system implying that majority of the farmers cultivated on lands owned by them or acquired from their fathers or kinsmen. The regression result shows an R^2 of 0.585 implying that 58.5% of changes in the availability of land were accounted for by changes in the variables included in the model while the remaining 41.5% was accounted for by error. Price of land and urbanization were negatively related to land availability at 5% significant level while age of farmers and distance to farm lands were also negatively related to land availability but at 10% significant level. The correlation result reveals a negative significant relationship between farm size and land market price. The correlation result also reveals a positive significant relationship between farm size and farm performance (proxied by net profit from farm produce sales). This implies that as farm size increases, performance also increases and vice versa. It was recommended that government intervene in the existent land hoarding challenge by rural dwellers and therefore make land available for willing farmers. Appropriate land planning programmes be promoted in a bid to reducing the fast run of urbanization with a consequent effect on land availability for agriculture.

Key words**:** *agricultural, availability, land, urbanization*

INTRODUCTION

The role of agriculture in developing countries like Nigeria is significantly and unarguably massive in not only contributing to the economic growth but in also in feeding her teeming population. Agriculture is therefore considered as the bedrock of the economy in Africa having employed about 70% of the workforce and generates, on average, 30 percent of the region's gross domestic product (GDP) [6]. There is a case of an untapped potential in the sector, that is, to increase individual farmers' yield per area of land cultivated consequently and ensure food self-sufficiency and security.

The inability to maximize the full capacity of this sector (albeit, providing food sufficient to meet the human daily dietary requirement) has been seriously linked to be the major cause of malnutrition. Malnutrition on the other has been reported to have serious human and economic consequences such that children's growth is grossly retarded creating an inability to reach their full mental and physical potentials. For adults engaged in farming activities, farm productivity is threatened.

Consequently, a link between nutrition, farm output and economic growth could be established. Infact, it has been shown that inadequate nutrition reduces the growth rate of GDP per capita in sub-Saharan Africa by between 0.16 and 4.0 percentage points (Arcand, 2000), cited in [5]. While the key factor in Africa's sub-standard nutrition can be attributed to poor feeding, agricultural underdevelopment characterized by low yield and low land utilization have also been linked thereto. Africa boasts about 25 percent of the world's arable land, yet its output is only about 10 percent of global agricultural output [9] thus showing a massive gap in yield. A similar study by World Bank/FAO [1] reports that of the 400 million acres that can be used for agriculture, less than 10 percent is currently cultivated. Thus, Africa is the largest underutilized land reserve in the world.

In Nigeria for instance, land is the most valued asset of many rural dwellers. Nigeria's land area measures 910,770 km² and harbours a growing population of 170,123,740 people, with more than 53 percent falling within the workforce bracket (2012 estimates). An estimated 71.2 million hectares of the land is considered suitable for agriculture, half of which is currently not under-utilization. The records of high rates of unemployment, poverty, and food importation [3, 4, 7, 10] coupled with land unavailability has thus led to sharp competition between individuals and between land users producing negative effects on the supply picture of land which is characterized by bidding and counter-bidding. The poor households may lack the financial ability to cope with this trend therefore recycling the food insecurity and low farm output dilemma.

In Abia State, like in most other population-stressed regions, land is getting more and more commercialized with the price increasing beyond the reach of many famers. There is difficulty in obtaining enough land for large scale farming by prospective farmers. Disputes over land titling are commonly found now between families and communities which at times results to loss of life and property.

Land resources often become a matter of economic significance whenever people begin to use them, compete with others for their uses and control, put a price or assume the costs associated with land development.

This means that those users of land offering higher prices get the land whereas the famers who lack adequate financing status are left with marginal land of poor fertility.

The implication will be a continuous decline in size and quality of land available and sufficient for agricultural activities with a suspected devastating effect on food production, malnutrition and food security.

From the ongoing, it is worthy to note that improving the status (availability) and productivity of rural land is crucial to achieving economic independence, food security and sustainable development not only at the micro level but also at the macro.

MATERIALS AND METHODS

Study Area

This research work was carried out in Abia State, Nigeria. The state lies between the latitude 50 03ºN to 50 07º and longitude 70 17ºE to 70 24ºE and it is located in the tropical rainforest zone of Nigeria. The state covers a land area of 5,243.7 square kilometers. It has a total population of 2,845,380 comprising 1,430,298 males and 1,415,082 females (NPC, 2006). The inhabitants are predominantly Igbos and engage in farming activities (crop and livestock) at low and medium scale levels.

Sources of Data and Method of Collection

Data were generated with the use of well-structured questionnaire from 60 rural farmers in the study area such as social economic characteristics, farm level characteristics etc.

Method of Data Analysis

Data generated were analyzed with the use of simple descriptive statistics like means, frequencies and tables and other econometric tools like correlation and multiple regression.

Model Specification

Correlation model is specified to capture the effect of:

(i)land availability (size of land, hectare) on farm performance (₦) and;

(ii)land market price (₦) on farm size (hectare).

The model is specified as:

$$r = \frac{n\,\varepsilon xy - \varepsilon x \varepsilon y}{\sqrt{n\,(\varepsilon x)^2 - (\varepsilon x)^2 - (n\varepsilon xy^2 - (\varepsilon y)^2}}$$

where:

r = correlation coefficient

x_a = land availability (measured by area of land cultivated in hectares)

y_a = farm performance (₦)

x_b = land market price (₦)

y_b = farm size (hectare)

The multiple regression model for factors affecting the availability of land is specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon$$

where:

Y= Availability of land (Size of current land

under cultivation measured in Hectares)
X_1 = Price of land (₦)
X_2 = Urbanization (Size of land lost due to urbanization measured in hectares)
X_3 = Age of farmers (Years)
X_4 = Household size
X_5= Cost of labour (₦)
X_6 = Distance to farm land (Km)
$\beta_1 - \beta_7$ = Regression coefficients,
ε = Random error

RESULTS AND DISCUSSIONS

Land Acquisition Practices and Access to Land

The land acquisition practices in the study area are presented in Figure 1.

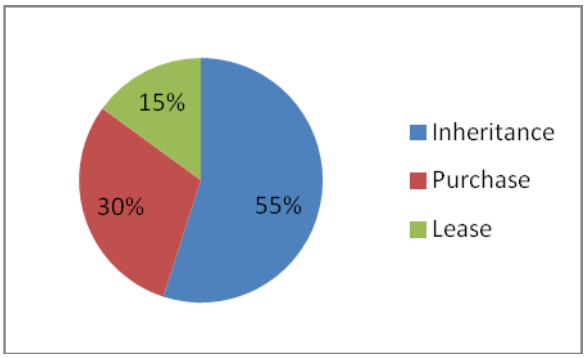

Fig. 1. Land Acquisition Practices and Access to Land
Source: Field Survey, 2016.

The study showed that 55% of the respondents practiced inheritance as the prevalent land tenure system. This could be due to level of developmental attainment. This implies that majority of the farmers cultivated on lands owned by them or acquired from their fathers or kinsmen. This was followed by 30% of the respondents who practiced the purchase lad system implying that they bought the land on which they farmed. The least was lease at 15%.

Factors Affecting Land Availability in the Study Area

A regression of Cobb-Douglas form was used to examine the influence of six (6) explanatory variables on the availability of agricultural land and the result is presented in Table 1.

The regression result above shows an R^2 of 0.585 implying that 58.5% of changes in the availability of land were accounted for by changes in the variables included in the model while the remaining 41.5% was accounted for by error.

Table 1.Regression result for factors affecting land availability in the study area

Variables	Coefficients (B)	t	Sig
(Constant)	-6.253	-.934	.363
X_1 = Price of land (₦)	-.900	-2.342	.311**
X_2 = Urbanization	-.211	-2.911	.375**
X_3 = Age of farmers (Yrs)	-.988	-1.546	.140*
X_4 = Household size	-.461	-1.061	.303
X_5 = Labour cost (₦)	.241	.718	.482
X_6 = Distance (Km)	-1.048	-1.833	.083*
Adj. R^2	0.446		
R^2	0.585		
F-Ratio	4.224***		

Source: Field Survey Data, 2016.
(*** = 1%, ** = 5% and * = 10% level of significance respectively)

The F-ratio was significant at 1% showing a good fit of the regression line. Of the six (6) variables included in the model, price of land and urbanization were negatively related to land availability at 5% significant level while age of farmers and distance to farm lands were also negatively related to land availability but at 10% significant level.

Price of land was negatively to land availability at 5% level of significance implying that land will become less available to farmers as their prices increased and vice-versa. Farmers tend to reduce the area cultivated whenever the land price increases beyond the available fund.

Similarly, urbanization had a negative relationship on land availability at 5% level of significance indicating that as the area lost due to development (such as residential and industrial buildings) increases, there is a reduction in the size of land available for agricultural cultivation.

The age of farmers' coefficient was negatively signed at 10% significant level implying that

land area available to agriculture will reduce as the farmers advance in age. This could be explained by the phenomenal reduction of energy and s as age increases, thus the farmers may have less strength to cultivate more land.
The study also revealed that distance to farm lands negatively influenced land size cultivated at 10% significant level showing that as distance to farms increases, farmers may reduce the area of land cultivated probably due to the energy expended in trekking to the farms.

Analysis of the Relationship between Farm size and Land Market Price

To determine how land prices affect farm size availability, correlation analysis was performed and the result shown in Table 2.

Table 2. Summary of the Correlation Analysis between Farm size and Land Market Price

		Farm size	**Land Market Price**
Farm size	Pearson correlation	1	-.316
	Sig (2-tailed)		.014**
	N	60	60
Land market price	Pearson correlation	-.316	1
	Sig (2-tailed)	.014**	
	N	60	60

Source: Field Survey, 2016.
(** = 5% significant level)

The result above reveals a negative significant relationship between farm size and land market price. As farm size increases, farmers are forced to reduce the size of land they can purchase so as to meet up with other household expenses like healthcare, school fees, feeding etc. This condition is worsened by the prevalent high cost of land, limited farmland (evidenced from the study) caused by ever-growing population which has put land under pressure for construction of buildings, industrialization and food production. The need to intensify use land to meet the growing demand for food therefore becomes pertinent.

Analysis of the Relationship between Farm size and Performance

To examine the relationship and effect of farm size on performance of farm enterprises, a correlation analysis was performed and the result is presented in Table 3.

Table 3.Summary of the Correlation Analysis between Farm size and Performance

		Farm size	**Performance**
Farm size	Pearson correlation	1	.324
	Sig (2-tailed)		.085**
	N	60	60
Land market price	Pearson correlation	.324	1
	Sig (2-tailed)	.085**	
	N	60	60

Source: Field Survey, 2016.
(** = 5% significant level)

The Table 3 above reveals a positive significant relationship between farm size and farm performance (proxied by net profit from farm produce sales). This implies that as farm size increases, performance also increases and vice versa. This further reveals that farmers will get more returns when they have larger farms under cultivation, thus large farmlands that are cultivated will surely lead to higher gross and net returns. This result conforms to *a priori* expectations.

CONCLUSIONS

This study examined the effect of agricultural land availability on the performance of rural farmers in Abia State. The effect of land market prices on the land availability was also examined. Land availability from the study was affected by land market prices, urbanization, farmers' age and distance to farm. The study also showed that farm size positively affected farm performance i.e. the more farm size cultivated, the more income received. Based on the findings of this study, it was recommended that government intervene in the existent problem of land hoarding by rural dwellers thus making land available for willing farmers; efforts must be made to keep the price of land within the reach of the poor masses. Land prices should also be set at uniform levels to avoid price discriminations.

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INFLUENCE OF AGRICULTURAL CREDIT GUARANTEE SCHEME FUND (ACGSF) ON FISHERY DEVELOPMENT IN NIGERIA

Lawrence Olusola OPARINDE, Taiwo Timothy AMOS, Michael ADESELUKA

The Federal University of Technology, Akure, Department of Agricultural and Resource Economics, P.M.B. 704, Akure, Ondo State, Nigeria. GSM: +2348062317878, Email: looparinde@futa.edu.ng.

Corresponding author: looparinde@futa.edu.ng

Abstract

Access to credit has been identified as a crucial tool in increasing fish production in the developing countries like Nigeria. ACGSF was established for the purpose of boosting agricultural production (fish production inclusive). It is, therefore, imperative to study the Influence of Agricultural Credit Guarantee Scheme Fund on fishery development in Nigeria. Annual time-series data between 1981 and 2012 were collected on relevant variables and analysed using Descriptive Statistics, Growth Function and Autoregressive Distributed Lag. The results of the analysis showed that fishery sub-sector was the least financed in the agricultural sector of the economy. This is reflected in low contribution of fishery sub-sector to Gross Domestic Product (GDP) due to the fact that the required importance is not given to the sub-sector as it is poorly financed by ACGSF. Also, growth rate of fishery contribution to GDP was 10.63% and the proportion of GDP from fishery to total GDP from Agriculture was 0.005%. In the long run, volume of loan to agriculture and fishery had positive and negative relationship respectively with GDP from fishery. The short run dynamics adjusts to the long run equilibrium at the rate of 34% per annum. In conclusion, fishery sub-sector has been experiencing poor finance from Agricultural Credit Guarantee Scheme Fund. Therefore, the study recommended that volume of ACGSF credit devoted to fishery sub-sector should be significantly increased if sustainable development will be recorded in the sub-sector. Also, credit given to the sub-sector should be monitored in order to prevent diversion and poor management.

***Key words*:** *ACGSF, Fishery, GDP, ARDL, Nigeria*

INTRODUCTION

It is an indubitable truism that fish has become the important source of protein to people in order to substitute for other animal proteins [30] because fish products are seen to be relatively cheaper compare to beef, pork and other animal protein sources in Nigeria [6]. Millions of people around the world including many in developing countries like Nigeria derive their means of livelihoods along fishing value chain while about 2.6 billion people get their protein from seafood. Also, fishing provides job opportunities for millions of people in Africa and provides a vital source of protein to over 200 million people. Another fact is that about 30% (29.5 Mt) of the world fish catch is used for non-human consumption such as production of fishmeal and fish oils that are used as feeds and raw-materials in agriculture, aquaculture, and industries. Fishmeal and fish oils are important in aquaculture production as they form key dietary components depending on the species being cultured [1].

About 2% of the national Gross Domestic Product is accounted for by the fisheries sub-sector of the Nigerian agricultural economy [26]. [2] noted that the declining supplies of capture fisheries can be adequately reversed by fish-aquaculture industry, while [20] observed that in a bid to reduce the existing supply-demand gap in Nigeria, fish farming is quickly gaining increased relevance. The rate at which seafood is being consumed domestically in Nigeria is very high, therefore, almost all the fish produced is consumed. The fish deficit in Nigerian is about one million tons annually due to the increasing demand for fish protein equivalent to 40% of the total animal protein requirement in the country [8].

No wonder the governments of the continent of Africa, under the umbrella of the African Union, have identified the great potential of fish farming and are determined to encourage

private sector investment in the subsector of the economy of African countries [25]. However, despite the abundant fisheries resources and the relatively high consumption of fish in Nigeria that is the largest simple consumer of fish products in Africa, its domestic output of 0.62 million metric tons still falls short of demand of 2.66 million metric tons [17]. The contribution of Sub-Saharan Africa to aquaculture production at world level is less than 1% [19]. To support future needs, capture fisheries have to be sustained and if possible enhanced, and aquaculture should be developed rapidly, to increase by over 260% i.e. an annual average of more than 8.3% by 2020 in sub-Saharan Africa alone [23].

According to [21], it is estimated that over 1.3 million tons of fish is consumed annually, whilst about 700,000 tons of frozen fish is imported per annum [8]. The existing gap between supply and demand is being offset by the imported fish in the country. Nigeria's domestic fish supply is from artisanal, commercial trawler, and aquaculture (fish farming) sources, with the artisanal fishery contributing more than 80% of the domestic production [16]. According to [15], there is need to close the gap between fish demand and supply in Nigeria as fish supply is 400, 000 tons in comparison to 800,000 tons of demand.

A supply deficit of 2.04 million metric tons is required to meet the ever increasing demand for fish in Nigeria. Nigeria is a large importer of fish with official records indicating 681,000 metric tons while export in 2008 was 0.065 million metric tons and valued at US$40.5 million. The local supply consists of productions from the artisanal was (89.5%-85.5%) while industrial and aquaculture subsector was (5%-2.5%) and (5.5%-12.0%) respectively [18]. However, it has been demonstrated that Nigeria is capable of substituting fish importation with domestic production in order to create employment, reduce poverty in rural and peri-urban areas where 70% of the population live and ease the balance of payment deficits [29].

Access to credit has been identified as a crucial tool in increasing fish production so as to bridge the gap between fish demand and supply in the developing countries like Nigeria. Increased domestic fish production will discourage fish importation but facilitate job creation. This is the reason why the Federal Government of Nigeria established Agricultural Credit Guarantee Scheme Fund (ACGSF) as it acknowledged the importance of agricultural credit to boost agricultural production including fish production. Therefore, evaluation of the influence of the ACGSF on the fishery development will give useful information for the formulation of policies targeted towards food security and sustainable fishery development in Nigeria. This is necessary since domestic fish production cannot meet up with the demand even with the establishment of ACGSF.

Overview of Agricultural Credit Guarantee Scheme Fund (ACGSF)

Agricultural Credit Guarantee Scheme Fund (ACGSF) was introduced as encouragement to commercial and merchant banks to give agricultural credit loan to farmers. The scheme began operation in 1978 with the Central Bank of Nigeria (CBN) managing the fund provided. Under the scheme, bank loans to the agricultural sector are guaranteed up to 75% of the amount in default by the farmer. The fund was set up by the Federal Government and the CBN in the ratio of 60:40. The following reasons necessitated the establishment of ACGS; high risk and uncertainty owing to natural hazards, threat of diseases and pest to crops/livestock, long gestation period required for livestock/crops to mature. The activities of ACGSF cover livestock, fisheries, food crops, cash crops and other agricultural activities [7].

Most often, financial institutions require huge collateral from customers before loans are granted to them. This is harmful to farmers' efforts at getting such loans to enhance their production. The ACGSF is aimed at reducing this dearth by guaranteeing these farmers or other individuals involved in agricultural production when seeking for loans from the banks [10].

The purpose of the fund is to provide guarantee in respect of loans granted by any bank for agricultural purposes.

MATERIALS AND METHODS

Data Sources and Collection

Annual time-series data, for this study on relevant variables, were collected from various issues of Central Bank of Nigeria Annual Reports and other relevant publications from 1981-2012.

Analytical Technique

Descriptive statistics, Growth function and Autoregressive Distributed Lag Model were used in the analysis of the data collected.

Growth Function Model Specification

There are various methods that can be used in computing the compound growth. According to [7] and [28] who stated that one of the methods is to use data at the beginning and at the end of a period which has been shown to ignore vital information. [11] observed that such a measure of growth is influenced heavily by the choice of years and it also ignores the information lying in-between the two selected years. It is, therefore, appropriate to choose that measure which takes into account the entire series observation. Following [11], this study adhered to the compound growth rate that was computed by fitting the exponential function in time to the data by using the following formula:

$$Y = b_0 e^{bt} \quad (1)$$

After linearizing in logarithm, equation 1 turns to:

$$LogY = b_0 + b_1 t \quad (2)$$

where:

Y= GDP from fishery subsector

t = Time trend variable

b_0, b_1, = Regression parameters to be estimated

The growth rate (r) is given by

$$r = (e^b - 1) \times 100$$

where e is Euler's exponential constant (2.7183).

In order to investigate the existence of acceleration, deceleration or stagnation in growth rate of GDP from fishery and Proportion of GDP from fishery to Agriculture, quadratic equation in time variables was fitted to the data for two periods (1981-1999 and 2000-2012) following [3] as follows:

$$LogY = b_0 + b_1 t + b_2 t^2 \quad (3)$$

The quadratic time term t^2 allows for the possibility of acceleration or deceleration or stagnation in growth during the period of the study. Significant positive value of the coefficient of t^2 confirms significant acceleration in growth, significant negative value of t^2 confirms significant deceleration in growth while non-significant coefficient of t^2 implies stagnation or absence of either acceleration or deceleration in the growth process. These two periods under consideration were chosen because of increase in fund being used by ACGSF in the late 1999. The fund was enhanced to ₦1billion on the 8th December, 1999 from the initial ₦100 million and further increased to ₦4billion in 2006.

Autoregressive Distributed Lag Model

In co-integration studies, many studies have employed vector auto-regressive (VAR) model to establish multivariate relationship but the use of Autoregressive Distributed Lag (ARDL) model is not popular in analyzing the relationship among variables of interest in fishery subsector. The bounds testing (Autoregressive Distributed Lag (ARDL) Model) co-integration procedure as used by [31]; [32]; [14] empirically analysed the long-run relationships and dynamic interactions among the variables of interest. It is against this background that ARDL is considered imperative to analyze relationship that exists among the selected climatic variables[2] on ACGSF loan and GDP contribution from fishery subsector in this study.

In ARDL bounds test, it is not compulsory that the variables of interest should be integrated of the same order in bounds approach unlike other techniques such as the Johansen co-integration approach. The ARDL bounds testing approach is applicable whether the variables (regressors in the model) are purely I(0), purely I(1), or mutually co-integrated. It is found that bounds approach is suitable for small sample which makes it more superior to that of multivariate co-integration (for details, see [33].

The hypothesis of no co-integration among the variables against the presence of co-integration among the variables was tested using F-test of the joint significance[3] of the

coefficients of the lagged levels of the variables. Regardless of whether the variables are *1(0)* or *1(1),* the F-test has a non-standard distribution. Inference is made based on two sets of adjusted critical values with lower and upper bounds. It is assumed that that all variables are *1(0)* by one set, while the other set assumes that they are all *1(1).* The rule is that the null hypothesis of no co-integration is rejected if the computed F-statistics falls above the upper bound critical value. Conversely, the null hypothesis cannot be rejected if the computed F-statistics falls below the lower bound, while the result would be inconclusive if it falls between the lower and upper bound [33].

The hypothesis can be stated as follows;

The null hypothesis of no co-integration (no long-run relationship) among variables of interest is given as:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

The alternative hypothesis (there is long-run relationship or co-integration exists) among variables of interest is given as:

$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0.$

The relationship between Gross Domestic Product (GDP) from fishery subsector, volume of ACGSF loan to fishery subsector, number of ACGSF loan to fishery subsector, volume of ACGSF loan to agriculture and number of ACGSF loan to agriculture is expressed implicitly as follows;

$GDPF = f(VLF, NLF, VLA, NLA)$ (4)

where: *GDPF* = Gross Domestic Product (GDP) from fishery subsector (Naira)

VLF = Volume of ACGSF loan to fishery subsector (Naira),

NLF = Number of ACGSF loan to fishery subsector,

VLA = Volume of ACGSF loan to agriculture (Naira),

NLA = Number of ACGSF loan to agriculture.

As observed by [5], the variables were transformed and measured in their natural logarithm (ln) for easy interpretation of coefficients in standardized form of percentage. According to [33], the ARDL model specification of equation (4) is expressed as unrestricted error correction model (UECM) to test for co-integration between the variables under study:

$$\Delta \ln GDPF_t = \beta_0 + \sum_{i=1}^{q} \beta_1 \Delta \ln GDPF_{t-i} + \sum_{i=0}^{q} \beta_2 \Delta \ln VLF_{t-i} + \sum_{i=0}^{q} \beta_3 \Delta \ln NLF_{t-i} + \sum_{i=0}^{q} \beta_4 \Delta \ln VLA_{t-i} + \sum_{i=0}^{q} \beta_5 \Delta \ln NLA_{t-i} + \omega_1 \ln GDPF_{t-1} + \omega_2 \ln VLF_{t-1} + \omega_3 \ln NLF_{t-1} + \omega_4 \ln VLA_{t-1} + \omega_5 \ln NLA_{t-1} + e_t \quad (5)$$

Once co-integration is established, the long run relationship is estimated using the conditional ARDL model specified as:

$$\ln GDPF_t = \beta_0 + \omega_1 \ln GDPF_{t-1} + \omega_2 \ln VLF_{t-1} + \omega_3 \ln NLF_{t-1} + \omega_4 \ln VLA_{t-1} + \omega_5 \ln NLA_{t-1} + e_t \quad (6)$$

The short run dynamic relationship is estimated using an error correction model specified as:

$$\Delta \ln GDPF_t = \beta_0 + \sum_{i=1}^{q} \beta_1 \Delta \ln GDPF_{t-i} + \sum_{i=0}^{q} \beta_2 \Delta \ln VLF_{t-i} + \sum_{i=0}^{q} \beta_3 \Delta \ln NLF_{t-i} + \sum_{i=0}^{q} \beta_4 \Delta \ln VLA_{t-i} + \sum_{i=0}^{q} \beta_5 \Delta \ln NLA_{t-i} + \delta ecm_{t-1} + e_t \quad (7)$$

where; β_0 = Constant term, ln = Natural log, et = White noise, $\beta_1 - \beta_5$ = Short run elasticities (coefficients of the first-differenced explanatory variables), $\omega_1 - \omega_5$ = long run elasticites (coefficients of the explanatory variables), ecm_{t-1} = Error correction term lagged for one period, δ = Speed of adjustment, Δ = First difference operator, q = Lag length.

RESULTS AND DISCUSSIONS

Sub-sectoral Loan Allocation in Agricultural Sector

ACGSF Loan Allocation in Agricultural Sector between 1981 and 2012 as shown in Fig. 1 indicates increase in the value of loan to the sector as a whole and also in nearly all the sub-sectors. However, it is crystal clear that crop sub-sector was given priority at the expense of other sub-sectors as it took the largest proportion of the sectoral loan from ACGSF during the period under study. This had direct impact on the level of GDP from these sub-sectors because the GDP contributions from fishery and livestock could not be compared to that of crops, which had the highest. The implication of this is that the two other sub-sectors could also record higher

GDP as the value of loan allocated is increasing. This had been noticed by [7] who stated that as it is the case of past programmes such as World Bank loans that have always been focused on the crop sub-sector to the detriment of the livestock sub-sector, a large portion of the activities of ACGSF is geared towards the crop sub-sector. Considering the level of local fish production and its importance both nutritionally and economically, it is desirable for ACGSF to drastically step up the value of loan that goes to fishery sub-sector so as to increase production that is very needful at this point in time. As shown in Figure 1, fishery sub-sector is the least financed by the ACGSF, which shows lesser importance attached to sustainable increase in fish production by the Nigerian Government. It is equally important to state that failure to increase value of loan that goes to fishery sub-sector is an invitation for international communities to flood Nigerian markets with both healthy and unhealthy fishes, which could have health implication on its citizens.

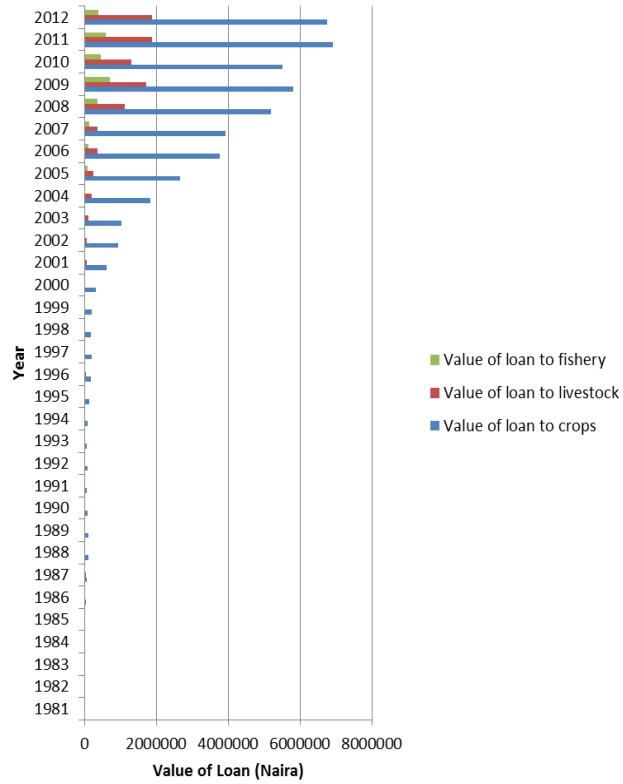

Fig. 1. ACGSF Loan Allocation in Agricultural Sector Between 1981-2012
Source: Computed from Central Bank of Nigeria (CBN) Data of Various Years.

Growth Rate of GDP from Fishery and Proportion of GDP from Fishery to Agriculture

Table 1 shows growth rate of GDP from fishery and proportion of GDP from fishery to agriculture considering two periods (1981-1999 and 2000-2012). GDP from fishery and proportion of GDP from fishery to agriculture had positive growth rate of 17.8% and 0.1% respectively in 2000-2012 while in 1981-1999, GDP from fishery and proportion of GDP from fishery to agriculture had positive and negative growth rate of 29.6% and 1.8% respectively. Considering 1981-2012, GDP from fishery and proportion of GDP from fishery to agriculture had positive growth rate of 10.63% and 0.005% respectively.

Table 1. Estimated Equation for Fishery Contribution to GDP and Growth Rates

Variable/Period	Coefficient	T-value	R^2	Growth Rate (%)
2000-2012				
GDP from Fishery	0.164***	27.998	98.6	17.8
Proportion of GDP from Fishery to Agriculture	0.001	0.206	0.4	0.1
1981-1999				
GDP from Fishery	0.259***	15.108	93.1	29.6
Proportion of GDP from Fishery to Agriculture	-0.018	-1.479	11.4	-1.8
1981-2012				
GDP from Fishery	0.101***	32.443	97.2	10.63
Proportion of GDP from Fishery to Agriculture	5.121E-5	0.244	2.2	0.005

Source: Computed from Central Bank of Nigeria (CBN) Data of Various Years.

Low growth rate recorded by the proportion of GDP from fishery to agriculture testified to the fact that fishery sub-sector is not given required attention as it is in other sub-sectors of Agricultural sector.

The growth rate of GDP from fishery in 1981-1999 was greater than that of 2000-2012 despite the fact that the scheme was operating with larger fund in 2000-2012. One of the reasons for this scenario could be that fishery sub-sector did not receive proportionate volume of fund with respect to increase in fund being used by the scheme in 2000-2012. This is another evidence that fishery sub-sector has not been well financed by ACGSF in Nigeria. Also, the growth rate of proportion

of GDP from fishery to agriculture in 2000-2012 was greater than that of 1981-1999. However, this little difference in growth rate cannot be compared with the huge difference in funds available for use by ACGSF in the two periods under consideration.

Acceleration, Deceleration or Stagnation in the Movement in Growth Rates of GDP from Fishery and Proportion of GDP from Fishery to Agriculture in 1981-1999 and 2000-2012

Quadratic equations were estimated in time variables to determine whether there was acceleration, deceleration or stagnation in the movement in growth rates of GDP from Fishery and Proportion of GDP from Fishery to Agriculture in the two periods. Table 2 shows that the coefficients of t^2 for GDP from Fishery and Proportion of GDP from Fishery to Agriculture in 2000-2012 were negatively significant at 1% and 5% respectively indicating deceleration in the growth of GDP from Fishery and Proportion of GDP from Fishery to Agriculture. This has further shown that fishery sub-sector was inadequately financed in 2000-2012 even when there was increase in the funds being used by ACGSF. On the contrary, the coefficient of t^2 for GDP from fishery was positively significant at 1% confirming acceleration in the growth of GDP from fishery in 1981-1999 when smaller amount of fund was being used by ACGSF.

Table 2. Estimated Quadratic Equations for Fishery Contribution to GDP

Variables/Period	b_1	b_2	R^2
2000-2012			
GDP from Fishery	0.239*** (22.359)	-0.005*** (-7.217)	99.8
Proportion of GDP from Fishery to Agriculture	0.019** (2.389)	-0.001** (-2.514)	39.0
1981-1999			
GDP from Fishery	0.056 (1.048)	0.010*** (3.938)	96.5
Proportion of GDP from Fishery to Agriculture	-0.114** (-2.354)	0.005** (2.030)	29.6

Figures in parenthesis represent t-value. *** = 1% Significant Level, ** = 5%

Source: Computed from Central Bank of Nigeria (CBN) Data of Various Years.

In the case of Proportion of GDP from Fishery to Agriculture, the coefficient of t^2 was positively significant at 5% suggesting acceleration in the growth in 1981-1999. This implies that the impact of ACGSF was positively felt by fishery sub-sector in 1981-1999 when smaller funds were being used by the scheme.

Unit Root Test Analysis

As stated by [27], it is necessary to carry out unit root tests in order to ensure that the assumption of ARDL stated by [33] is not infringed in spite of the fact that ARDL co-integration technique does not require pre-testing of variables included in the empirical model for the order of integration. The standard Augmented Dickey-Fuller (ADF) unit root test was employed to check the order of integration of the variables used in the analysis. As shown in Table 3, the ADF test statistic revealed that GDP from fishery subsector (GDPF) and volume of ACGSF loan to fishery (VLF) were stationary at level I(0) and first difference I(1), while number of ACGSF loan to fishery (NLF), volume of ACGSF loan to agriculture (VLA) and number of ACGSF loan to agriculture (NLA) were stationary at first difference I(1). The combination of I(0) and I(1)can be used under ARDL unlike Johansen procedure and this is the justification for using bounds test approach in this study.

Table 3. Results of Unit Root (ADF) Test

Variable	Level [I(0)]		First Differences [I(1)]	
	Constant	Constant and Trend	Constant	Constant and Trend
lnGDPF	-5.761(6)***	-4.214(2)	-7.368(5)***	-7.371 (5)***
lnVLF	-6.272(0)***	-6.697 (0)***	-6.171(0)***	-6.588(0)***
lnNLF	-3.503(4)	-3.681 (3)	-5.797(0)***	-6.222 (0)***
lnVLA	-2.467(0)	-2.897(0)	-5.030(0)***	-5.017(0)***
lnNLA	-3.022(0)	-3.555(0)	-5.819(1)***	-7.266(1)***

Source: Computed from Central Bank of Nigeria (CBN) Data of Various Years.

Notes:

***, imply significance at 1% level respectively.

The figures in parentheses for the ADF (Dickey-Fuller, 1979) statistic represents the lag length of the dependent variable used to obtain white noise residuals. The lag length for the ADF was selected using Automatic-based on AIC, max lag = 7

The values in parenthesis is the lag value.

Co-integration Test Based on ARDL Bounds Testing Approach

The F-statistic tests the joint null hypothesis that the coefficients of the lagged level variables are zero (i.e. no long-run relationship exists between the variables in

question). The F-statistic was estimated using Wald Test of coefficients in the ARDL-OLS regressions. As indicated in Table 4, the value of calculated F-statistic for lnGDPF (lnGDP | lnVLF, lnNLF, lnVLA, lnNLA) is 7.33 which is higher than the upper bound critical value of 4.37 at the 1% level. Therefore, the null hypothesis of no co-integration was rejected which indicates that there is a long-run co-integration relationship among the variables under consideration. The result of this study is in conformity with the findings of [12] and [13] who reported a long run association between non-oil export and the ACGSF schemes, and Agricultural Sector Output Percentage to Gross Domestic Product (ASOGDP), ACGSF and Commercial Bank Credit to Agricultural Sector (CBCA) respectively in Nigeria.

Table 4. Results of Co-integration Test Based on ARDL Bounds Test Approach

Critical Value	Critical value Bounds of the F-statistic	
	Lower bound I(0)	Upper bound I(1)
1%	3.29	4.37
5%	2.56	3.49
10%	2.20	3.09

Computed F – Statistic: F_{lnGDPF}(lnGDP | lnVLF, lnNLF, lnVLA, lnNLA) = 7.33

Note: Critical Values are cited from Pesaran *et al.* (2001), Table CI (iii), Case 111: Unrestricted intercept and no trend, Number of regressors (K) = 4.

Results of Long Run Analysis

The long run coefficients of ARDL (1,4,1,4,1) as presented in Table 5 revealed that number of ACGSF loan to fishery subsector and volume of ACGSF loan to agriculture had positive and significant influence on Gross Domestic Product from fishery subsector in the long run, while volume of ACGSF loan to fishery had negative but significant influence on Gross Domestic Product from fishery subsector in the long run. This implies that 1% increase in number of ACGSF loan to fishery subsector and volume of ACGSF loan to agriculture would lead to 0.63% and 0.98% increase in Gross Domestic Product from Fishery subsector respectively. The outcome of this study supports the findings of [12] who stated that ACGSF positively influenced non-oil export value of Nigeria. However, the negative relationship that existed between GDP from fishery and volume of ACGSF loan to fishery could be attributed to diversion of funds allocated to the sub-sector to another sub-sector or non-productive activities. This could be possible because of inadequate monitoring of the funds allocated by the ACGSF.

Table 5. Estimated Long Run Coefficients Using ARDL Approach

Regressor	Coefficient	Standard Error	T-ratio
lnNLA	-0.3298	0.2510	-1.31
lnNLF	0.6305***	0.1334	4.73
lnVLA	0.9827***	0.3565	2.76
lnVLF	-0.6535***	0.1984	-3.29
C	-1.6144	1.2206	-1.32

Note: ***, significant at 1%

ARDL(1,4,1,4,1) selected based on Schwarz Bayesian Criterion.

Results of Short Run Analysis

The analysis of Error Correction Model (ECM) based on ARDL bounds test approach was used to obtain the short run dynamic coefficients associated with the long-run co-integration relationships. The results of the short run coefficients of ARDL (1,4,1,4,1) model are presented in Table 6. The outcome of the short run interactions is similar to the long run relationship in terms of sign of the coefficients. This shows that similar reasons given for the long run relationship might be responsible for the results of short run interactions. The statistically significant negative coefficient of ECM(-1) verified the long run relationship among the variables under consideration. According to [34], ECM measures how quickly the endogenous variable adjusts to the changes in the independent variables before the endogenous variable converges to the equilibrium level. Negative and statistically significant ECM demonstrates that adjustment process is effective in restoring equilibrium. Negative and low ECM in absolute value points out a slow adjustment. It is, therefore, crystal clear that ECM in this study is statistically significant at 1% level and had a value of -0.3412. The implication of this is that about 34.1% of disequilibria from the previous year's shock converge to the long-run equilibrium in the current year.

Table 6. Results of the ARDL Short-run Relationship

	Coefficient	Standard Error	T-value
ΔlnNLA	-0.1254	0.0765	-1.64
ΔlnNLF	0.2016***	0.0628	3.21
ΔlnVLA	0.4668***	0.1386	3.37
ΔlnVLF	-0.1303**	0.0631	-2.06
ecm(-1)	-0.3501	0.0443	-7.89

R-Squared = 0.39134, R-Bar-Squared = 0.20610, S.E. of Regression = 0.20006, F-stat. F(5, 25) = 2.9576 [0.031], Residual Sum of Squares = 0.09472 Equation Log-likelihood = 10.5222 , DW-statistic = 2.0743
Note: **,***, significant at 5%, 1% respectively.

Results of ARDL Diagnostic Tests

The outcome of the tests as shown in Table 7 revealed that the F-test failed to reject the null hypotheses of no serial correlation, homoscedasticity and normal distribution at 5% significant level. Furthermore, stability tests using the cummulative sum of recursive residuals (CUSUM) and cummulative sum of squares of recursive residuals (CUSUMq) plots as indicated in Fig. 2 and 3 respectively, show that the model coefficients are stable in both the short run and long run.

Table 7. Results of Diagnostic Tests

Test	χ^2 statistic	Probability
Serial Correlation Test	2.9841	0.225
Heteroskedasticity	9.9616	0.822
Normality	0.2899	0.865

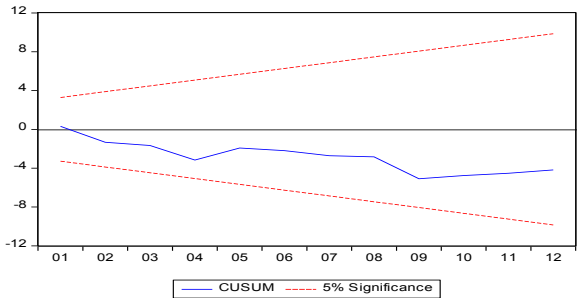

Fig. 2. Plot of the Cumulative Sum of Recursive Residuals (CUSUM) Tests for ARDL Model:

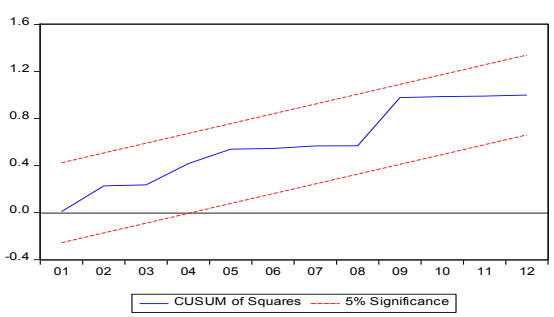

Fig. 3. Cumulative Sum of Recursive Residuals of Square (CUSUMq) Tests for ARDL Model

CONCLUSIONS

It can be concluded that fishery sub-sector is the least financed in the Agricultural sector by Agricultural Credit Guarantee Scheme Fund (ACGSF) which manifested in the contribution of fishery sub-sector to Gross Domestic Product (GDP) between 1981 and 2012. Also, the growth rate for GDP contribution from fishery in 1981-1999 was more than that of 2000-2012 when ACGSF was operating with larger funds. In the long run, the number of ACGSF loan to fishery subsector and volume of ACGSF loan to agriculture had positive and significant influence on GDP from fishery subsector, while volume of ACGSF loan to fishery had negative but significant influence on Gross Domestic Product from fishery subsector. Also, the outcome of the short run interactions is similar to the long run relationship in relation to the sign of the coefficients. The ECM is statistically significant at 1% level with the value of -0.3412, indicating that there is a slow adjustment process in restoring equilibrium.
Therefore, it is recommended that volume of ACGSF loan devoted to agricultural sector and especially fishery sub-sector should be significantly increased if sustainable development will be recorded in the sub-sector. Also, the negative sign exhibited by volume of ACGSF loan to fishery could be a sign of fund diversion from the subsector to another subsector or non-productive activities. It is therefore imperative that adequate monitoring and evaluation policy measure is put in place. This will go a long way in curbing diversion and poor management of ACGSF loan in fishery subsector.

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ASPECTS OF TRADE WITH APPLES (2011 - 2013)

Radu Lucian PÂNZARU[1], Dragoş Mihai MEDELETE[1], Daniela POPA GRIGORE[2]

[1]University of Craiova, Faculty of Agronomy, 19 Liberty, 200421, Craiova, Romania, Phone: +40 741 180 976, Fax: + 40 251 418 475, E-mail:rlp1967craiova@yahoo.com
[2]State Agrarian University of Moldova, Faculty of Economy
42 Mircesti, Chișinău, Moldova, Phone: 312258

Corresponding author: medelete@yahoo.com

Abstract

The apple tree is one of the species representative for Romania through the surfaces in operation and yields obtained (469,437 t for 2015, which represented 39.27% of total national production of fruit). Based on this, I considered interesting to track the Romanian apple trade in terms of quantity (55,099.7 t imports and 26,443.67 t exports - averaged over the period 2011-2013), especially in value. The paper places Romania in context of global, continental and regional situation – by specific indicators operating at global, continental and regional that reporting can be done, according to available statistics. It can be seen that the trade balance of Romania, related to apples, is strictly weak during the period analyzed.

Keywords**:** *trade balance deficit, surplus, export, import, apples*

INTRODUCTION

By the specifics and peculiarities of apple species that is noted it's framed among fruit growing sector. In this context, overall, we estimate that the species develops importance to food, industrial, agricultural technology and technological, environmental, feed, export and source of profit [1].
The economic importance of apple, extending beyond the sphere of fruit growing and consumption, creating economic activities, jobs and financial resources in parallel industries related to the production of pesticides, fertilizers, packaging, food and transport [5].
The share that apple culture has in the global economy of fruit is due, primarily, role that fruits have in rational human nutrition then in prevention and control of diseases, in increasing national income, and improving the microclimate conditions of life [7].
Making international trade involves prospecting foreign market for import-export of agricultural products and / or food must undergo several stages (documentation and information, study the opportunities offered by foreign and analyze key economic indicators prospecting (studying) the actual foreign market, the domestic market studied drawing conclusions, making decisions) [3].
International transactions with apples must be viewed in the context of the global market. World market represents all relationships established between individual producers from different countries and between national economies through trade transactions [4].
In trade with fruits and vegetables, the degree of perishable products requires great efficiency in directing and commodity circulation [2].
Although Romania has an important fruit growing area, low yields and lack of organization of producer groups, under the excessive parceling plantations and their high degree of aging in the individual causes lack a competitive market [9]. Also vegetables and fruits imported produce strong competition on the Romanian market due to appearance, packaging and appearance of the season [8].

MATERIALS AND METHODS

For the development work, it was used a database of international visibility [10].
The indicators used, refers to the period 2011-2013 and presented at the level of its continental (Africa, Americas, Asia, Europe and Oceania), regional (European Union),

national (Romania) and global (worldwide).
Analysis of indicators went from annual or multi-building structure of imports, exports and trade balance (thousands $). It was used as the comparison method based on the use of mobile base index calculated by formula: $I_{bm} = \frac{Y_n}{Y_{n-1}} x100$, in which: Y_n - the level of indicator for each component of the dynamic series; Y_{n-1} - the level of temporal sequence indicator considered as a basis for comparison or reference period [6].

RESULTS AND DISCUSSIONS

The total value of global imports and continental apple, their structure and how they have evolved over time are shown in Table 1.
Worldwide, in 2011, total import value was 7,182,225 thousand $, which value is based on contributions continental: 12,384 thousand $ for Oceania, 398,316 thousand $ across the continent Africa, 980,623 thousand $ in Americas, 1,993,264 $ thousands from the Asian continent, 3,797,638 thousands $for Europe. Following these values indicator structure is as follows: 0.17% Oceania, 5.55% Africa, 13.65% Americas, 27.75% Asia and 52.28% Europe.
If we analyze the specific situation of 2012, can be noted limits of variation of the indicator, from 15,578 thousand $ for Oceania (0.21%) to 3,775,009 thousands $ in Europe (50.30%). Taking into question and the other values continental indicator - 2,048,322 thousand $ Asia (27.29%), 1,125,722 thousand $ Americas (15.0%), 540,218 thousand $ Africa (7.20%) - arrive at a total value of world imports of 7,504,849 thousand $.
For 2013, there is a total world imports of apples, which reaches 8,476,782 thousands $. Establishment of this value is based on contributions sequential continental: 17,459 thousand $ Oceania (0.20%), 517,135 thousand $ Africa (6.10%), 1,331,609 thousand $ Americas (15.71%), 2,295,259 thousand $ Asia (27.08%), 4,315,320 thousand $ Europe (50.9%).
Calculating the average period was reached a total value of world imports of 7,721,285 thousand $, value, which is based on the following structure: 51.32% Europe (3,962,655 thousand $), 27.36% Asia (2,112,282 thousands $), 14.84% Americas (1,145,985 thousand $), 6.28% Africa (485.223 thousand $), Oceania 0.20% (15,140 thousand $).
Within the European Union there was an average import value of 2,939,513 thousand $, which resulted in an average share in global imports at 38.07%.
For Romania, the value of imports of apples reached an average of 27,563.67 thousand $, which represented 0.36% of the world indicator.

Table 1. Apples - World Imports (2011–2013)

Specification	2011		2012			2013			Average 2011 – 2013		
	Th. $. *	Str. ** %	Th. $. *	Str. ** %	2012/ 2011**	Th. $. *	Str. ** %	2013/ 2012**	Th. $. **	Str. ** %	Average/ 2013**
Africa	398,316	5.55	540,218	7.20	135.63	517,135	6.10	95.73	485,223	6.28	93.83
Americas	980,623	13.65	1,125,722	15.00	114.80	1,331,609	15.71	118.29	1,145,985	14.84	86.06
Asia	1,993,264	27.75	2,048,322	27.29	102.76	2,295,259	27.08	112.06	2,112,282	27.36	92.03
Europa	3,797,638	52.88	3,775,009	50.30	99.40	4,315,320	50.91	114.31	3,962,655	51.32	91.83
Oceania	12,384	0.17	15,578	0.21	125.79	17,459	0.20	112.07	15,140	0.20	86.72
Total	7,182,225	100	7,504,849	100	104.49	8,476,782	100	112.95	7,721,285	100	91.09
European Union	2,844,231	39.60	2,731,927	36.40	96.05	3,242,381	38.25	118.68	2,939,513	38.07	90.66
Romania	25,516	0.36	27,025	0.36	105.91	30,150	0.36	111.56	27,563,67	0.36	91.42

* http://faostat3.fao.org/download/T/TP/E
** own calculation

The evolution over time of the indicator (conducted through mobile base indices) highlights a number of issues, such as Africa shows an uneven trend indicator, the variable component indices. Overruns for reporting term were 1.35 times in 2012 and subunit

values recorded for 2013 and period average (decreases by 4.27 and 6.17% respectively beside the bases of reporting); at the American continent, there is the upward evolution of value of imports. Thus, in 2012 recorded growth of 14.80% compared to 2011, then 2013 are recorded demotions of 1.18 times - compared to 2012, while the average period is one subunit (-13.94%); if we analyze the situation for Asia, we see the upward evolution of the indicator. In these circumstances, are discussing of demotions, of the terms of reference, for 1.02 times for 2012 and 1.12 times for 2013, but decreased by 7.97% and the average of the period; Europe presents uneven developments in the value of imports. Such decreases were recorded to the term of reference as follows: 0.60% in 2012 and 8.17% to the average of the period and an increase at the level of 2013 by 14.31%; Oceania is characterized by an upward trend in the value of imports, specific increases in 2012 (+25.79%), followed by further increases in the year 2013 (+12.07%). For the average period reveals sub-unit value indices dynamics (-13.28%); global imports value show a positive trend. Overruns of comparator were 1.04 times for 2012 and 1.12 times in 2013 and reached 8.92% decreases for the period average; the European Union is characterized by uneven developments in the value of imports. They show for 2012 a decrease of 3.95%, and an increase in the year 2013 (+18.68%) and again a decrease for average the period (-9.34%); Romania, shows an upward trend of value of imports. Thus exceeding the reference by 5.91% for 2012 and 11.56% in 2013, while the average of the period were decreased by 8.58% over the comparison base (2013).

Table 2 presents the imports.

In 2011, five continental units recorded values of exports of: 289,292 thousand $ Oceania, 292,204 thousand $ Africa, 1,381,218 thousand $ Asia, 1,890,937 thousands $ Americas and 3,295,949 thousands $ Europe. These values have led to a general global level, of the indicator of 7,149,600 thousands $, which has contributions percentage (in the structure) of: 46.10% Europe, 26.45% Americas, 19.32% Asia, 4.09% Africa and 4.04% Oceania. In these circumstances, global level of the indicator reached 7,149,600 thousand $.

Table 2. Apple - World Exports (2011-2013)

Specification	2011		2012			2013			Average 2011 – 2013		
	Th. $. *	Str. ** %	Th. $. *	Str. ** %	2012/ 2011**	Th.$. *	Str. ** %	2013/ 2012**	Th.$. **	Str. ** %	Average/ 2013**
Africa	292,204	4.09	317,653	4.42	108.71	446,115	5.56	140.44	351,990.7	4.72	78,90
Americas	1,890,937	26.45	2,016,528	28.08	106.64	2,213,400	27.57	109.76	2,040,288.0	27.38	92.18
Asia	1,381,218	19.32	1,321,256	18.40	95.66	1,455,209	18.13	110.14	1,385,894.0	18.59	95.24
Europa	3,295,949	46.10	3,223,875	44.89	97.81	3,501,216	43.61	108.60	3,340,347.0	44.82	95.41
Oceania	289,292	4.04	302,711	4.21	104.64	412,212	5.13	136.17	334,738.3	4.49	81.21
Total	7,149,600	100	7,182,023	100	100.45	8,028,152	100	111.78	7,453,258.0	100	92.84
European Union	3,105,077	43.43	3,070,259	42.75	98.88	3,322,010	41.38	108.20	3,165,782	42.48	95.30
Romania	12,790	0.18	3,759	0.05	29.39	5,655	0.07	150.44	7,401.33	0.10	130.88

* http://faostat3.fao.org/download/T/TP/E
** own calculation

In the case of 2012, the total value of exports was 7,182,023 thousand $ at which the five continental units contributed variable, as follows: 4.21% Oceania, 4.42% Africa, 18.40% Asia, 28.08% Americas, 44.89% Europe. Corresponding to these weights, actual values of the indicator continental were 302,711 thousand $ for Oceania, 317,653 thousand $ in case of Africa, 1,321,256 thousand $ Asia, 2,016,528 thousands $ in Americas and 3,223,875 thousands $ Europe.

If we analyze the situation, specifies of 2013 reveals variations in the indicator from 412,212 thousand $ for Oceania, to 3,501,216 thousand $ on the European continent, while the global level of the indicator reached a value of 8,028,152 thousand $. The structure of indicator is as follows: 5.13% Oceania, 5.56% Africa - 446,115 thousand $, 18.13% Asia - 1,455,209 thousand $, 27.57%

Americas - 2,213,400 thousands $ and 43.61% Europe.

Average period is characterized by a total, global exports of 7,453,258 thousand $ in the structure of which is recorded continental percentages: 44.82% Europe (3,340,347 thousand $), 27.38% Americas (2,040,288 thousand $), 18.59% Asia (1,385,894 thousands $), 4.72% Africa (351,990.7 thousand $), 4.49% Oceania (334,738.3 thousand $).

In terms of positioning the European Union in the global context value of export, there is sequential annual weights as follows: 43.43% in 2011 to 3,105,077 thousand $, 42.75% for the year 2012 to 3,070,259 thousands $, 41.38% in 2013 - 3,322,010 thousand $ and 42.48% to the average period - 3,165,782 thousand $.

Referring to Romania's situation can be observed the following: the values of Romanian exports of apples ranged from 3,759 thousand $ in 2012 to 12,790 thousand $ in 2011, and the median was 7,401.33 thousand $; Romania held global variable share in total export structure: 0.05% in 2012, 0.07% for 2013, 0.10% for the period average and 0.18% for 2011.

The dynamics of indicator, built through mobile base indices, highlights the following issues: Africa evolution is an ascending one dynamics is characterized by the existence indices below par and above unit. Overtaking the reporting term were 1.08 and 1.40 times respectively in 2012 and 2013 while reductions – beside this - recorded levels of 21.10% for the period average; American trend indicator is ascending dynamics is composed of strictly indexes above unit. In those circumstances, the terms of comparison were exceed as follows: 1.06 and 1.09 times in the year 2012 and 2013 period average was lower by 7.82% over the previous term dynamic of the series; in the Asian continent, discussing a fluctuating indicator trend, underlined by the overruns of the reporting base (1.10 times for 2013), but also decreases by 4.34 and 4.76% for the year 2012 and the average period; in Europe there is uneven developments in export value. So in 2012 are recorded decreases by 2.19% compared to the first term of the dynamic series, then in 2013 appearing increase with 8.60% compared to the previous term dynamic of the series. Following this situation, the average period was lower by 4.59% compared to the specific level of 2013; Oceania indicator shows an ascendant evolution. So the terms are exceeded by 1.04 and 1.36 times compared to 2012 and 2013 respectively. For the average period reveals that it was lower by 18.79 to comparison basis; overall global export value falls on an upward trend due to the dynamic levels of the indices above par. Exceedances of comparator was 0.45% in 2012 and 11.78% for 2013. Accordingly, average of the period was lower term the reporting with 7.16%; the European Union is characterized by a dynamic uneven. So, the indicator decreased by 1.12% in 2012 compared to 2011, after which the in 2013 appears an excess of 8.20% compared to 2012. Finally, the average period is lower by 4.70% compared to the level of the reporting (2013); in the case of Romania indicator dynamics is one uneven. Drastic decreases from 2012 (-70.61 compared with the first period analyzed - 2011), followed by increases in the year 2013 (+50.44% over the previous term dynamic of the series). In these circumstances, the average of the period it exceeded by 1.30 times the reporting base (2013).

The data included in table 3, shows the trade balance situation.

Table 3. Apples - The commercial balance of global trade - thousand $ (2011-2013)*

Specif.	2011	2012	2013	Average 2011 – 2013
	export - import ±	export - import ±	export - import ±	export - import ±
Africa	-106,112	-222,565	-71,020	-133,232.3
Americas	+910,314	+890,806	+881,791	+894,303
Asia	-612,046	-727,066	-840,050	-726,388
Europe	-501,689	-551,134	-814,104	-622,309
Oceania	+276,908	+287,133	+394,753	+319,597.97
Total	-32,625	-322,826	-448,630	-268.027
European Union	+260,846	+338,332	+79,629	+226,269
Romania	-12,726	-23,266	-24,495	-20,162.34

* own calculation

In 2011 the global trade balance was deficient -32,635 thousand $, aspect which is based of trade deficits: -612,046 thousand $ Asia, -501,689 thousand $ Europe and -106,112 thousands $ Africa. But there are surpluses to

Americas and Oceania: 910,314 and 276,908 thousand $.
In 2012, the global trade balance remains weak -322,826 thousand $, character determined by specific deficits in Asia, Europe and Africa (-727,066, -551,134 and -222,565 thousands $). Surpluses appear that reduce the overall deficit, for the same continents as in 2011 (Oceania and Americas: 287,133 and respectively 890,806 thousands $).
If we analyze the specific situation of 2013, we note that it is still deficient (-448,630 thousand $) worldwide, which is determined by specific negative state of affairs of Asia, Europe and the African continent (-840,050, -814,104 and respectively -71,020 thousand $). For Americas and Oceania are recorded surplus balances: +881,791 and respectively +394,753 thousand $.
Determining the average period it can be seen (Fig. 1) the deficit of the trade balance (-268,027 thousand $) situation determined by the following state of affairs: -726,388 thousand $ Asia, -622,309 thousand $ Europe, - 133,232.3 thousand $ Africa, + 319,597.97 thousands $ Oceania, +894,303 thousand $ America.

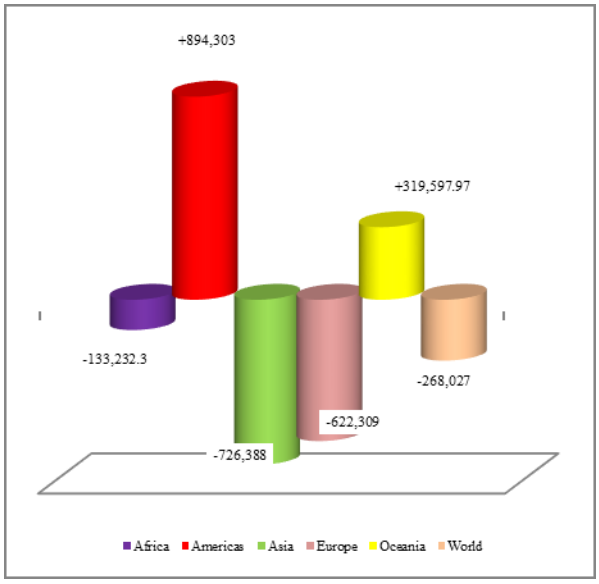

Fig. 1. Apples. Global trade balance, period average (thousands $)

At EU level, the trade balance of apples is strictly surplus as follows (fig. 2): +260,846 thousand $ in 2011, +338.332 thousand $ for 2012, +79,629 thousand $ in the case of 2013, +226,269 thousand $ in the period average.

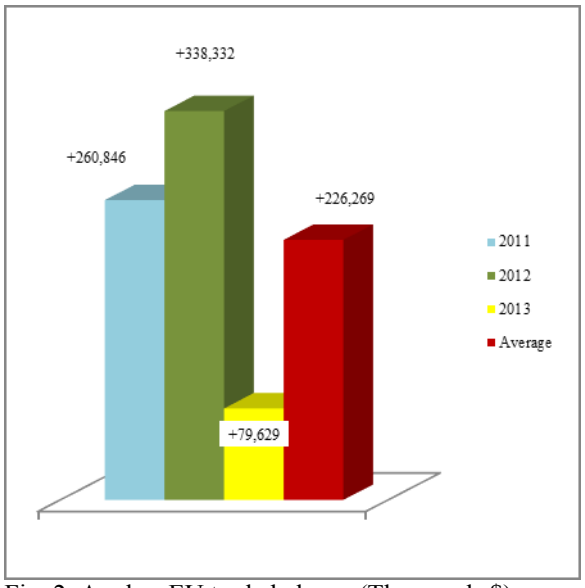

Fig. 2. Apples. EU trade balance (Thousands $)

In Romania's case (fig. 3) we notice that the commercial balance of foreign trade, with apples, is strictly poor: -12,726 thousand $ for 2011, -23,266 thousand $ in 2012, -24,495 thousand $ in 2009, -20,162.34 thousand $ in the case of the period average.

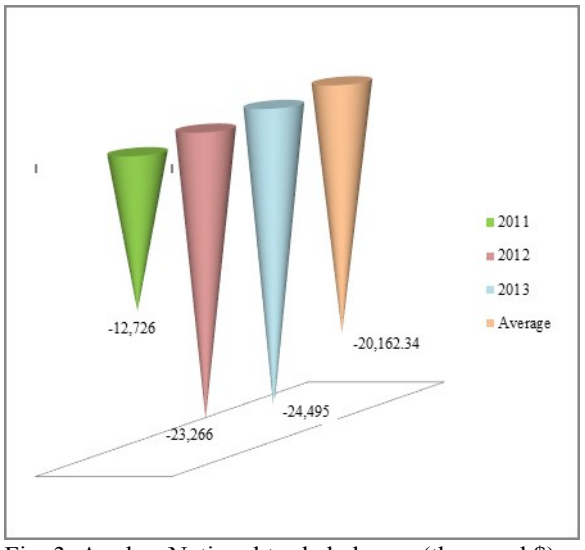

Fig. 3. Apples. National trade balance, (thousand $)

CONCLUSIONS

The study led to the following conclusions:
- the dynamic value of imports of apples has been increasing throughout the world, situation similar to that in Oceania, Asia, Americas and Africa. For Europe, the indicator has varied oscillating;
- the European Union is an important actor on worldwide, on imports of apples, holding

35.37% of the tonnage of imports and 38.07% of their value. The situation is even more pronounced if we consider the European level - about 75-80% of the volume and value of imports. The development was uneven;
- Romania is not a major player, in terms of imports, on the world market, owning shares of respectively 0.66 and 0.36% respectively of the quantities imported values - less beneficial aspect. Variation of indicators has been one uneven - both quantitative and value level - during the period analyzed;
- the evolution, over time, of export fluctuating the trend being given by Europe and Asia (for the rest of the world discussing the upward trends);
- when referring to the situation the European Union is worth noting that this position changes compared to the situation specific imports - increased share of global exports. The organization remains the main actor in the European market (over 85% in the quantities exported to Europe and 90% in terms of value of European exports). Uneven development is remarkable for both quantities exported and by the value of exports;
- as in the case of imports and exports Romania is not a major player in the global market. There is a negative aspect, the average weight loss at 0.32 and 0.10% namely for quantities and values exported - unfavorable situation;
- the weak global balance is a prominent phenomenon (268,027 thousand $);
- the EU does not fall in the overall situation European trade balance is strictly surplus with fluctuated (260,846, 338,332, 79,629 and namely 226,269 thousand $ for the four sequences of the series dynamic - 2011, 2012, 2013 and period average);
- Romanian commercial exchanges balance is strictly deficient, a phenomenon which highlights our country's inability to secure necessary consumption from own production (-20,162.34 thousand $).

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BEE HONEY PRODUCTION IN ROMANIA, 2007-2015 AND 2016-2020 FORECAST

Agatha POPESCU

University of Agricultural Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, Zip code 011464, Bucharest, Romania, Phone: +40213182564, Fax: +40213182888, Email: agatha_popescu@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper analyzed the situation of honey production in Romania and by micro-region of development using the empirical data provided by National Institute of Statistics for the period 2007-2015, it determine de trend lines and regression functions and set up the forecast for the period 2016-2020. In 2015, Romania had 1,392.8 thousand bee families, by 41.81 % more than in 2007. They produced 27,893 tons by 66.35 % more than in 2007 according to NIS, but according to the EU Commission Romania came on the top position with 35,000 tons honey. The contribution of the micro-regions of development to honey production is in the decreasing order the following one: South West Oltenia, Center, North East, South Muntenia, West, North West, South East and Bucharest-Ilfov. The general trend in honey production was an increasing one, as reflected by the linear regression functions, both at country level and almost all the micro-regions except Bucharest-Ilfov. In 2020, it is estimated as Romania will produce 34,400 tons based on the average growth rate of 9.06 %. To increase honey production, beekeepers should keep more than 100 bee families per apiary, apply new technologies, use modern hives, selected bee queens, assure a corresponding feeding, maintenance and health to the bee families. Honey market should be extended by a more intensive promotion of the bee products, a higher quality of honey and development of organic honey and Romanian brands. In this way, beekeepers' income and living standard will increase as well as of the rural communities where they belong to.

Key words**:** *bee families, honey production, dispersion, territory, present and future, Romania*

INTRODUCTION

Apiculture is an economic sub-branch of agriculture allowing the use of natural resources to produce honey and other bee products by means of the bee families. It is a pleasant and useful occupation, a way to stop or reduce the rural population migration to the cities, a source of income or additional income and a mean to improve the living standard of the people living in the rural space, a source of export opportunities, and a natural solution for crop pollination. Also, it contributes to the preservation of biodiversity and environment [18, 19].

Bee families offer a large variety of products like: honey, pollen, beeswax, propolis, and bee venom to beekeepers, which allow them to earn important income from their selling [14].

Honey is a natural product carried out by bees from flowers nectar. It is considered a high nutritive value food due to its chemical composition: 80-85 % carbohydrates, 15- 17 % water, 0.3 % proteins, 0.2 % ashes, vitamins, amino-acids, organic acids, minerals, enzymes, bioflavonoids and antioxidants. This reflects its high nutritive value and therapeutic qualities and justifies why honey is used in human consumption, in medicine, cosmetics, food industry etc.[17].

Romania has a suitable geographical position, three types of relief, a continental climate, and a high potential to produce honey, at least 20,000 tons from about 11 million ha of cultivated and wild flora [2].

Romania is characterized by the diversity of the melliferous flora determined by the large variety of plant species, flower sizes, blooming periods, genetic potential of the cultivated crop, relatively uniform distribution of the flora in the territory. For this reason, beekeeping is spread in all the eight micro-regions of development and in all the 41 counties of the country [3].

The melliferous spontaneous and cultivated

resources are very important for bee families and also for beekeepers who have to be able to identify their location and settle their apiaries in the areas suitable for pickings which could strengthen the bee families to produce more honey, pollen and other products [4].

In 2011 Romania came on the 7th position in the EU with 40.000 beekeepers owning over 1.2 million bee families, and 21.000 tons honey production. Honey yield accounted for 18.5 kg per bee family, 2 times higher than in 1990 and considered the key factor of honey production growth.

The average apiary size was very small 23 bee families, ranging between 20 and 400 bee families [15].

An apiary is efficient from an economic point of view if the number of bee families is higher than 100. The higher the number of bee families, the higher the economic efficiency [20].

The increase of honey production is mainly determined by honey yield. A higher honey production and high honey quality could cover better the internal market and increase exports [21].

The export of honey is also determined by the low honey consumption per inhabitant, representing about a half of 1.5 kg/inhabitant, the EU-28 average.

About 60 % of honey production and 80 % of organic honey production was exported mainly in the EU market (Germany, United Kingdom, Nordic countries, Italy etc) where it is a deficit in the market. In 2011, honey price ranged between Euro 2.4-3,5 per kg according to honey type and the value of the exported honey accounted for Euro Million 29.6 [15].

In 2015, Romania produced 35,000 tons of honey by 75 % more than in 2014, which placed it on the 1st position in the EU-28. This was possible because of the favorable year 2015 for pickings and efforts made by beekeepers to increase honey yield per bee family and deliver more honey in the market. In this respect, the absorption of about 10 % of the Euro 66.2 Million budget, of which 50% from the EU and 50 % from the national budget has been of much help for beekeepers [13, 22, 23].

Therefore, Romania is an important honey producer in the EU. It is situated on the top position being followed by Spain, Hungary, Germany, Italy, Greece, France, Poland, Portugal, Croatia.

As long as the EU domestic production is able to cover only 60 % of consumption, the EU is a net importer of honey. This is a reason for the Romanian beekeepers to increase the number of bee families, honey production and honey export in the EU market [7].

In this context, the main objective of the paper was to analyze the evolution of honey production in Romania in the period 2007-2015 and establish the forecast for the period 2016-2020. In this purpose, the paper presented the evolution of the number of bee families and honey production in the country and by micro-regions of development to identify the territorial distribution, like a basis to set up the estimates of the future honey production in the next five years. The paper also presents the main problems the beekeepers are facing and finally the conclusions are accompanied by concrete solutions which should be taken into consideration by beekeepers to improve honey production and increase their incomes.

MATERIALS AND METHODS

The paper was set up based on the empirical data provided by the National Institute of Statistics in the year 2016 regarding the number of bee families and honey production in Romania in the period 2007-2015.

Honey production was analyzed both at the country level and also by micro-regions of development.

The following aspects have been approached in the paper: evolution of the number of bee families in Romania and in the territory by micro region; evolution of honey production at country level and by micro region; average growth rate and total honey production in the analyzed period; description statistics for these two indicators: mean, mean error, median, standard deviation, standard deviation error, variance, kurtosis, skewness, minim and maximum values, and variation

coefficient; linear regression function for honey production at the country level and by region, and also the honey production forecasting for the next five years, 2015-2020. The main methods used have been the following ones:

-Fixed basis index, $I_{FB}=(y_t/y_0)*100$ (1)

-Variable basis index, $I_{VB}=(y_t/y_{t-1})*100$ (2)

-Average growth rate,

$\bar{R}= (\bar{I}*100)- 100,$ (3)

where $\bar{R}$= average growth rate and $\bar{I}$= average index of dynamics, [1].

$$\bar{I}= \sqrt[n-1]{\frac{y_t}{y_1}} \quad (4)$$

-The average annual growth rate was calculated using the formula:

$$\bar{R}_a = (\sqrt[n-1]{\frac{y_n}{y_0}} - 1)*100. \quad (5)$$

-Total honey production in the period 2007-2015 was determined using the formula:

$Y_t = \sum_{t=1}^{n} y_t.$ (6)

-Average honey production in the period 2007-2015 was calculated according to the formula:

$$\bar{y}= \frac{\sum_{t=1}^{n} yt}{n} \quad (7)$$

-The graphical method was used to illustrate the dynamics of the number of bee families and honey production at the country level and by region.

-The trend of honey production at the country level and by micro region, $\widehat{yt}$= f(t), i = $\overline{1,n}$ was analyzed using the linear regression function according to the formula:

$\widehat{yt}$= a + bt, (8)

where t = 1÷T considering that $\sum(y_t - Y_t)^2$min, that is $\sum(yi - a - bt)^2$min. The solutions for the a and b parameters were calculated according to the formulas:

$$a= \frac{\sum yt}{n} \quad (9)$$

and $$b= \frac{\sum t y_t}{\sum t^2} \quad (10)$$

and also using the least square method [5].

-The horizon 2016-2020 forecasting was based on the extrapolation of the statistical series of data, according to the average growth rate of honey production in the period 2007-2015, mathematically represented by

$Y'_{ti}= y_0 + t_i \bar{\Delta}'.$ (11)

-The data and the results were tabled and correspondingly interpreted.

RESULTS AND DISCUSSIONS

Number of beekeepers, apiaries and bee hives. In 2015, in Romania, there were 22,930 beekeepers (apiaries), of which 1,545, that is 6.73 % keep over 150 bee families, and the number of bee hives totalized 1,586,000. This means that the average size of an apiary is 69.16 bee hives.

Over 50% of the number of apiaries are of small size and just about 20 % are of high dimension.

According to the EU, the Standard Output for a bee family is 52.26 SO. But taking into account the EU funding to support beekeepers to enlarge their apiaries, the small farms size should range between Euro 8,000 and 11,999 Euro SO (meaning 155-229 bee families) and the medium and larger sized apiaries should have between Euro 12,000 and 50,000 SO (meaning 230- 957 bee families) [6].

Photo 1. A beekeeper and bee families at rape pickings

Number of bee families. The number of bee families increased by 41.81 % in the analyzed period from 982.5 thousands bee families in 2007 to 1,392.8 thousand bee families in 2015.

This was determined by the incentives offered to beekeepers to encourage them to keep more bee families, as Romanian honey is more and more required for export due to its high quality.(Fig.1.)

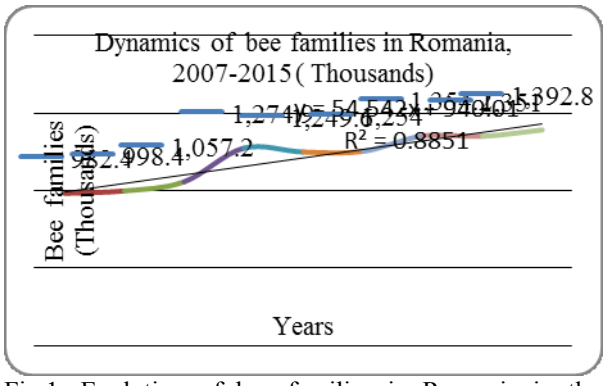

Fig.1. Evolution of bee families in Romania in the period 2007-2015 (Thousands)
Source: Own design based on NIS Data base, 2016, [16]

Dispersion of bee families by micro-region of development. The number of bee families is not equally distributed in the territory due to the climate conditions and opportunities for pickings in close relationship with the existent flora.

The ranking of the regions, in the decreasing order, in the year 2015 is the following one: the top position is occupied by South West Oltenia region with 298.1 thousand bee families; on the 2nd position comes the Central part of Romania with 202.2 thousand bee families; on the 3rd position is situated the North East region with 198.7 thousand bee families; on the last positions are: West region with 172.7 thousand bee families, North West region with 171.2 thousand bee families, South East region with 138.3 thousand bee families and finally, Bucharest-Ilfov region with 13.8 thousand bee families (Table 1).

Table 1. Dispersion of bee families by region of development in Romania, 2007-2015 (Thousands)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2015/2007 %
North West	128.9	126.5	129.2	170.3	162.3	162.4	170.9	174.8	171.2	132.81
Center	145	145.4	154	184	185.5	188.8	195.7	191.4	202.2	139.44
North East	138.7	138.2	143.7	178.7	170.8	170.7	195.3	193.3	198.7	143.25
South East	127	128.5	136.2	152.5	150.5	141.2	138.3	136.7	138.3	108.89
South Muntenia	145.9	150.9	164.7	193.1	184.8	185.6	192.1	194.2	197.9	135.64
Bucharest Ilfov	22.4	21.9	16.1	19.2	17.8	18.9	18.2	13.9	13.8	61.60
South West Oltenia	141.5	145.4	173.9	197	210	218.3	270.7	275.5	298.1	210.67
West	132.8	141.5	139.3	180	168	168.2	172.8	171.1	172.7	130.04
Total	982.2	998.3	1,057.1	1,274.8	1,249.7	1,254.1	1,354	1,350.9	1,392.9	141.81

Source: Own calculation based on NIS Database, 2016 [16]

Photo 2. Apis Mellifera Carpatica

In the analyzed period the highest growth in the number of bee families, more exactly a more than a double number, was noticed in South West Oltenia, and at the opposite pole it is situated Bucharest Ilfov region where the number of bee families declined by about 48.40 %. In almost all the regions of Romania, the number of bee families increased, except Bucharest Ilfov region.

The percentage distribution of bee families by region is shown in Fig.2 for the year 2007 and in Fig.3. for the year 2015.

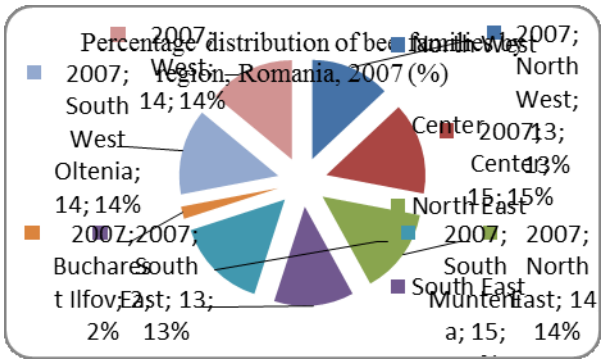

Fig.2.Distribution of bee families by region in 2007 (%)
Source: Own design based on NIS Data base, 2016 [16]

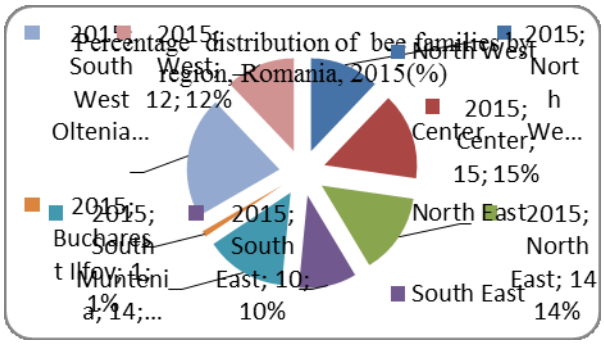

Fig. 3. Distribution of bee families by region in 2015 (%)
Source: Own design based on NIS Data base, 2016 [16]

Photo 3.Bee family

Honey production. Honey production increased at country level by 66.35 % from 16,767 tons in 2007 to 27,893 tons in the year 2015. This was due to the increased number of bee families and also due to the growth of the honey yield per bee family(Fig.4.)

The production was smaller in the years with weak pickings because of the serious droughts, more exactly in 2007, 2009, 2012 and 2014.

As the number of the bee families is owned in proportion of 99.9% in the private sector, honey production is almost entirely produced in the private apiaries.

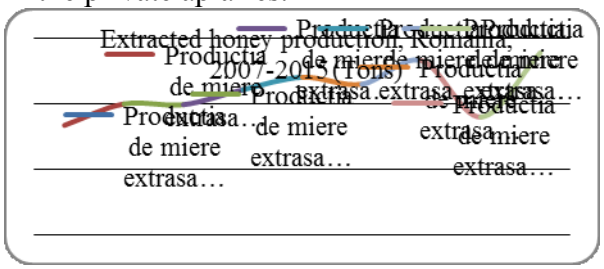

Fig. 4. Evolution of the extracted honey production in Romania in the period 2007-2015 (Tons)
Source: Own design based on NIS Data base, 2016 [16]

Dispersion of honey production by micro-region. Being influenced by the distribution of bee families in the territory and their honey yield, honey production varied from a micro region to another. As it is expected the decreasing order of honey production by micro-regions is similar with the ranking of the region based on the number of bee families.

The highest growth in honey production was recorded in North West region (+100.56 %), and a deep decline of - 26.32 % was recorded in Bucharest Ilfov area. But, the general trend was an increasing one in all the regions, except Bucharest Ilfov (Table 2).

The percentage distribution of honey production by region is shown comparatively for the year 2007 and 2015 in Fig.5.

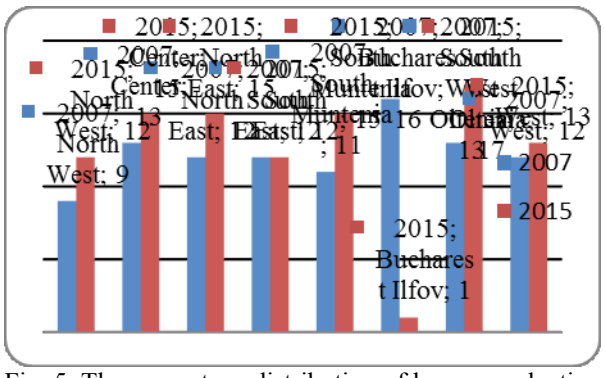

Fig. 5. The percentage distribution of honey production by micro-region in 2007 and 2015 (%)
Source: Own design based on NIS Data base, 2016 [16]

Comparative analysis between the percentage growth of honey production and the growth of the number of bee families. Looking at the figures in Table 1 and Table 2 regarding the increase/decrease across the whole analyzed period 2007-2015, it is possible to identify in what measure the two

influence factors: number of bee families and honey production per bee family have determined the total honey production at the country level and by each micro-region of development.

Table 2. Dispersion of honey production by region of development in Romania, 2007-2015 (Thousand Tons)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2015/2007 %
North West	1.78	2.53	2.42	2.77	3.16	2.91	3.12	2.29	3.57	200.56
Center	2.63	2.98	3.21	2.89	3.47	3.35	3.96	2.53	4.27	162.35
North East	2.44	3.36	2.54	3.89	3.69	3.37	3.43	2.71	4.08	167.21
South East	2.33	2.46	2.55	2.65	2.73	2.92	3.13	2.25	3.27	140.34
South Muntenia	2.22	2.74	2.69	3.59	3.32	3.40	4.15	2.69	4.06	182.88
Bucharest Ilfov	0.38	0.39	0.30	0.23	0.22	0.22	0.38	0.17	0.28	73.68
South West Oltenia	2.58	2.82	3.46	3.41	4.04	3.80	4.49	2.72	4.66	180.62
West	2.46	2.75	2.75	2.79	3.51	3.10	4.02	2.68	3.71	150.81

Source: Own calculation based on NIS Database, 2016 [16]

At the country level, it is easy to notice that the number of bee families increase is less than the honey production growth, meaning that the average honey production per bee family is the key factor with the deepest impact on total honey production. And this situation characterizes almost all the micro-regions except, South West Oltenia and Bucharest Ilfov, where the growth of the number of bee families had a higher influence than honey yield on honey production.

The average growth rate of honey production during the analyzed period was the following one: 11.86 % in North West, 11.63 % in South West Oltenia, 10.95 % in South Muntenia, 10.49 % in North East, 9.81 % in the Central micro-region, 7.75 % in West micro-region, 5.60 % in South East and 4.25 % in Bucharest-Ilfov micro-region (Table 3).

Table 3. Average growth rate of honey production by region of development in Romania, 2007-2015 (%)

	2008	2009	2010	2011	2012	2013	2014	2015	Average growth rate % 2007-2015
North West	42.13	-4.35	14.46	14.07	-7.92	7.21	-26.61	-55.89	11.86
Center	13.30	7.71	-9.96	20.06	-3.46	18.20	-36.12	68.77	9.81
North East	37.70	-24.41	53.14	-5.15	-8.68	1.78	-21.00	50.55	10.49
South East	2.92	3.65	3.92	3.01	6.95	7.19	-28.12	45.33	5.60
South Muntenia	23.42	-1.83	33.54	-7.53	2.40	22.00	-35.29	50.92	10.92
Bucharest Ilfov	2.63	-23.08	-23.34	-4.35	0	72.72	-55.27	64.70	4.25
South West Oltenia	9.30	22.69	-1.45	18.47	-5.95	18.15	-39.43	71.32	11.63
West	11.78	0	1.45	25.80	-11.69	29.61	-33.34	38.43	7.75
Romania	19.51	-0.50	11.49	8.55	-4.40	15.65	-32.36	54.60	9.06

Source: Own calculation based on NIS Database,2016 [1]

Photo 4. Honey in jars

Descriptive statistics for the number of bee families and honey production at country level is presented in Table 4.

Table 4 .Descriptive statistics for the number of bee families and honey production

	Bee families	Honey production
Mean	1,211.611	22,084
Standard error	52.46	1,255.11
Median	1,254	22,222
Standard deviation	157.38	3,765.35
Variance	24,768.23	14,177,866.44
Kurtosis	-1.486	-0.963
Skewness	-0.593	0.202
Minimum	982.4	16,767
Maximum	1,382.8	27,893
Coefficient of variation (%)	12.98	17.05

Source: Own calculation based on NIS Database, 2016 [16]

Linear regression functions for honey production for the analyzed period for Romania and each micro-region of development are presented in Fig.6-13.

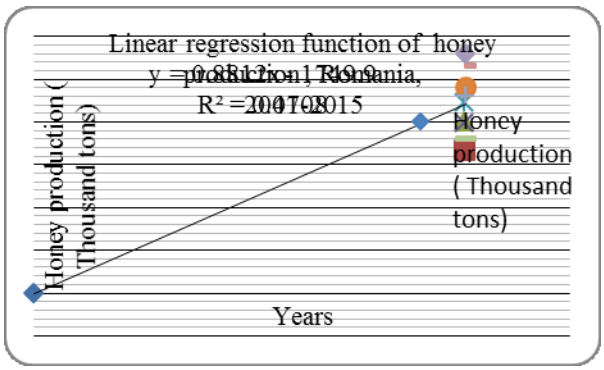

Fig.6. Linear regression of honey production at Romania's level in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

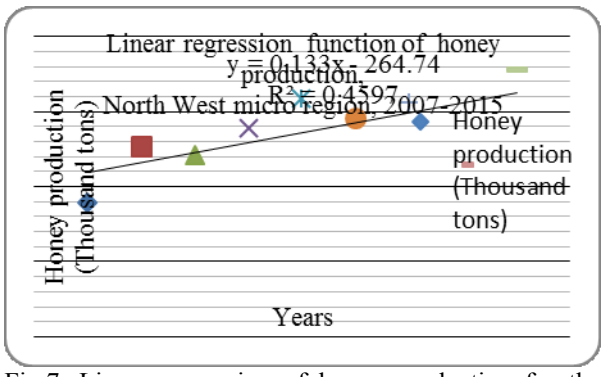

Fig.7. Linear regression of honey production for the North West micro-region in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

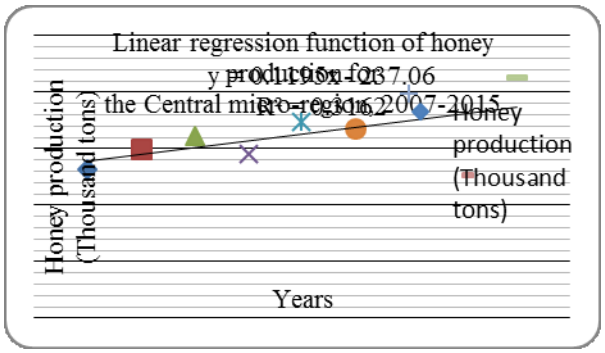

Fig.8. Linear regression of honey production for the Central micro-region in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

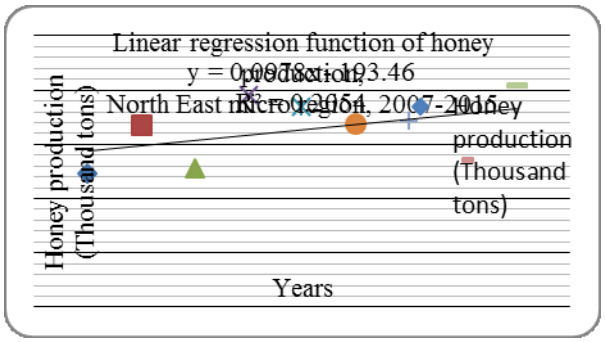

Fig.9. Linear regression of honey production for North East micro-region in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

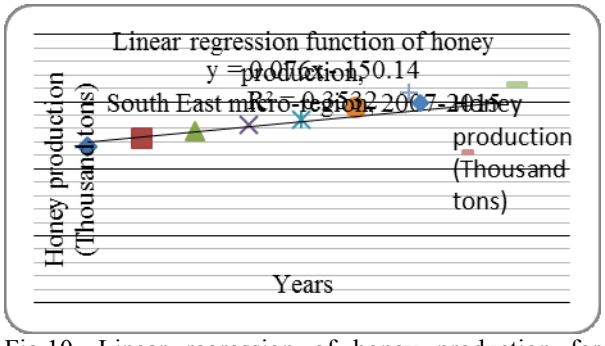

Fig.10. Linear regression of honey production for South East micro-region in the period 2007-2015

Source: Own design based on NIS Data base, 2016 [16]

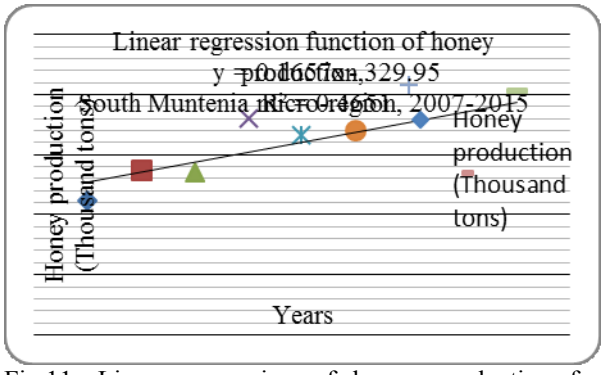

Fig.11. Linear regression of honey production for South Muntenia micro-region in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

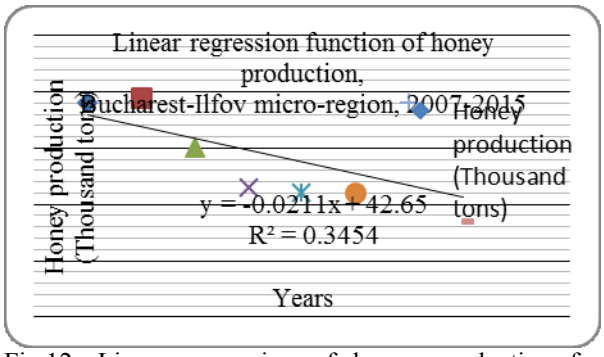

Fig.12. Linear regression of honey production for Bucharest-Ilfov micro-region in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

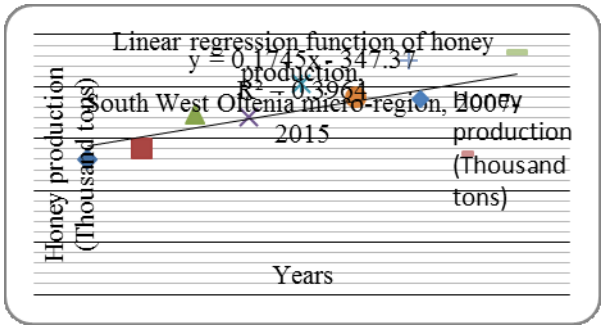

Fig.13. Linear regression of honey production for South West Oltenia micro-region in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

Fig.14. Linear regression of honey production for West micro-region in the period 2007-2015
Source: Own design based on NIS Data base, 2016 [16]

Photo 5. Fair of honey and other bee products.

Honey production forecast for the period 2016-2020. Taking into consideration the average growth rate of honey production for the period 2007-2015 and the average honey production in the same interval, it was forecasted the production for the next five years, as shown in Table 4. As one can see, Romania could produce more honey reaching 34.4 tons in the year 2020. The highest contribution to this production is expected to be given by South Muntenia, North East, Central area, North West and West micro regions of development.

The main problems Romania and Romanian beekeepers are facing are the following ones:

-The small apiary size, which is in average 69 bee families/apiary in 2015 which could not allow a higher marketed honey amount, a lower production cost, and a higher income for beekeeper.

-The climate change from a year to another, the alternation of extreme climate phenomena concretized in a large variation of temperatures, severe droughts, high rainfalls, cold winters etc with a negative influence on the bee family power, pickings and honey yield.

-The more and more reduced opportunities for bee families to contribute to the crop pollination and collect the nectar due to the use of new varieties and hybrids by farmers.

-The treatments applied for plant protection using more pesticides etc created important problems regarding the poisoning of the bee families and bringing losses to beekeepers.

Table 5. Honey production forecast in Romania and by micro-region of development for the period 2016-2020 (Thousand tons)

	Total honey production 2007-2015 (Thousand tons)	Average honey production, 2007-2015 (Thousand tons)	Average growth rate, 2007-2015 (%)	Honey production forecast 2016-2012 (Thousand tons)				
				2016	2017	2018	2019	2020
NW	24.28	2.72	11.86	3.04	3.40	3.80	4.25	4.75
C	29.29	3.25	9.81	3.56	3.90	4.28	4.69	5.15
NE	29.51	3.27	10.49	3.61	3.98	4.39	4.85	5.35
SE	24.29	2.70	5.60	2.85	3.00	3.17	3.34	3.52
S Munt.	28.86	3.21	10.95	3.56	3.94	4.37	4.84	5.36
Buc.-Ilfov	2.57	0.28	4.25	0.29	0.30	0.31	0.32	0.33
SW Olt.	31.98	3.55	11.63	3.96	4.42	4.93	5.50	6.14
W	27.77	3.08	7.75	3.32	3.58	3.85	4.14	4.46
Romania	198.72	22.08	9.06	24.08	26.26	28.63	31.22	34.4

Source: Own calculations.

-The high price for fuel increased the transportation cost of the bee families in the pastoral pickings.
-The high price for apiary inputs (bee families pavilion for transportation in pastoral, honey extractors, medicines, etc) led to increased bee family maintenance and production cost.
-The appearance of the syndrome CCD (Colony Collaps Disorder) more and more frequently conducted to the loss of bee families and this is a new problem among the others for the Romanian apiculturists.
-The honey collection, storage, bottling and labeling, and branding is another problem the beekeepers are facing.
-Honey price is still low and in the years with low pickings and honey production, it does not cover production costs.
Similar problems were identified in Bulgaria and other countries too [14].
-Another problem is represented by the use of antibiotics (mainly streptomycin) in sugar syrup offered by beekeepers to the bee families to stimulate feeding in spring season, to stimulate the bee queen and prevent the occurrence of bee diseases. For this reason, antibiotics are found sometimes in honey whose consumption could determine resistance to them in the human body [24].
All these problems should be carefully analyzed by Romanian Beekeepers Association and Ministry of Agriculture and Rural Development to find the suitable solutions. In this respect, the National Apiculture Programme, established based on EU Regulation No.1308/2013, completed with EU Regulations No.1366/2015 and 1368/2015 provides measures and funds to meet beekeepers needs and foster the production and marketing of apiculture products [8, 9,10, 12]. For the period 2017-2019 are provided Euro 216 Million to be spent on national apiculture programmes in the 28 EU Member States. The EU funding for these programmes is based on the number of beehives according to EU Commission Implementing Decision No.1102/2016 [11].
The following specific measures are eligible to be financially supported by this programme:
(i)technical assistance (Beekepers training on breeding or disease prevention, extraction, storage, packaging of honey etc.);
(ii)combating beehive invaders and diseases, particularly varroasis; (iii)rationalisation of transhumance (important for pollination and bee nutrition);
(iv)analyses of apiculture products (honey, royal jelly, propolis, pollen and beeswax);
(v)restocking of hives;
(vi)applied research;
(vii)market monitoring;
(viii)enhancement of product quality (to exploit the potential of apiculture products on the market).

CONCLUSIONS

Romania has 22,930 beekeepers (apiaries) where there are kept 1,586,000 bee hives. The

average size of an apiary is 69.16 bee hives, but 6.73 % of beekeepers, that is 1,545 owners have over 150 bee families.

In 2015, there were 1,392.8 thousand bee families, by 41.81 % more than in 2007. The climate conditions and the natural and cultivated flora do not determine an equal distribution of the bee families in Romania's territory. The decreasing order of the micro-regions where bee families are grown is: South West Oltenia, Center, North East, South Muntenia, West, North West, South East and Bucharest-Ilfov.

In 2015, Romania's honey production was 27,893 tons by 66.35 % more than in 2007 according to NIS Database 2016. According to the EU Commission Report, Romania is on the top position in the EU-28 with 35, 000 tons. The distribution of honey production in the territory is similar with the one of the bee families.

The linear regression functions reflected an increasing general trend of honey production in the analyzed period both at the country level and almost all the micro-regions, except Bucharest-Ilfov where production declined in close relationship with the number of bee families.

The forecast for the period 2016-2020 estimates that in 2020, Romania will produce 34,400 tons of honey for an average annual growth rate of 9.06 %. Important contributions are expected to be given by each micro-region of development.

The development of beekeeping should continue the tradition long of thousands years in Romania. To grow honey production, beekeepers must continue to increase the number of hives and bee families, to strengthen the bee family power, to improve and complete feeding using a large variety of resources, to assure a good maintenance and health to the bee families and prevent and correspondingly treat bee diseases respecting the thresholds imposed by the EU regarding the use of medicines.

An increased honey production could cover better the internal market and domestic consumption and also could stimulate honey exports in the EU and other countries. Also, it could bring more incomes for apiarists and improve their living standard.

The development of beekeeping will contribute to the development of the communities in the rural areas, and also could have a positive impact on processors and retailers.

Honey is important in Romania's agro-food export, successfully contributing to the trade balance and helping the country to be a net exporter for this product.

To increase honey production, beekeepers could be aware that their apiary must have more than 100 bee families to be profitable.

They must apply new technologies, using modern hives, selected bee queens, corresponding feeding, to assure a better maintenance and health control of the bee families.

The marketing of the bee products must be intensified by a better analysis of the domestic and international market in order to assure the enlargement of the bee products market, by a more intensive advertising and promotion of the bee products to increase domestic consumption, a higher quality of honey to help sale price to be higher and cover better the production costs, the development of organic honey and other bee products to increase the acquisition price, the development of Romanian brands, the guarantee of the high quality.

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MAIZE CULTURE - AN INTENSIVE OR EXTENSIVE PRODUCTION SYSTEM IN ROMANIA

Agatha POPESCU

University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Email: agatha_popescu@yahoo.com

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper aimed to analyze the dynamics of maize production in Romania and the influence of cultivated area and maize yield on this output, using the empirical data provided by the National Institute of Statistics for the period 2007-2015. The analysis is based on various methods like the chained substitution of factors, and fixed indices, coefficient of correlation and determination, and regression function. In the analyzed period, the cultivated area with maize increased by 3.12 % reaching 2,604 thousand tons in 2015. Romania potential to produce maize is about 12,000 thousand tons, placing the country among the top producers in the EU-28. Maize is the most important cereal crop contributing by 47 % to cereal production. In 2015, maize yield accounted for 3,449 kg/ha being by 126 % higher than in 2007, but tge performance is still very low compared to other EU countries. The main changes in maize production were determined by average maize production ($r = 0.968$ and $R^2= 0.9386$), and in a weak measure by cultivated surface ($r = 0.080$ and $R^2=0.0065$. The same aspect relationships were confirmed by the regression functions between these indicators. As a conclusion, maize yield is the key factor increasing production. Maize culture is cultivated in an intensive production system in Romania. Farmers should be on the factors supporting production growth as follows: to use high value certificated maize seeds from hybrids with a higher production potential, to apply the corresponding agricultural works according to the modern technologies, to take into account the need of crop rotation, to assure the corresponding plant density per unit of surface, the adequate doses of fertilizers, to take care of pest control, to assure irrigation and also to assure the insurance of maize culture against climate phenomena. Maize production is important for internal consumption and also for export.

***Key words*: *Key words**: maize crop, cultivated area, maize yield, maize production, Romania*

INTRODUCTION

Agriculture is very important for assuring food for population and a high life quality and living standard.

Agricultural systems are functional units including the natural and social-economic framework created for obtaining vegetal and animal production under the management and control of the farmer, in order to obtain high production performance and economic efficiency.

Intensive production system in agriculture requires important inputs such as: large agricultural land surface, high quality certificated seeds, modern machinery, fertilization, pesticides, irrigations, labour, fuel, etc to assure high qualitative and qualitative production, a high economic efficiency and competitiveness [1].

Besides wheat and rice, maize is an important human food resource, accounting for 94% of all cereal consumption at world level [5].

Maize is an important cereal proving high nutritional value food products for human and animal consumption. Of 100 kg maize grains it could be obtained77 kg maize flour, 63 kg starch, 44 l alchool, 71 kg glucose, 1.8-2.7 l oil and 3.6 kg maize cake.

Maize has a high production potential, by 50 % higher than the other cereals. It is able to porduce constant harvests, it is good in monoculture for many years, a good prior plant for most of crops, and its cultivation is mecanisable 100 %, it has a good feed-back to fertilization and irrigation, it has a good resitance to drought, it could be cultivated on various soil types, and could be used for many purposes [9, 10].

Maize is an important cereal in Romania,

being cultivate on 47.1 % of the agricultural land cultivated with cereals. For its maize cultivated area, Romania is placed in the top in the EU-28 and among the top producers in the EU and in the world [3, 10].
Also, maize is an agro-food product required for export, Romania's trade balance being a positive one [6].
Despite that in general, maize is a resistant crop to drought, the global climate change with its extreme phenomena mainly droughts has affect this crop even in Romania imposing irrigation and specific soil tillage to assure high production performance [7].
Romania has still a low maize yield, one of the smallest in the EU-28. This situation is justified by the fact that only 0.38 % of the farms have over 100 ha average size and maize is cultivated in about 2.5 agricultural holdings of various dimensions [2].
In this context, the paper objective was to analyze the evolution of maize production in Romania in the period 2007-2015 using the empirical data provided by the National Institute of Statistics. Another purpose was to identify the measure in which the cultivated surface and maize yield have influenced maize production, as a reflection of what type of agricultural system is maize production, an intensive or extensive one.

MATERIALS AND METHODS

The paper is based on the empirical data regarding maize cultivated area, yield and production provided by National Institute of Statistics for the period 2007-2015. The dynamics of these indicators was graphically represented and interpreted by means of trend line.
the method of the chained substitution of factors was use to analyze the influence of maize cultivated area and yield on maize production, starting from the formula:

$$P = A*Q, \quad (1)$$

where P= maize production, A = cultivated area and Q= average maize production. The production change, ΔP, will have the following formula:

$$\Delta P = P_i - P_{i-1},$$

where P_i= production in the year i, i=1,2,....n, and P_{i-1}= production in the year i-1.
Replacing the symbols in the formula, we obtain:

$$\Delta P = Q_i*A_i - Q_{i-1}* A_{i-1}, \quad (2)$$

where Q_i= average production in the year i, and Q_{i-1}= average production in the year i-1; A_i= cultivated surface in the year i, and A_{i-1}= cultivated surface in the year i-1.
The influence of the two factors on maize production will be:
-The influence of the cultivated area:

$$\Delta A = A_i* Q_{i-1} - A_{i-1}* Q_{i-1} \quad (3)$$

-The influence of the average production:

$$\Delta Q = A_i* Q_i - A_i* Q_{i-1} \quad (4)$$

Finally, the production change, ΔP, is due to the changes in cultivated surface, ΔA, and the changes in maize yield, ΔQ, according to the formula:

$$\Delta P = \Delta A + \Delta Q \quad (5)$$

The results of this calculations were tabled and correspondingly interpreted.
Also, it was studied the regression of production in relation to the cultivated area and average production, as well as the determination coefficient and coefficient of correlation.

RESULTS AND DISCUSSIONS

The maize cultivated area. The cultivated surface with maize has varied in the analyzed period from 2,525 thousand ha in the year 2007 to 2,604 thousand ha in the year 2015. Therefore, in the analyzed period, maize cultivated area increased by 3.12 %.
Even thou it was noticed this general trend, it is obviously that from 2007 to 2010, the cultivated area registered a continuous decline, and then it increased in the years 2011 and 2012, being followed again by declines in 2013 and 2014, and finally in the

last year of study it increased again. This variations were caused by the importance of maize in crop structure, to assure crop rotation.(Fig.1).

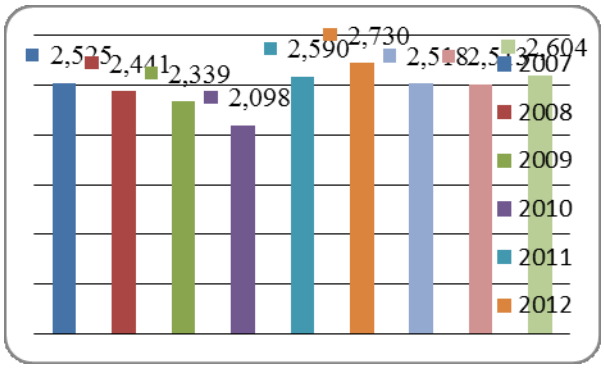

Fig. 1. The dynamics of the cultivated area with maize, Romania, 2007-2015 (Thousand ha)
Source: Own design based on the date provided by National Institute of Statistics Database, 2017.

Maize occupies the highest share in the cultivated area with cereals, 48%, taking into account the importance of the maize grains for human and animal consumption, and for industry. Also, maize has an important share in the cultivated area of Romania, being about 32 %.(Table 1).

The average maize production recorded a general ascending trend from 1,526 kg/ha, the lowest performance, recorded in the year 2007, to 3,449 kg/ha registered in the year 2015. Therefore, during this period, maize yield increased by 126.01 %.

The highest performance was 4,770 kg/ha registered in the year 2014. The fluctuation of yield from a year to another were determined by a large range of factors and mainly by the climate factors.

The years with strong droughts 2007 and 2012 were deeply marked by a diminishing maize yield, with a negative impact of maize production.(Fig.2).

Table 1.The share of maize in the cultivated area with cereals and in the total cultivated area in Romania, 2007-0215 (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015
% in the cultivated area with cereals	49	47	44	42	50	50	46	46	48
% in the cultivated area	32	31	30	27	32	34	31	31	32

Source: Own calculation based on the data provided by National Institute of Statistics Database, 2017.

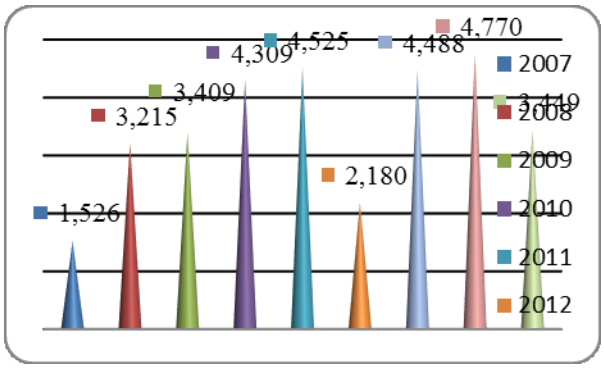

Fig. 2. The dynamics of the maize yield, Romania, 2007-2015 (kg/ha)
Source: Own design based on the data provided by National Institute of Statistics Database, 2017.

The maize production increased in the analyzed period by 133.13 % from 3,854 thousand tons in the year 2007 to 8,985 thousand tons in the year 2015. However, analyzing the figures, in the year 2007 it was recorded the lowest maize production, while in the year 2015 Romania registered the highest maize production. The variations were caused by the changes in cultivated surface and average production per surface unit. (Fig.3.).

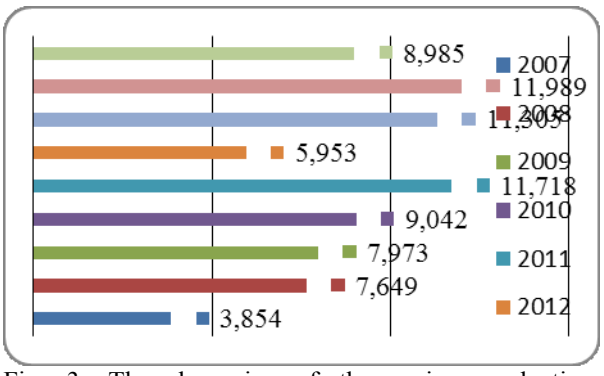

Fig. 3. The dynamics of the maize production, Romania, 2007-2015 (Thousand tons)
Source: Own design based on the data provided by National Institute of Statistics Database, 2017.

Maize production has an important place among the cereals cultivated in Romania, proved by its highest contribution to cereals production. In 2015, the share of maize in

cereal production was 47 %, but it varied during the analyzed period from 47% recorded in 2008 to 56 %, the highest share, registered in the year 2011 (Table 2).

Table 2.The share of maize production in the cereals production, Romania, 2007-2015 (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015
% in the cereals production	49	47	54	54	56	46	54	54	47

Source: Own calculation based on the data provided by National Institute of Statistics Database, 2017.

The maize production change (Δ P) in the analyzed period. The production change has varied from a year to another, having both positive and negative values. It recorded + 5,352 thousand tons change, the highest change in absolute value in the year 2013 versus 2012, and +124 thousand tons in the year 2010 versus 2009. The negative change was recorded in the year 2012 versus 2011, - 5,765 thousand tons, and - 3,004 thousand tons in the year 2015 versus 2014, these declines being determined by drought.(Table 3).

Table 3. Maize production change, Romania, 2008-2015 (thousand tons)

	2008 vs 2007	2009 vs 2008	2010 vs 2009	2011 vs 2010	2012 vs 2011	2013 vs 2012	2014 vs 2013	2015 vs 2014
Δ **P**	3,995	124	1,069	2,676	-5,765	5,352	684	-3,004

Source: Own calculation based on the data provided by National Institute of Statistics Database, 2017.

The influence of the cultivated area on maize production has been in the most of cases a negative one, ranging from -22 thousand tons in the year 2014 versus 2013 to -819 thousand tons in the year 2010 versus 2009. A positive influence +2,119 thousand tons was noticed in the year 2011 versus 2010, and 633 thousand tons in the year 2012 versus 2011, and 434 thousand tons in the year 2015 versus 2014.(Table 4)

Table 4. Maize production change due to the change of the cultivated area (thousand tons)

	2008 vs 2007	2009 vs 2008	2010 vs 2009	2011 vs 2010	2012 vs 2011	2013 vs 2012	2014 vs 2013	2015 vs 2014
Δ **A**	-128	-328	-819	+2,119	+633	-461	-22	43

Source: Own calculation based on the data provided by National Institute of Statistics Database, 2017.

The influence of the maize yield on maize production was a positive one in the most of the years, except 2012 versus 2011 and 2015 versus 2014, when the country was facing a string drought which deeply diminished production. In this years, the change of the average production accounted for -6,398 thousand tons, and respectively for -3,438 thousand tons (Table 5).

Table 5. Maize production change due to the change in maize yield (thousand tons)

	2008 vs 2007	2009 vs 2008	2010 vs 2009	2011 vs 2010	2012 vs 2011	2013 vs 2012	2014 vs 2013	2015 vs 2014
Δ **Q**	4,123	452	1,888	557	-6,398	5,813	706	-3,438

Source: Own calculation based on the data provided by National Institute of Statistics Database, 2017.

The correlation coefficients and coefficient of determination between maize production and cultivated area, (P*A), between maize production and maize average production (P*Q), and between cultivated area and average production (A*Q) are presented in Table 6.

The coefficient of correlation between cultivated area and production is a weak one, r = 0.080, reflecting that maize production is not influenced by the cultivated surface too much. Also, the coefficient of determination reflected that the change of maize production was determined in a very small proportion by the change of the cultivated surface, just 0.65 %.

The coefficient of correlation between maize yield and maize production has a high value,

reflecting that the output per ha is the key factor for increasing production performance, r = 0.968. The same aspect was confirmed by the coefficient of determination whose value was R^2= 0.9386, proving that the variation of production is determined 93.86 % by the variation of maize yield.

Finally, the coefficient of correlation between the cultivated area and maize yield has a low value, r = 0.321, and also the coefficient of determination confirmed this weak relationship by its value, reflecting that just 10.31 % of maize production change is due to the change of the cultivated area.

(Table 6).

Table 6.The coefficients of correlation (r) and coefficients of determination (R^2) between the three indicators characterizing maize production

Pair of indicators	r	R^2
Cultivated area x Production (A*P)	0.080	0.0065
Yield x Production (Q*P)	0.968	0.9386
Cultivated area x Yield (A*Q)	0.321	0.1031

Source: Own calculations.

The regression functions between the three pairs of indicators characterizing maize production are presented in Fig.4,5 and 6.

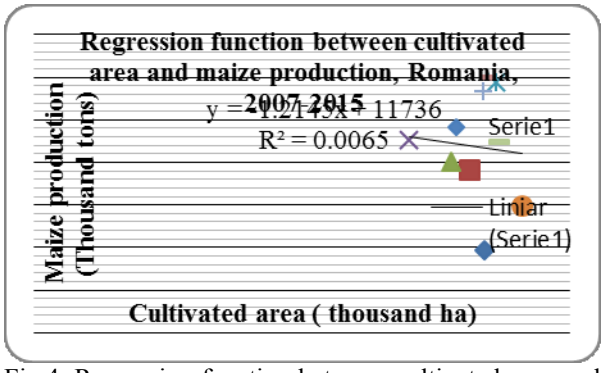

Fig.4. Regression function between cultivated area and maize production, Romania, 2007-2015
Source: Own design based on the data provided by National Institute of Statistics Database, 2017.

The regression function y = -1.2145x + 11736, between cultivated area and maize production reflects a general very weak influence (Fig.4.)

The regression function y = 2.3633x + 349.54, between maize yield and maize production reflects a string positive influence, the higher maize yield the higher maize production. (Fig.5.)

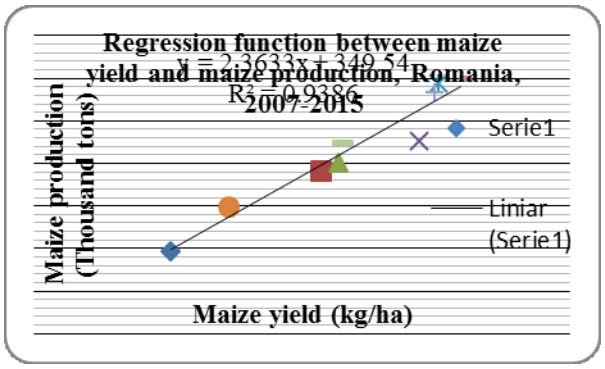

Fig.5 Regression function between maize yield and maize production, Romania, 2007-2015
Source: Own design based on the data provided by National Institute of Statistics Database, 2017.

The regression function y = -1.9855x + 8473.7, between cultivated area and maize yield reflects a weak influence (Fig.6.)

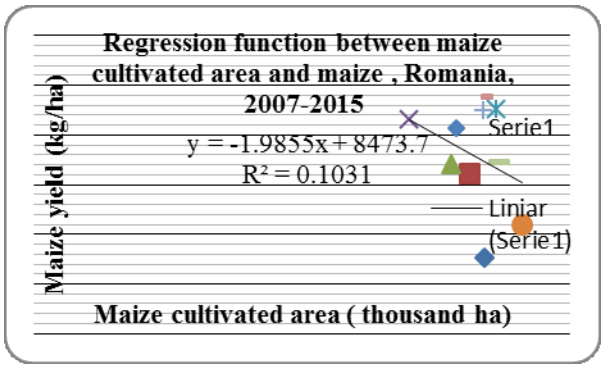

Fig.6. Regression function between cultivated area and maize yield, Romania, 2007-2015
Source: Own design based on the data provided by National Institute of Statistics Database, 2017.

CONCLUSIONS

The analysis regarding maize production in Romania in the period 2007-2015 reflected an increase of the cultivated surface by 3.12 %, maize remaining the most important crop with a share of 48 % in the cultivated area with cereals and 32 % in the cultivated area in Romania. In 2015, maize production was 2,604 thousand tons.

Romania has a high potential to produce maize, the performances of about 12,000 thousand tons in the years 2013 and 2014 proved this, placing Romania close to France

among the most important producers of maize in the EU-28. Maize is an important cereal in Romania, contributing by 47 % to cereal production.

Maize yield has substantially increased in the analyzed period by 126 %, reaching 3,449 kg/ha in 2015. However, the output per ha recorded by Romania is still very low compared to average production registered by other EU countries.

Maize production changes are mainly determined by average maize production ($r = 0.968$ and $R^2 = 0.9386$), and in a weak measure by cultivated surface ($r = 0.080$ and $R^2 = 0.0065$). Also, between the cultivated surface and maize yield is a weak positive correlation and reduced determination ($r = 0.321$, $R^2 = 0.1031$).

The same aspect relationships were confirmed by the regression functions between these indicators.

Therefore, as a final conclusion, maize yield is the key factor increasing production. This is very important for farmers who must be aware that only being focused of the tools to growth maize yield they could obtain higher maize productions. In this respect, it is important to use high value certificated maize seeds from hybrids with a higher production potential, to apply the corresponding agricultural works according to the modern technologies, to take into account the need of crop rotation, to assure the corresponding plant density per unit of surface, the adequate doses of fertilizers, to take care of pest control, to assure irrigation and also to assure the insurance of maize culture against climate phenomena, floods etc.

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ESTIMATING THE HEREDITY OF SOME QUANTITATIVE TRAITS OF TWO-ROW SPRINGBARLEY (*HORDEUM VULGARE var. distichum)*

Ioana PORUMB[1], RUSSU Florin[2], Emanuela FILIP[2]

[1]University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-4 Manastur Street, Cluj-Napoca, Romania, E-mail: ioanaporumb18@yahoo.com
[2]Agricultural Research and Development Station, Turda, 27, Agriculturii Street, Turda City, Cluj County, Romania,

***Corresponding author*:** ioanaporumb18@yahoo.com

Abstract

Production is, perhaps, the most complex trait and, in comparison with other quantitative traits, itis the hardest to evaluate in the early generations of selection, which is primarily due to the highstate of heterozygosity and to the great number of major and minor genes implied in the herediyof this trait. The research undergone reached the conclusion that, in their turn, the elements of production possess a complex heredity. To estimate the effects of heredity gene involved in quantitative characters, yield component, it was used for genetic analysis model proposed by Hayman (1958) and applied by Gamble (1962). In this regard, the averages of the traits from the parental populations and from the geneticpopulations from the lineages were analysed, the following being estimated: additive geneticeffects (a), dominant (d) and the epistatic interactions of the type additive x additive (aa), additivex dominant (ad), dominant x dominant (dd), involved in the heredity of the analysed traits.

***Key words*:** *Spring barley, Gamble, gene effects, dominance, traits cantitative, plant height, TKW*

INTRODUCTION

Accoding to [1], barley is used on a large scale as animal feed and inthe production of beer, but, lately, interest has been shown for the increasing of utilisation as foodfor people. The world barley production represents approximately 30% of that of corn, however, in comparison to the latter, barley contains more proteins, methionine, lysine, cysteine and tryptophan. In the feeding of ruminants, barley can also be found on the third place, from the point of view ofits degree of digestibility, after oat and wheat[5].

As it is known, in the heredity of quantitative trait (the elements of production and some morphological traits) a great number of genes is involved, with reduced and resemblant effects, acting, most of the times, additively in the determination of the respective trait. In the literature, these genes are known under the name of 'polygenes'. Besides the additive action of the polygenes in the heredity of quantitative traits, other types of interactions are implied, intra-allelic (dominance and recessiveness) and inter-allelic (epistasis), in the end all these determining a complex heredity of these traits. The implication of each polygene cannot be analysed singularly, but only as a unitary whole, at the level of the gene complex.

The main morphoproductive traits that were the object of this study were represented by: spike length,number of grains/spike, grain weight/spike and the TKW, the heredity of the plants' height was alsoanalysed, with the aim of improving the breeding programmes that focus on its reduction it. In this paper,only the genic effects for the plants' height and the number of grains/spike will be presented.

The analysis ofthese elements through quantitative genetics has a probabilistic character – it becomes precise only throughthe use of molecular markers in the analysis of these QTL.

At the basis of choosing the parental forms stoodthe homozygosity criteria, while the parents were differentiated more or less in regard to the traits analysed, a number of six hybrid combinations being performed. The cultivars chosen for this study were representedby two autochthonous varieties (JUBILEU – SCDA Turda; PRIMA – SCDA Suceava) and ten either older ornewer foreign varieties (THURINGIA, VICTORIANA, VIENNA – Saaten Union; ODISEY, CHRONICLE, SALOME – Limagrain; MAGNIF, ANABELLE – varieties of Czech origin.)

MATERIALS AND METHODS

In order to estimate the genic effects implied in the heredity of quantitative traits, production traits,the model of genetic analysis proposed by [1]and put into practice by [4] was used. In this regard, the averages of the traits from the parental populations and fromthe genetic population from the lineages were analysed, with additive genic effects (a), dominant (d) and the epistatic interactions of the type additive x additive (aa), additive x dominant (ad),dominant x dominant (dd) implicated in the heredity of the analysed characters being estimated. For every trait, a number of 50 plants were studied, with the mention that there were somecombinations in which a smaller number of plants were analysed in the F1 generation. The heightof the plants was determined with the help of a graduated ruler from ground level to the top of thearistae, while spike length was measured from the base of the spike to its top.

RESULTS AND DISCUSSIONS

The average performances of the parental populations and those of the segregant generations corresponding to each cross breeding for the plants' height are presented in table 1, the average of parental populations being between 87 and 112 cm. The average of the F1 generation has gotvalues intermediate between the two parents at the majority of the combinations, but, in the F2 generation, most combinations registred values that were superior in comparison to the F1 generation. Looking at the backcrossing generations, it can be observed that there is a behaviour fairly in concordance with the value of the parent that participates in the respective backcross. In the case of combinations 2 and 3, the higher values of the plants' height from F2 as compared tothose from F1 and of the tallest parent, indicate the presence of some transgressive segregants. In the case of combinations 5 and 6, the fact that the value of the plants' height in F2 is inferior tothe shortest parent or only a bit higher (combination 6) is an indicator to the existance of somenegative transgressive segregations. All these come to show the complex mechanism behind the transmission of plant height and the difficulties met in the improvement of this trait, which is why it is reccomended that the selection be made in successive generations, through thechecking of lineages.

Table 1. The average plant height values (cm) of the parental populations in a spring barley crossbreeding system (Turda, 2016).

POPULATIONS						
COMBINATION	P1	P2	F1	F2	BCI	BCII
CB1 (Thuringia x Jubileu)	101	112	97	103	108	100
CB2 (Prima x Victoriana)	109	90	103	111	113	95
CB3 (Magnif x Odisey)	106	92	95	108	103	101
CB4 (VictorianaxAnabelle)	92	102	81	96	100	103
CB5 (Chronicle x Salome)	92	87	92	88	96	95
CB6 (Viena x Anabelle)	100	98	99	97	103	100

At the level of the F1 generation, in the majority of combinations, with the exeception of 1 and 4, the average of spike length is superior to the average of the best parent, which in these situations indicates a quite pronounced effect of heterosis, probably due to the effects of over dominance. In F2, for the four combinations still, a slight genetics depression can be observed; however, this is not significant and it points to the accumulation of additive genes in a heterotic state at the level of this generation. With respect to the retrocrossing generations, it can be said that in what the spike length is concerned, the behaviour in these generations corresponds to the performances of the parent from the respective cross, even if the differences are smaller. A deviation from this behaviour can be observed in the case of combination I, which confirms the probabilistic character of this method. From among the parents, in terms of spike length, the genotypes Jubileu and Anabelle stand out.

Table 2. The average spike length values (cm) for the parental populations in a two-row spring barley backcrossing system

POPULATION						
COMBINATION	P1	P2	F1	F2	BCI	BCII
CB1 (Thuringia x Jubileu)	9,60	10,80	8,80	11,50	10,40	8,00
CB2 (Prima x Victoriana)	10,1	9,60	10,50	9,50	11,00	10,70
CB3 (Magnif x Odisey)	9,70	10,40	10,80	10,20	11,00	11,60
CB4 (Victoriana x Anabelle)	9,80	10,90	10,40	10,80	12,00	11,60
CB5 (Chronicle x Salome)	8,60	9,20	9,40	8,60	9,20	10,10
CB6 (Viena x Anabelle)	9,20	9,70	10,00	8,90	10,40	10,00

Estimation of genic effects

In o ur research, from the data presented in table 3, it can be observed the significant to very significant effects of the additivity genes in expressing plant height, with the exception

of combinations 3 and 5. An absolutely superior value of additivity genes can be highlighted in the case of combination 2, while the negative values of the additive effect in combination 4 are due tothe fact that the second parent's height was superior, an exception to this behaviour is made, again, by combination 1, for which the Jubileu cultivar is probably not homozygotous for the majority of the loci.

The high absolute values of the very significant dominance effects (only significant in combination 1) distinguish themselves, which confirms the important role dominance plays in the conditioning of this trait. For almost all the combinations, the values of the epistatic effects are superior to those of the additivity effects, which suggests a greater implication of the former in the heredity of plant height. Similar effects in what the implication of dominance genes in the heredity of plant height are concerned were also reported by [3]. On the other hand, [6] mention that, in plant height control, a high number of alleles intervenes, which usually act additively when they have a normal distribution.

Table 3. Estimation of gene effects on plant height in a set of six two-row barley hybrid combinations (Turda 2016)

GENE EFECTS						
COMBINATION	**m**	**a**	**d**	**aa**	**ad**	**dd**
CB1 (ThuringiaxJubile)	102,9 ***	8,1 ***	-3,9*	5 **	13,8 ***	-14,6 ***
CB2 (Prima x Victoriana)	110,5 ***	18 ***	-24,78 ***	-28,13 ***	8,45 **	19,03 ***
CB3 (Magnif x Odisey)	107,9 ***	2,55	-26,71 ***	-22,98 **	-4,18 **	2,73
CB4 (VictorianaxAnabelle)	96 ***	-3,3 *	6,25 ***	22,2 ***	1,5	-72,1 ***
CB5 (Chronicle x Salome)	87,88 ***	0,8	33,93 ***	31,68 ***	-1,85	-55,18 ***
CB6 (Viena x Anabelle)	97 ***	3,25 **	17,4 ***	18,1 ***	2,1	-23,8 ***

An estimated presentation of the role genes have in the control of spike length is displayed in table 4. From the reduced absolute values of additive genic effects, a reduced implication of additivity in the conditioning of this trait can be deduced. Regarding the dominance genes, their very significant contribution in the heredity of the spike length can be observed, this being eflected, as well, in the absolute superior values of the addititity genic effects. Actually, in 5 of the6 combinations studied, the values of the dominance effects are also superior to ones epistatic of the type aa and ad. All these come to strenghten the major role of dominance effects in spike length conditioning.The major contribution of dominance effects in the expressing of spike length was also reported by [2], who show that the study of spike length heredity indicates, in the genetic determinism of this trait, the presence of the phenomen of dominance and non allelic interactions.

Table 4. Estimation of gene effects on spike lenght in a set of six hybrid two-row barley combinations (Turda 2016)

GENE EFECTS						
COMBINATION	**m**	**a**	**d**	**aa**	**ad**	**dd**
CB1 (Thuringiax Jubileu)	11,54 ***	2,42 ***	-10,57 ***	-9,23 ***	3,01 ***	10,32 ***
CB2 (Prima x Victoriana)	9,53 ***	0,3	5,66 ***	5,07 ***	0,03	-7,65 ***
CB3 (Magnif x Odisey)	10,22 ***	-0,58 *	4,94 ***	4,17 ***	22,9 ***	-7,59 ***
CB4 (VictorianaxAnabelle)	10,18 ***	0,32	6,53 ***	6,43 ***	0,88 ***	-12,8 ***
CB5 (Chronicle x Salome)	8,58 ***	-0,9***	4,55 ***	4,08 ***	-0,59 **	-5,82 ***
CB6 (Viena x Anabelle)	8,92 ***	0,4	5,63 ***	5,12 ***	0,64 *	-7,14 ***

CONCLUSIONS

In barley production, a series of interdependant physiological processes are implied, which take place gradually in the course of the vegetation period, finding themselves under the influence ofthe environmental conditions a significant period of time (from sprouting to physiological maturity).

As it could be observed, all the agronomical elements of production have, in their turn, a complex heredity, which complicates selection works even more. The best breeding results were obtained when the selection criteria used were represented by the components of production with a heredity as simple as possible.

The role of additivity effects in plant height control is closely related to the differentiations between parental forms, so in the case CB2 (Prima x Victoriana), the values of the additivity effects are high and very significantly positive. The control of plant height is governed by dominant andepistatic additivity effects. The selection for plant height (evidently, for the forms resistant to fall) may begin in the earlier generations of selection, but the reduction of height has to be associated with high productivity, precisely because the plant height is directly and very significantly corellated with the number of grains/spike, the weight of the grains/spike and TKW. The superiority of the F1 generation to the parental forms in the case of spike length indicates thepresence of the phenomenon of heterozygosity in the case of this trait for four of the six combinations studied. In spike length conditioning, the greatest role can be attributed to the dominant, as well as to the epistatic effects of

genes.

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CURRENT SITUATION AND ESTIMATION OF THE FINANCING NEEDS TO IMPROVE AGRICULTURAL TRAINING OF THE FARM HEADS

Marioara RUSU[1], Liliana GURAN-NICA[2]

[1]Institute of Agricultural Economics, Romanian Academy, 13, Calea 13 Septembrie, District 5, Bucharest, Phone: 0213182411; E-mail: rusu.marioara@gmail.com.
[2]Spiru Haret University, Faculty of Geography, 13, Ion Ghica Street, District 3, Bucharest, Phone: 021/3140076; E-mail: liliana_guran@yahoo.co.uk.

Corresponding author: rusu.marioara@gmail.com

Abstract

This paper investigates the professional education of farm heads from Romania and makes a rough estimation of the basic financial resources to train them for the next twenty years. Results are mainly based on statistical data analysis. Coming out conclusions show that Romanian farm heads hold the last place in the European Union (EU) regarding professional training. To improve this situation have estimated a need of about two billion euros for the next twenty years. Based on the results, the paper proposes several main areas for upskilling.

Key words**:** *agricultural training, farm heads, Romania*

INTRODUCTION

In Romania, agriculture is an important sector of rural economy: it has vast land resources - 14.6 million hectares of agricultural land with a structure encouraging the development of diversified agriculture: arable land 64.3%, pasture and meadows 32.9%, and vineyards and orchards 2.8% [3]. According to Eurostat, farming population (2.5 million people) represent 25.6% of total employed population, 5.7 times higher than the average of EU28 (4.5%). If we compare the share of agriculture's contribution to GDP (4.7%) to the share of the agricultural employment, we conclude that labour productivity in this sector is very low [1]. In fact, from this point of view Romania ranks last but one among the UE28 countries [7]. This shows in great extent why the most rural areas of Romania falls among the poorer EU regions and why migration, mainly rural one, was so noticeable in the recent years [8].

If under socialism large farms of hundreds and thousands of hectares prevailed, after 1990 the situation changed, the land was returned to former owners and farm size was reduced considerably [4]. Romania has the most fragmented agrarian structure within the EU, with about 3.6 million farms, representing 32.2% of total EU farms. Another feature of Romanian agriculture is it pronounced polarization. On the one hand there are farms larger than 100 ha, which although represent only 0.3% of total farms, operates 48.8% of the utilized agricultural area. On the other hand, there are small farms, below 2 hectares, which have a share of 73.3% of all farms and 13.0% of total utilized agricultural area [11]. Most of these farms are considered small subsistence and semi-subsistence farms: self-consumption of subsistence farms represent 90-92% of their production and in the case of semi-subsistence farms is 50-52% [5].

Bearing in mind this context, professional training for farm heads is of particular significance since it is known that the success of a business depends primarily on the quality of the management. This quality is determined by the skills and knowledge of the person authorized as manager. Efficient management is a model of linking innate abilities with knowledge gained through experience and training. Education and training aims to develop knowledge, abilities, and other job skills of farmers [6].

Strengthening knowledge and skills has never

been so vital to create inclusive and sustainable societies, as in the knowledge-oriented globalized world from nowadays. It is key element to eradicate poverty, promote equitable economic and social development, human rights, fighting inequality, and environmental protection [9].

MATERIALS AND METHODS

In this paper, in the first step, we identified who are the farm heads in Romania and what are their main characteristics/particularities. Although in the literature there are many definitions, both the farm head and classifications of the professional training system in this paper we consider the definition and classification used by EUROSTAT.

Box 1. Types of training and farm head definition

• *Farm head* is an individual person who, daily, has the responsibility of leading financial and production of an agricultural holding.
•*Types of training-practical experience* - experience gained through work done in a farm;
- *basic agricultural training* - training at a general agricultural college and / or in an institution specialized in the field of agriculture; apprenticeship in agriculture;
- *full agricultural training* - training courses, equivalent to at least two years at a college, university or other institution of higher education in agriculture.

The methodology used was based on statistical analysis of the primary data, using Excel as a tool for quantitative analysis. The statistics data that were the basis for the analysis came from the following sources: a) Eurostat; and b) National Institute of Statistics (NIS).
In the second step, there were established computation assumptions for a rough estimation of the financial support. It should be noted that there is no currently data or studies that enabled to establish accurately the parameters for calculating financial needs for professional training for farm heads in Romania.
Estimation of the necessary financial resources for farm heads training was based on the following assumptions (Table 1):
- it was established the targets of the farm heads, with full and basic agricultural training, to be reached on the timeframes expected (2018- 2025- 2035); it was considered the Polish model;
- it were established the average annual cost per student / trainee on two types of training (basic and full agricultural training); (in the full case it was considered a training course of at least two years). For the 2015-2018 period, it was started from the amount allocated by Romania to general training process (no data specific to agricultural training); in the second period (2018-2025) was considered that these allocations will represent 70% of the amounts allocated by Poland; and for the last period (2025-2035) were used allocations that Poland currently does;
- it was calculated the average annual number of farm heads which will leave farming, taking into account trends recorded in age groups; structure of farm in Romania is dominated, primarily, by older people who naturally will leave the system;
- the calculations watched not only to reduce the number of farms and increase in average agricultural area; it is considered that the utilized agricultural area will remain constant throughout the period.

Table 1. Working assumptions necessary for assessment of the basic financial support for farm heads training

Indicator	Bench-mark (2013)	SHORT TIME 2018	MEDIUM TIME 2025	LONG TIME 2035
Targets				
Farm heads with full agricultural training (%)	0.47	5	14	28
Farm heads with basic agricultural training (%)	3.13	5	11	22
Working assumptions				
Utilized Agricultural Area (mil. ha)	13.056	13. 056	13.056	13.056
Farm heads number (mil.)	3.630	2.996	1.961	1.306
Average agricultural area (ha)	3.,60	4.36	6.66	10.00
Average expenditures per student for full agricultural training (euro)	1873	1873	2600	3714
Average expenditures per student for basic agricultural training (euro)	821	821	1797	2567

Proposed targets should close Romania as much as possible on the level of Poland, a

country that is on a top position among the EU Member States as regards agricultural training of farm heads.

RESULTS AND DISCUSSIONS

Among European Union Countries, Romania has the largest number of farm heads - 3.62966 million (approximately 30% of total EU farm heads) but which is characterized by the lowest level of training: 96 40% have only practical experience, 3.13% basic agricultural training and 0.47% full agricultural training (Fig. 1).

If we analyse the farm heads according to the age group it is noted that the largest number locates in the group over 65 years (1.459 million), followed by the 55-64 age group (820 000).

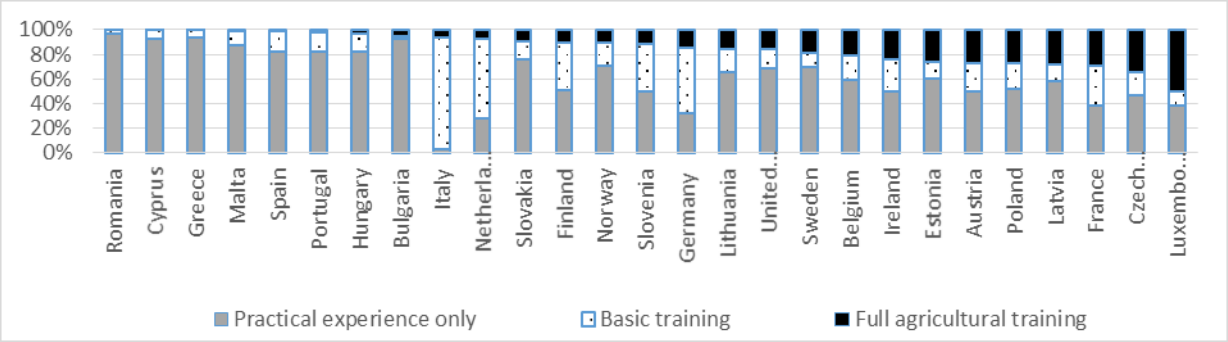

Fig. 1. Distribution of farm heads according to agricultural training in the EU Member States, in 2013 (Source: authors' processing by Eurostat, 2016)

Together, these two groups, totalling 62.79% of the number of farm heads in Romania. On the other hand, young farm heads have a low number – 171,960 of the total farm heads (4.73%) (Fig. 2).

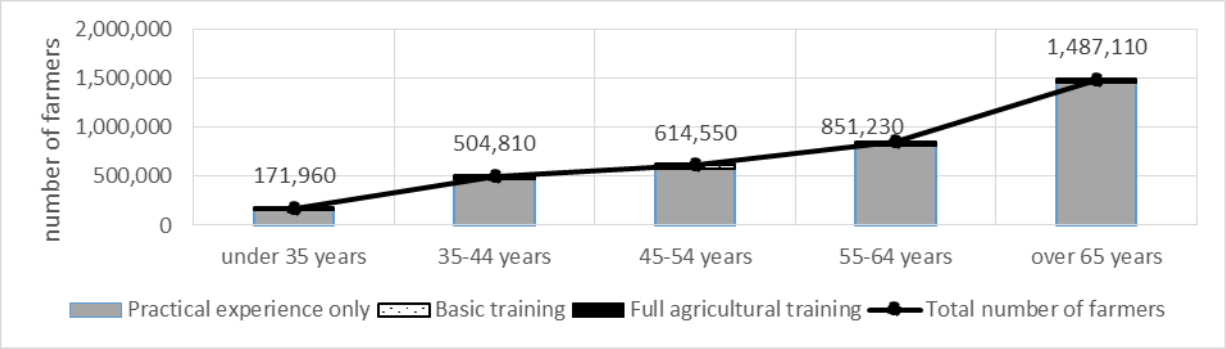

Fig. 2. Number of farm heads according to agricultural training and age group, in Romania, in 2013 (Source: authors' processing by Eurostat, 2016)

Analysis of agricultural training, by age group indicates that regardless of age professional training is extremely low, with small differences. Thus, the full agricultural training has very small share: from a minimum of 0.23% in the case of farm heads aged over 65 years and a maximum of 2.24% in the case of farm heads belonging to the age group under 35 years. The majority of farm heads have only practical experience.

The analysis of utilized agricultural area, however, shows a different picture: the largest area, about 30% of the total UAA, is worked by young farm heads aged under 35 years (about 4 million hectares, of which 1.8 million ha operated by the farm heads with full agricultural training), while the those of belonging to the age group over 65 years work only 21% of the total UAA, and most of them have only practical experience (Fig. 3).

In Figure 4, we can see that young farm heads, regardless of type of agricultural training, works most large farms, while the group over 65 years operates small-scale

farms. In addition, it can be observed the upward trend of the average size of the farm according as increase the training of farm heads.

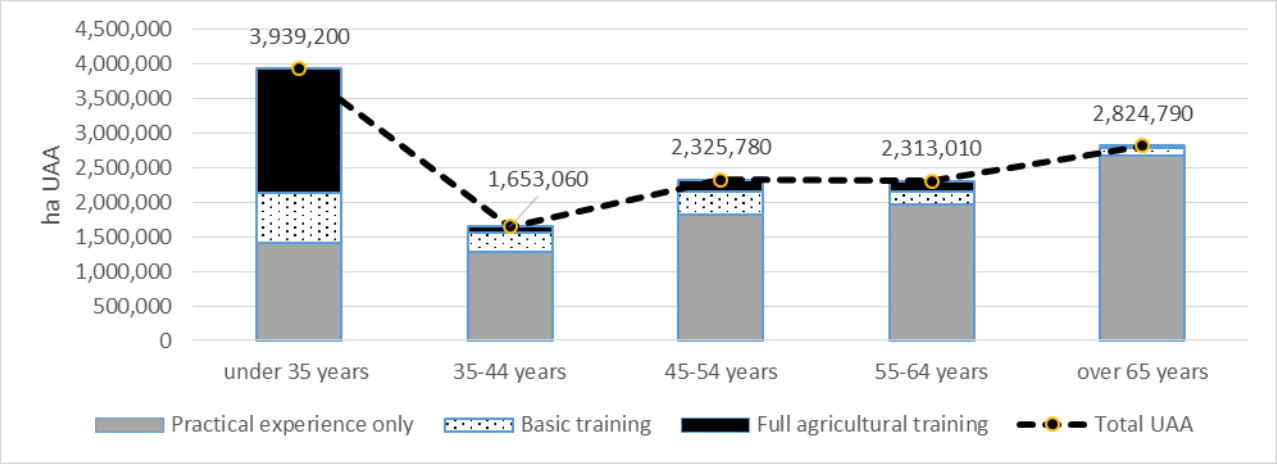

Fig. 3. The utilized agricultural area according to farm heads agricultural training and age group, 2013 (Source: authors' processing by Eurostat, 2016)

Young farmers have been identified as an important group to boost the technological advances in this sector and to rapidly meet the social, economic and environmental changes.
However, recent research has revealed why agriculture has proven to be an economic sector increasingly unattractive for young farmers: severe challenges in terms of climate change, decline in soil fertility, changing markets, social structures and land ownership patterns changes, etc.[12].

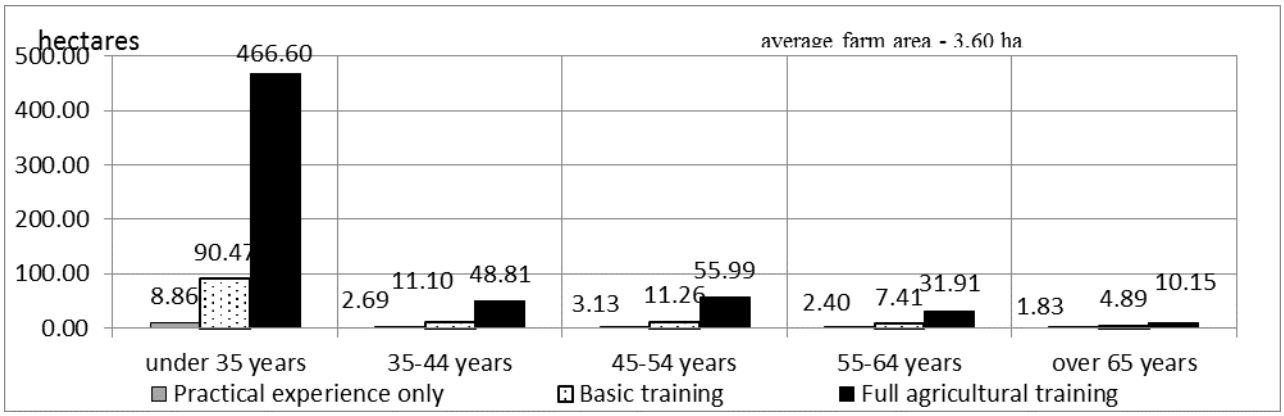

Fig. 4. Average area by age group and agricultural training of farm heads, 2013 (Source: authors' processing by Eurostat, 2016)

Although some specialists have seen small farms as the key to sustainable and equitable development of rural areas, many developing countries have experienced the emergence of "super farms" and increased opportunities for governments to sell or lease large areas of farmland to foreign investors [2].
Analysis of used agricultural area by economic size of the farm and the professional training of farm heads indicates a direct connection between these two dimensions (Figure 5).

The same pattern is observed for the distribution of the number of farm heads by economic size of farm and level of agricultural training: there is a concentration of small farms, under 8000 euros, where the farm heads have only practical experience. Large farms (especially those over 100,000 euro) are small in number but their farm heads, with basic or full agricultural training, are in a significant proportion.

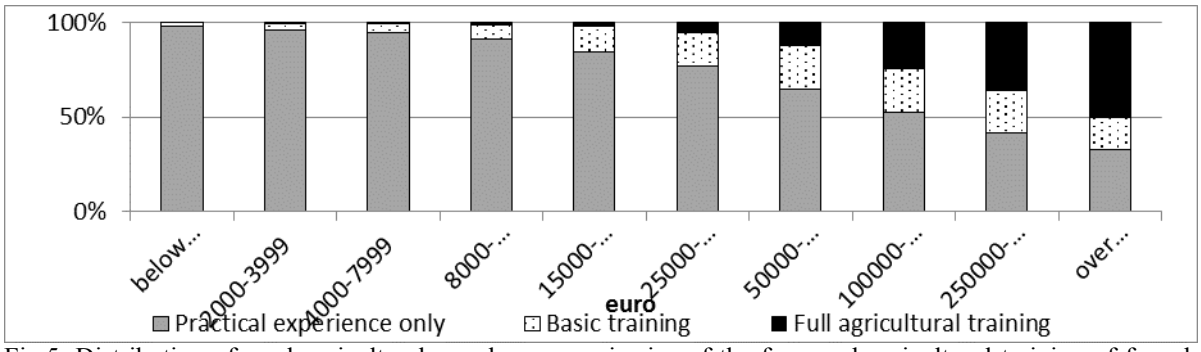

Fig.5. Distribution of used agricultural area by economic size of the farm and agricultural training of farm heads, 2013 (% of total economic size class) (Source: authors' processing by Eurostat, 2016)

As a result of this brief analysis, the question arises is how we can improve the situation and with what resources? Assessment of financial support for agricultural training programs was made considering the results presented above. Financial funds should support the quantity and quality of agricultural training so that it can be offset by productivity differences between farms managed by trained farm heads and those who have only practical experience. According to calculations presented in Table 2, for the period under review is estimated 2.154 billion Euros necessary for both basic and full agricultural training.

Improving education and training of farmers is a dimension without which progress can not be achieved in the agricultural sector.

Table 2. Result indicators on improving agricultural training programs of farm heads in 2018-2035

Indicator	Period 2018-2035
Full agricultural training	
Estimated amount for full agricultural training programs (mil. euro)	1822.25
Number of farm heads beneficiaries of full agricultural training programs	365,564
Total number of farm heads with full agricultural training at the end of the period	384,524
Basic agricultural training	
Estimated amount for basic agricultural training programs (mil. euro)	331.67
Number of farm heads beneficiaries of basic agricultural training programs	173,479
Total number of farm heads with basic agricultural training at the end of the period	287,229

Source: authors' own estimation

Thus, the proposal of agricultural training programs is an undeniable necessity. Agricultural training programs should be relevant, qualitative, inclusive, flexible, innovative, consultative, collaborative and transparent.

CONCLUSIONS

Agricultural training of farm heads should occur simultaneously with the adjustment of agricultural structures, and in particular with the farm structures. In addition, this process should be accompanied by agricultural and rural policy aimed, primarily, attracting young farmers trained in agriculture. In the training field, it needs to perform a detailed assessment of the needs and requirements for the training of human resources, for supporting, the development of agricultural practical programs and training in agricultural education institutions and not least by encouraging and promoting appropriate forms to facilitate continues learning. It is noteworthy that many programs for the training of farmers has not increased farmers' incomes and not created new jobs in rural areas because they had a needs – based approach rather than asset-based approach [10].

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RURALITY AND COMPETITIVENESS TYPOLOGIES: ANALYSIS AT THE COUNTY LEVEL IN ROMANIA

Marioara RUSU

Institute of Agricultural Economics, Romanian Academy, 13, Calea 13 Septembrie, District 5, Bucharest, Phone: 0213182411; E-mail: rusu.marioara@gmail.com

Corresponding author: rusu.marioara@gmail.com

Abstract

In recent decades, the European Union's interest to rural areas has increased. This interest is somewhat explained in that these areas are mainly characterized by weaker economic and social development than urban ones. The aim of this paper has been to achieve a typology of Romanian counties on rurality and competitiveness. This approach has generated a synthetic image of their spatial differentiation. As a working method, the multivariate analysis of two sets of indicators that define the two issues was used, followed by a comparison of the results. The main conclusion indicates that there is an inverse relation between rurality and competitiveness / well-being: the higher the rurality the lower the territorial competitiveness. The results of this work can be a starting point to design specific rural development policies.

Key words**:** *competitiveness, regional typologies, Romania, rural policy, rurality*

INTRODUCTION

In a period of increasing global competition and urbanization, many rural areas are struggling to maintain their economic vitality and viability. Although there is no single comprehensive measure of economic performance, researchers agree that, in general, rural areas have lower performance than urban ones [25][19][16]. European Union (EU) faces several key challenges regarding rural areas and solving them will prove to be a very complex and expensive process. Their primary objective is to increase efficiency by using factors such as competitiveness, innovation, etc. [6].

Getting aware of the endangered rural identity, of its resources and viability, many EU member states, particularly those with developed economies, tried to stop the unfavourable tendencies and preserve rural heritage. The diversity of problems facing rural areas today requires specific identification tools and appropriate intervention policies. Thus, EU programs have become important funding sources for rural development since the late eighties. The EU took into account the change of rural development policy, which aim to guide national and regional governments towards achieving a balance between the rural heritage preservation need, on one hand, and the modernization and development of rural life, on the other hand [1][5].

Research Agenda of the EU recognizes the importance of the spatial perspective of rural development policies and classification of rural areas [3][20]. Thus, over the years, many rural typologies were established at European level [10]. However, few studies take into account the link between the state of rurality and the competitiveness/well-being of the regions.

In order to address the relationship between rurality and competitiveness it is necessary to clarify, in the first place, the meaning of the concepts and to identify their defining characteristics.

Frequently, "rural" refers to a physical, economic, social and cultural concept that is opposite to "urban". There is a rich literature about rural and its characteristics. The rural area was investigated and defined at different moments of time, by different specialists, from different positions, with the main purpose to understand a complex reality [23]. There is an approach based on physical and economic characteristics, such as extensive

use of land, low population density, particular types of landscapes, low density of buildings and prevalence of agricultural production, etc. There is also an approach that focuses more on social issues - socio-professional structure, general cohesion of rural communities and the institutionalization of their functions, etc. [18][26][21]. The literature lack consensus regarding the definition of rural areas, whose meaning also evolves in time.

The competitiveness concept has been as well the subject of intense debates at academic a level, both supporters and opponents existing with regard to its operation opportunity and nature [15]. Depending on the level at which this is expressed, the conceptual framework, the assessment methods and understanding the significance of the competitiveness concept have a series of specific features. Differences of opinion referring to its macroeconomic or microeconomic, sectoral or territorial nature continue to motivate the identification of common elements that could represent a widely accepted conceptual framework [24].

Study the territorial competitiveness has become increasingly important, both in theory and in practice, representing the source of territorial policies and strategies [11]. A series of recent debate on territorial development have shown / proved that competitiveness is actually a combination of economic, social and environmental factors [13][8].

Territorial competitiveness is often treated as synonymous with welfare: competitiveness is sustained growth in living standards of a nation or region [7]. In this context, competitiveness has been seen as a complex concept, which focuses more on the dynamics and long-term prosperity of a region and less restricted competition on the resources. Thus, the competitive regions are places where both the companies and people want to settle and invest [14].

In conclusion, several rurality and competitiveness definitions were formulated throughout the years. On one hand, an unequivocal definition of the rural concept is quite a difficult approach, this being a generic term that covers very different realities, being an interdisciplinary investigation field. On the other hand, the regional/territorial competitiveness is a concept characterized by complexity and multidimensionality. Competitiveness is a main factor supporting economic growth and bridging up the social and economic gaps, in the context of convergence processes. Both concepts have rather a relative than absolute dimension and significantly interact.

MATERIALS AND METHODS

The diversity of definitions and interpretations given to the rurality and competitiveness concepts can lead to a variety of methodological approaches and evaluation tools. These concepts are difficult to quantify. In the first place because existing methods of analysis cannot fully capture the multiple dimensions of the investigated concepts. This paper aims to realize a typology of Romanian counties on rurality and competitiveness. For this purpose, the paper adapted the model used by Balestrieri for the assessment of rural municipalities on the basis of the relation between the existing rurality/urbanization and competitiveness/welfare levels in order to evaluate the similarities and differences. The study uses two sets of indicators that are grouped into three categories: activities, persons and practices. The first category – population – shows that in the absence of a critical human mass there will be no adequate framework for innovation, research, innovating solutions, autonomous development and surmounting dependencies. The second category – activity – refers to the economic progress expressed by different aspects of employment. The third category – practices relates to the fact that the spatial organization system can be an important stimulus for attractiveness and development [2].

For Romania, the selected indicators are differentiated according to the research objective, the existence and accessibility of statistical data and the spatial scale [9][17]. There were certain constraints in the practical building of the database, generated by the availability of indicators: many indicators proposed in the area studies could not be used, as they were not available at county level or

their quality was not satisfactory. Thus, on the basis of available information at county level, both for rurality and for competitiveness, a set of indicators was selected that are subsumed under the categories mentioned above (Table 1).

Table 1. Matrix of rurality and competitiveness - categories and indicators

Category	Indicator	Data source/year
RURALITY		
Activities	Importance of agriculture (share of agricultural enterprises in total enterprises)	NIS, TempoOnline database 2014
	Importance of population working in agriculture (share of population employed in agriculture in total employed population)	NIS, TempoOnline database 2014
Persons	Demographic density (number of inhabitants per km²)	NIS, TempoOnline database 2014
	Demographic importance of the county (share of rural population of the county in total rural population)	NIS, TempoOnline database 2014
Practices/ Structures	Importance of land area used in agriculture (share of agricultural area in total area)	NIS, TempoOnline database 2014
COMPETITIVENESS		
Activities	Importance of agriculture (share of agricultural enterprises in total enterprises)	NIS, TempoOnline database 2014
	Importance of population working in agriculture (share of population employed in agriculture in total employed population)	NIS, TempoOnline database 2014
Persons	Demographic density (number of inhabitants per km²)	NIS, TempoOnline database 2014
	Demographic importance of the county (share of rural population of the county in total rural population)	NIS, TempoOnline database 2014
Practices/ Structures	Importance of land area used in agriculture (share of agricultural area in total area)	NIS, TempoOnline database 2014

First, in order to reduce the large amount of data and to capture the common elements of the set of variables, the factor analysis – analysis of main components - was used (using the software package Statistical Package for the Social Sciences -SPSS).

The purpose of this analysis was to identify new variables, on the basis of data matrix, which should synthetically express the old variables, so that the total amount of information should not be lost but on a controlled basis [12]

Thus, the rurality analysis followed a multidimensional approach, which goes beyond the simple population density, dimension that is frequently used in the classification of the rural areas. In this context, in order to investigate the rurality of counties, a set of five variables was proposed, as presented in Table 1. Through the application of the correlation analysis (Pearson coefficient), the indicator "share of agricultural enterprises in total enterprises" was eliminated. Thus, four indicators were included in the Principal Component Analysis, which were contracted into two significant factors that contain 72.547% of the information of initial indicators (Table 2).

Table 2. Rurality – total variance

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of variance	cumulative %	Total	% of variance	cumulative %
1	1.508	37.703	37.703	1.508	37.703	37.703
2	1.394	34.845	72.547	1.394	34.845	72.547
3	0.764	19.100	91.648			
4	0.334	8.352	100.000			

Extraction Method: Principal Component Analysis.

Similarly, to the manner addressing the rurality, to characterize the competitiveness/welfare twelve indicators were used (Table 1).

Table 3. Competitiveness – total variance

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.942	43.795	43.795	3.942	43.795	43.795
2	1.617	17.970	61.765	1.617	17.970	61.765
3	1.299	14.431	76.196	1.299	14.431	76.196
4	0.748	8.310	84.506			
5	0.500	5.561	90.067			
6	0.347	3.856	93.923			
7	0.231	2.571	96.495			
8	0.188	2.092	98.587			
9	0.127	1.413	100.000			

Extraction Method: Principal Component Analysis

Using the correlation analysis, out of the twelve indicators initially taken into consideration, only nine were retained, three

were eliminated (labour force replacement rate, natural increase of the population and the migration growth rate). By the application of the Principal Component Analysis, described above, four main factors were extracted that describe 76.197% of the initial information (Table 3).

econd, the cluster analysis, statistical method by which the elements of a set are grouped into subsets, starting from one or several characteristics of these elements were applied [12]. We tried to classify the forty-one counties starting from a series of known attributes, having in view that the elements of each class are as similar as possible.

Thus, both for rurality and for competitiveness, the forty-one counties were grouped through the cluster analysis of hierarchical type, the farthest neighbour method, calculation modality between two objects (classes) – Euclidean distance.

For comparability, we stopped at a classification of the 41 counties into five classes, both for the rurality and competitiveness, which are introduced in the next section.

RESULTS AND DISCUSSIONS

The results acquired on the basis of the above-presented methodology indicate that rurality at NUTS3 level has significant variations (Table 4).

Table 4. Rurality classes

	Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**	**Cluster 5**
Component counties	Brăila, Buzău, Mehedinți, Neamț, Satu-Mare, Vrancea, Botoșani, Călărași, Dolj, Giurgiu, Ialomița, Olt Teleorman, Vaslui	Alba, Arad, Bistrița-Năsăud, Caraș-Severin, Covasna, Gorj, Harghita, Hunedoara, Maramureș, Sălaj, Tulcea, Vâlcea	Dâmbovița, Galați, Iași	Argeș, Bacău, Bihor, Brașov, Cluj, Constanța, Mureș, Sibiu, Suceava, Timiș	Ilfov, Prahova
Rurality	Extreme	High	Moderate	Low	Rather urban
No. of counties	14	12	3	10	2
Share (%)	34.15%	29.27%	7.32%	24.38%	4.88%
Characteristics	- significant agricultural potential supported by the significant share of agricultural land and of the population employed in agriculture; - low population density.	- medium agricultural potential expressed by medium values of the share of agricultural land and population employed in agriculture; - low population density.	- agricultural potential characterized by medium share of agricultural land and low share of population employed in agriculture; - medium population density	- medium to low agricultural potential characterized by medium share of agricultural land and low share of population employed in agriculture; - medium population density.	- agricultural potential supported by medium values of natural agricultural resources and low values of population employed in agriculture; - very high population density.

In conformity with the hypothesis from which we started, the initial expectations confirmed that going from the counties with extreme rurality to the counties with urban influence, the importance of labour force employed in agriculture and of the natural resources expressed by the share of agricultural land decreases, while the population density increases.

Thus, the counties with extreme rurality have the greatest share, summing up 34.15% of total counties. These counties are mainly located in the southern and eastern part of Romania (Figure 1).

The counties with high rurality (29.27%) cover significant areas in the south-eastern part, in the canter and northern part of Romania. The centre of the country is mainly occupied by counties with low rurality. Two counties, Ilfov and Prahova, which are located in the proximity of the capital city Bucharest, were classified as rather urban.

Fig. 1. Territorial distribution of counties by rurality level (Source: author's processing NIS data)

The main conclusion that can be drawn from the analysis is that most counties from Romania are characterized by different rurality levels, with very few counties that can be defined as urban (two counties).

The competitiveness analysis led to the identification of five clusters /classes covering different competitiveness / welfare levels, as presented in Table 5.

Going from the counties with a very low competitiveness level to the counties with high competitiveness, we can notice an increase of the average monthly salary, of the share of individual entrepreneurs, of the higher education graduates and of the local infrastructure, while the trends of the population and labour force dynamics are discontinuous.

Figure 2 presents the territorial distribution of counties according to the competitiveness level. We can notice the high share of counties with low and very low competitiveness, accounting for 70.73%, which are located all over Romania's territory.

The Iași, Argeș and Prahova counties belong to the moderate competitiveness class. The counties with rather high competitiveness level have a low share (19.52%) and are mainly located in the central and eastern part of the country. There is only one county, i.e. Ilfov, classified as having high competitiveness / welfare.

The comparison of obtained results from the analysis of rurality and competitiveness typologies revealed the following aspects: the counties with extreme and high rurality belong to the very low and low competitiveness classes (24 counties); the intermediary rurality is accompanied by a relatively high competitiveness (7 counties); there is only one county classified as having low rurality and moderate competitiveness and an urban county with very high competitiveness.

There are also combinations in disagreement with the initial hypothesis. In this situation, unexpected combinations emerge that reveal either a performance above expectations, like the case of the county Arad, which is included in the high rurality class and the medium competitiveness class, or a performance that is below expectations: the county Prahova, included in the urban class belongs to the medium competitiveness class; three counties, i.e. Argeș, Bacău and Suceava belong to the

intermediary rurality class, the first county being found in the moderate competitiveness class, while the other two counties are found in the very low competitiveness class.

Table 5. Competitiveness classes

	Cluster 1	**Cluster2**	**Cluster 3**	**Cluster 4**	**Cluster 5**
Component counties	Călăraşi, Giurgiu, Ialomiţa, Teleorman, Tulcea, Brăila, Caraş-Severin, Covasna	Botoşani, Buzău, Dâmboviţa, Dolj, Galaţi, Gorj, Harghita, Neamţ, Hunedoara, Sălaj, Maramureş, Olt, Mehedinţi, Satu-Mare, Suceava, Vâlcea, Vaslui, Vrancea, Alba, Bacău, Bistriţa,	Argeş, Iaşi, Prahova	Bihor, Cluj, Mureş, Sibiu, Arad, Braşov, Timiş, Constanţa	Ilfov
Competitiveness	very low	low	Moderate	rather high	high
No. of counties	8	21	3	8	1
Share (%)	19.52%	51.21%	7.32%	19.52%	2.43%
Characteristics	- high dependency ratio and medium employment rate; - very low number of higher education graduates and of employees in research & development; - low to medium share of individual entrepreneurs; - the modernized rural infrastructure has medium to low value; - monthly salary gain has medium values; - the agricultural sector is characterized by a significant share of large-sized farms.	- high dependency ratio and employment rate medium to high; - medium share of modernized roads; - low share of higher education graduates and of employees in research & development; - low to medium share of private entrepreneurs; - medium-sized farms; - monthly salary gain is low to medium.	- medium dependency ratio and employment rate; - medium share of higher education graduates and of employees in research & development; - low share of modernized roads; - small-sized farms; - monthly salary has medium values; - medium to high share of private entrepreneurs	- medium dependency ratio and high employment rate; - medium share of modernized roads; - medium to high share of higher education graduates and of employees in research & development; - high monthly salary.	- dependency ratio above the average and medium employment rate; - high share of modernized roads; - high share of employees in research & development but low share of higher education graduates; - high values of monthly salary; -high share of private entrepreneurs

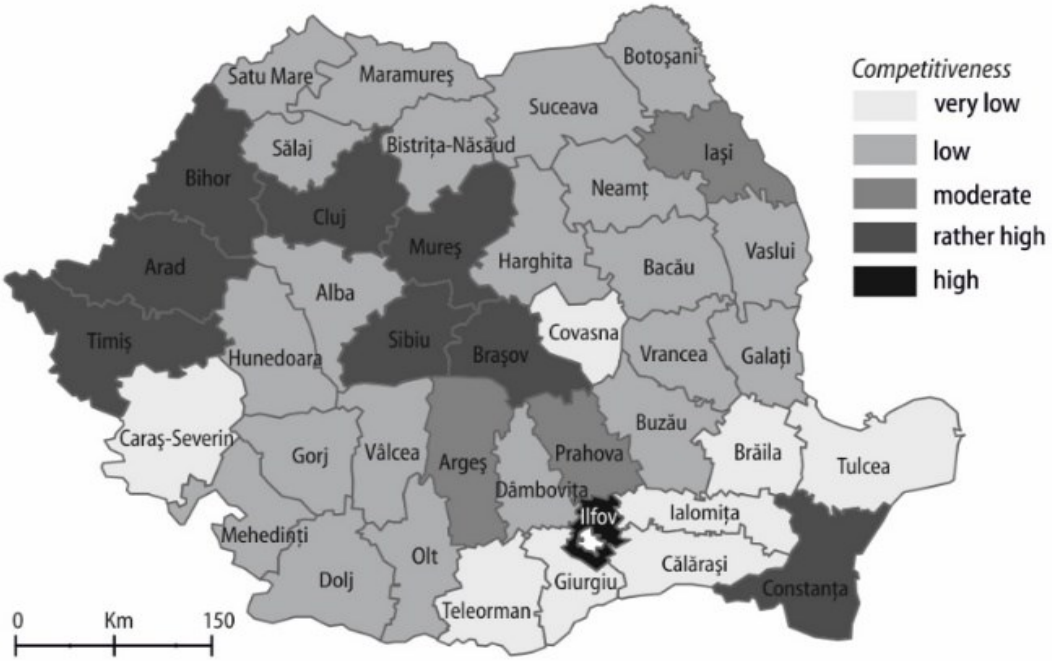

Fig. 2. Territorial distribution of counties by competitiveness level (Source: author's processing NIS data)

The counties Dâmbovița and Galați belong to the lower rurality class and are found in the moderate competitiveness class.

CONCLUSIONS

The EU interest in the rural areas has grown in time. This interest is partly explained by the fact that the rural areas are generally characterized by a lower economic and social performance as compared to the urban areas. The purpose of this paper was to classify Romania's territory (at county level – NUTS3) investigating the existing relationships between rurality and competitiveness so as to enhance knowledge of this connection.

The main conclusion that was drawn reveals that the results confirm the initial hypothesis: the higher the rurality level the lower the territorial competitiveness.

Thus, by comparing the results of the two analyses, we can find the following situation: i) all the counties that are found in the extreme rural class belong to the low competitiveness class (71.43%) and very low competitiveness class (28.57%); ii) except for the county Arad, all the counties classified as having a high rurality level were classified into the low competitiveness class (66.67%) and very low competitiveness class (25%); iii) most counties that belong to the low rurality class belong to the relatively high competitiveness cluster (70%); iv) the counties belonging to the medium rurality class are found in the low competitiveness class; an exception is the Iași county, which is found in the medium competitiveness class; v) as regards the two relatively urban counties, the Ilfov county is found in the high competitiveness class, while the county Prahova is in the medium competitiveness class.

The methodology used has both strengths and weaknesses. The advantages of this approach are given by the transparency of the framework matrix of indicators that makes it possible to analyse rurality and competitiveness on the basis of its determinants. However, the transposition of the two concepts on the map can lead to false accuracy because each county presents an important heterogeneity at commune level. One of the main contributions of this paper is that the identification of the rurality – competitiveness relationship at county level provides the decision-makers and other rural players with important benchmarks for the

design of adequate rural development policies.

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STUDY ON THE MEAT SECTOR IN THE EUROPEAN UNION

Mariana SANDU[1], Ştefan MANTEA[2]

[1]Romanian Academy, Center for Studies and Researchers of Agroforestry Biodiversity, 13, Calea 13 Septembrie st., 5th District, Bucharest, Postal code 050711, Romania, Tel. / Fax. + 4.021.318.81.06, E-mail: marianasandu47@gmail.com
[2]Romanian Group for Investments and Consulting, 17, Iordache Golescu Street, District 1, Bucharest, Romania, Tel. +4.021.222.68.37, E-mail: stmantea@gmail.com

Corresponding author: marianasandu47@gmail.com

Abstract

Agricultural and food sectors worldwide are affected by globalization, the changes in the rules governing international trade and national and international policies regarding agriculture and competition. These sectors face on one side with a glut of food markets, and on the other hand, with an increase in consumer requirements regarding the quality of the final product. Consumer requirements may include food safety or some social aspects (protecting the environment, promoting biodiversity, improvement of animal welfare, fair trade, etc.). This study analyzes the meat market in the European Union, namely the development and availability of meat average consumption per capita in the period in which these indicators have declined. In the 27 European Union member states (EU-27), the year 2013 marked the lowest average consumption of meat per capita in the last decade, 64.7 kg, respectively, 10.7 kg / capita beef, 30.8 kg / capita pork, 21.3 kg / capita poultry meat and 1.9 kg / capita sheep and goat meat. The level of meat consumption was influenced by the decrease in meat production and the high costs of feed in the first half of the year which rose to a record high price of meat, coupled with decreases in revenue due to the economic crisis. Due to economic recovery and slightly downwards of prices, total meat consumption per capita in the EU has rebounded slightly, rising by 1.95 kg per capita by 2015.

Key words**:** *agricultural sector, requirements, availability, consumption, prices*

INTRODUCTION

In society, the role of livestock production has changed in recent years and this change continues to intensify.
Globally, livestock production plays an important role in ensuring food security, in particular through the provision of food with a rich protein content. In addition, the demand for animal products is increasing, especially in developing countries.
A major social aspect is associated with competitiveness meat supply chain. Ensuring a minimum income for meat producers is vital to support rural communities given that most producers are from rural areas. [10]
On the other hand the introduction of modern technologies in animal farming have raised questions about animal production systems, including animal welfare.
With the Treaty of Amsterdam (1997), the EU recognizes that animals are sentient beings and provides that, in agriculture, animal welfare must be taken into account and the EU consumers supports the improvement of raising conditions of livestock. The objective was to improve the overall level of animal welfare by introducing welfare standards. [1]
On the other hand, another major problem for agriculture are the new challenges, global impact on climate change, in terms of carbon footprint, in particular for the production of beef. [13]
More specifically, the development of livestock sector should ensure environmental sustainability and the animals used to adapt easily to these challenges. [6]
In the livestock sector, awareness of environmental problems should prompt a series of best practices to assess the impact of agricultural systems on the environment in parallel with their economic performance. [14] More specifically, methods of evaluating environmental footprint on the ground of the products of animal origin should be developed and applied to all types of production. [7]

Reducing emissions of greenhouse gases, especially methane from livestock production can be achieved by improving existing agricultural development of new innovative systems that minimize waste and by reducing the production of methane during digestion. [8]

Intensification of farming systems induced an increase in emissions of nitrogen in soil-crop-animal interaction. For the future, the strategy should aim at closing the nutrient cycle at the farm level, which can be achieved only if it is envisaged an integrated approach to the whole agricultural system. [9]

Within agricultural systems, the main objective is to maintain (or even increase) competitiveness of animal production systems in order to ensure sufficient income for farmers and maintaining a degree of autonomy of the farm. Worldwide, opening a market for animal products has changed considerably the goals in European livestock production system and producers have had to adapt to this situation. [11]

For consumers, a major requirement is the need for products of animal origin (eg, fresh meat or meat already prepared) to provide essential elements for life but do not exceed human needs, thus avoiding health problems that have emerged in modern society (for example, obesity, cardiovascular risk, cancer). The controversial association between meat consumption and incidence of certain cancers needs clarification, although recent studies suggest that this is of utmost importance for processed red meat compared to the white meat. [14]

The European meat market is very fragmented due to the presence of national or European labeling index related to quality, origin or provenance, which coexist. This wealth of schemes and labels creates an extremely complex situation and a risk of overloading consumers with information. [5]

In addition, the price level has always been one of the reasons that led to the purchase of food in Europe and will continue to have greater importance than the origin, brand, quality, or a combination thereof. [2]

MATERIALS AND METHODS

This study aims to analyze the meat sector in the European Union, namely the development and availability of meat average consumption per capita in the period in which these indicators have declined.

The methodology of this study is based on qualitative and quantitative analysis of the following indicators: livestock, domestic production gross, net production, imports, exports, domestic availability, consumption and the degree of self-sufficiency.

Data collected by the European Commission, Eurostat database and DG-AGRI, for the period 2009 – 2013, were statistically processed and interpreted.

For the introduction to the paper were consulted a number of scientific papers which have provided important information regarding the animal production.

RESULTS AND DISCUSSIONS

In the case of food products of animal origin, the production achieved at EU level is correlated with the existing livestock. The production of meat is closely linked to the dynamics of the animal production sector, public policies in agriculture and the prices of crops for animal production.

Meat production has a diverse structure among EU Member States, through the size of farms and livestock and productivity of the sector.

In recent years, the context in which meat is produced has changed considerably due to issues relating to animal welfare, environmental protection and consumer safety.

At the level of EU-27, 2012-2013, the total number of cattle has increased slightly, respectively by 0.6% in herds of dairy cows and 1.1% for the meat animals.

If we analyze the data from Table. 1. observe that domestic production of beef and veal increased by 3.9% in 2013 compared to 2012, growth that influenced the domestic availability of this product.

On the other hand, imports of beef rose by 0.3% in 2013 compared to 2012, while

exports fell by 32% due to a small amount of beef to the EU market,due to high prices and not least the loss of two major export destinations (Turkey and Russia).
The average per capita consumption of beef has recorded a downward trend since 2011. In total, the European Union is deficient in beef.
At the level of EU-27 total herds of pigs fell by 1.3% in 2013 compared to 2012, the main EU producers recording negative developments of this indicator: Germany -1.6%, Spain -2.9%, Denmark -1.2%, France -0.6% -6.6% and Italy.
In correlation with the total decrease in the number of pigs, also decreased the total amount of pork produced in the EU-27 (-0.1%) in 2013 compared to 2012 (table no. 2).
As regards the imports of pork, they increased in 2013 over the previous year. Also the pigmeat consumption is affected by low internal availability and higher prices for this product, for the third year in a row, per capita consumption declines by 0.3%. However the EU is self-sufficient in pork.

Table 1. Balance of supply for beef and veal in the EU-27

EU-27	*Tons **					*Variation (%)*			
	2009	*2010*	*2011*	*2012*	*2013*	*10/09*	*11/10*	*12/11*	*13/12*
Gross internal production	7,779	7,813	7,706	7,387	7,676	0.4	-0.1	-0.4	3.9
Net production	7,717	7,917	7,846	7,531	7,555	2.6	-0.1	-0.4	0.3
Imports - live animals	0.1	0.2	0.1	0.1	0.1				
Exports - live animals	104	116	156	161	121	11.5	34.5	32.1	-24.8
Imports**	420	374	318	302	303	-11	-15	-0.5	0.3
Exports**	117	277	356	242	164	136.7	28.5	-32	-32
Internal Availability (total)	8,020	8,013	7,808	7,592	7,694	-0.1	-2.6	-2.8	1.0
Consumption (kg / capita/ year)	11.2	11.3	11.2	10.9	10.7	1.0	-0.1	-0.3	-0.2
The degree of self-sufficiency (%)	96	99	100	99	98.2				

Source: European Commission (Eurostat and DG Agri.); * Weight of carcase** Total trade, except live animals.

Table. 2: Balance of supply for pork in the EU-27

EU-27	*Tons **					*Variation (%)*			
	2009	*2010*	*2011*	*2012*	*2013*	*10/09*	*11/10*	*12/11*	*13/12*
Gross internal production	21,567	22,295	22,617	22,171	22,152	3.4	1.4	-0.2	-0.1
Net production	21,449	22,219	22,551	22,135	22,127	3.6	1.5	-1.9	-0.1
Imports - live animals	0.15	0.12	0.02	0.02	0.01				
Exports - live animals	118.1	75.5	66.2	36.6	25	-36.1	-12.3	-12.4	-31.7
Imports**	34	22	15	16	17	-34.3	-31.9	6.6	6.3
Exports**	1,540	1,839	2,175	2,182	2,164	19.4	18.2	0.3	0.2
Internal Availability (total)	19,943	20,402	20,392	19,969	19,980	2.3	0.1	-2.1	0.1
Consumption (kg / capita/ year)	31.2	31.8	31.7	30.9	30.8	1.9	-0.3	-0.3	-0.3
The degree of self-sufficiency (%)	108.1	109.3	110.9	111.0	110.7				

Source: European Commission (Eurostat and DG AGRI.); * Weight of carcase** Total trade, except live animals.

In the European Union total herds of sheep and goats decreased by 0.8%, the increasing total herds in the UK (+ 4.4%) and Romania (+ 3.5%) was not sufficient to offset the decline in Spain (-4%), France (-2.2%) and Greece (2%). However the total production of sheep and goat meat in the EU-27 increased by 6.6% in 2013 compared to 2012 (table no. 3).
On the basis of increasing imports by 9.5% in 2013 compared to 2012, was an increase of 5.6% in the availability of domestic

consuption in meat of sheep and goats.
Average consumption per capita fell from 2012, EU-27 still remaining weak on these products.
Production of poultry meat increased by 2.5% in 2013 compared to 2012, this growth should partially offset the decline in production from other sort of meat (table no. 4). The main producing countries that generated this increase are: the United Kingdom (+ 3.6%), Germany (+ 0.4%) and to a lesser extent France.
In the period 2012-2013, both imports and exports of poultry meat increased by 4.9% and 0.2% respectively.
Regarding the consumption of poultry meat per capita, it remains in an upward trend since 2010. The internal availability of consumption rose by 2.9% in 2013 compared to 2012, EU27 maintaining self-sufficient in this product.

Table. 3: Evolution supply balance for sheep and goats in the EU-27

EU-27	*Tons **					*Variation (%)*			
	2009	*2010*	*2011*	*2012*	*2013*	*10/09*	*11/10*	*12/11*	*13/12*
Gross internal production	987	915	933	894	953	-0.7	1.9	-4.2	6.6
Net production	983	904	912	868	913	-8.1	0.9	-4.2	5.2
Imports - live animals	-	-	-	-	-				
Exports - live animals	9	11	22	27	39	22.2	100	22.7	44.4
Imports**	271	239	222	189	207	-11,2	-7,1	-4,9	9,5
Exports**	8	13	16	25	30	62.5	23.1	56.2	20
Internal Availability (total)	1,247	1,130	1,118	1,032	1,090	-9.4	-1.1	-7.3	5.6
Consumption (kg / capita/ year)	2.2	2.0	2.0	1.8	1.9	-0.9	0	-10	-5.5
The degree of self-sufficiency (%)	79.1	81.0	83.5	86.7	83.7				

Source: European Commission (Eurostat and DG AGRI.); * Weight of carcase** Total trade, except live animals.

Table. 4: Evolution supply balance for poultry meat in the EU-27

EU-27	*Tons **					*Variation (%)*			
	2009	*2010*	*2011*	*2012*	*2013*	*10/09*	*11/10*	*12/11*	*13/12*
Gross internal production	11,926	12,245	12,430	12,398	12,706	2.6	1.5	-0.3	2.5
Net production	11,917	12,237	12,423	12,391	12,697	2.7	1.5	-0.3	2.5
Imports - live animals	0.3	0.7	1.0	1.3	1.0				
Exports - live animals	8.8	8.3	7.8	8.3	10	-5.7	-6.1	6.4	20.5
Imports**	848	782	819	818	858	-7.8	4.7	-0.1	4.9
Exports**	928	1,149	1,288	1,324	1,327	23.8	12.1	2.8	0.2
Internal Availability (total)	11,837	11,870	11,954	11,885	12,228	0.3	0.7	-0.6	2.9
Consumption (kg / capita/ year)	20.9	20.7	20.8	21.1	21.3	-0.1	0.5	1.4	0.9
The degree of self-sufficiency (%)	100.8	103.2	104.0	104.3	103.8				

Source: European Commission (Eurostat and DG AGRI.); * Weight of carcase** Total trade, except live animals.

In the 27 European Union member states (EU-27), 2013 meant the lowest average consumption of meat per capita in the last decade, 64.7 kg, respectively, 10.7 kg / capita beef, 30.8 kg / capita pork, 21.3 kg / capita poultry meat and 1.9 kg / capita sheep and goat meat. The level of meat consumption was influenced by the decrease in meat production and the high costs of feed in the first half of the year that rose the price of meat to a high record, coupled with decreases in revenue due to the economic crisis.
The purchasing power of consumers is a determinant factor for the level of meat consumption per capita. This is especially true in the beef sector where prices are generally

higher than those for other forms of animal protein. The low competitiveness of beef is mainly due to the length of the production cycle for meat in bovine and lower feed efficiency compared to pigs or poultry.

Meat consumption depends not only on economic considerations:

-Religion and faith have a significant impact on the food choices of the citizens (consumption of pork is prohibited in Islam, animals are sacred in Hinduism). In the EU, these considerations are not as important as in countries such as India, Indonesia and Saudi Arabia.[12]

-Cultural and educational reasons influence the changes in lifestyle by internationalization of the national customs for food.

-Consumers are also more or less susceptible to outbreaks of animal diseases which can affect their health. For example, in Germany, outbreaks of bovine spongiform encephalopathy in 1996 and 2001 led to a significant decline in the consumption of beef.

-Moreover, some ethical considerations (eg, animal welfare, animal slaughter) and environmental (eg, water quality and biodiversity) are taken increasingly into account by European consumers.[4]

Due to economic recovery and slightly downwards of prices, the total meat consumption per capita in the EU has rebounded, increasing by 1.95 kg per capita in 2015.

According to forecasts of economic analysis department of the Agricultural Directorate of the European Commission (DG AGRI), the consumption of beef and sheep will drop in the next 10 years, according to the trend observed in the last decade. Sheep meat is consumed in the lowest amount in the EU, representing only 2.7% of total meat consumption. Forecasts also show reduced production of beef, up 7% from the average in 2010-2012 period, reaching a total volume of 7.6 million tonnes in 2023. [3]

Pork will remain preferred for Europeans for the next 10 years, but pork production will grow by only 2.8% over the next 10 years, up to a total annual average of 23.4 million tonnes in 2023. Production will suffer some environmental restrictions in some of the countries with the highest production of pork, such as the Netherlands and France.

The most dynamic market in the meat sector will be the poultry because it is considered cheaper and healthier than others. Consumption of poultry meat will increase by 1.5% each year, while poultry meat production could reach 13.6 million tonnes annually, increasing by 0.8% every year until 2023, as the forecasts show.

CONCLUSIONS

At the World level, agricultural sectors are affected by globalization, the rules governing the international trade and the national and international policies regarding agriculture and competition.

Important issues concerning the animals production refers to the competitiveness of supply chain for meat and to ensure a minimum income for producers subject to the standards of animal welfare.

Meat production has a diverse structure among EU Member States, through the size of farms and livestock and productivity of the sector.

The production of meat is closely linked to the dynamics of the livestock sector, public policies in agriculture and the prices of crops for animal production.

Even if the domestic availability recorded higher values in 2013 compared to 2012, per total the EU remains weak for the beef, sheep and goats meat.

The purchasing power of consumers is a determinant factor of the level of meat consumption per capita.

At the level of EU-27 in 2013 was recorded an average consumption of meat per capita of 64.7 kg, the lowest level in a decade.

The level of meat consumption was influenced by the decrease in meat production and the high costs of feed related to revenue declines caused by the economic crisis.

Amid economic recovery and slightly downwords of prices, the total meat consumption per capita in the EU has rebounded, increasing by 1.95 kg per capita by 2015.

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PUBLIC-PRIVATE PARTNERSHIPS – FINANCING INSTRUMENT OF THE MECHANISM OF ECONOMIC GROWTH AND DEVELOPMENT OF THE AGRICULTURAL SECTOR

Aliona ȘARGO, Elena TIMOFTI

State Agrarian University of Moldova, 44 Mircesti St., MD - 2049, Chisinau, Republic of Moldova, phone: +373 767 15 222, Fax: (+373 22) 31-22-76, E-mail:e.timofti@uasm.md
Phone: (+373)069232743; E-mail: alionasargo@yahoo.com

Corresponding author: alionasargo@yahoo.com

Abstract

In economic science, economic growth represented a prime topic because by solving the problems in this area it was hoped to achieve the strengthening of the state and increase of its wealth and welfare. All this led to the establishment in the economic field, of an important segment of research, namely, the theory of economic growth that is required to develop rules for optimal use of limited resources, as well as means of achieving nation's welfare. As in other sectors of the national economy, a series of indicators are present in agriculture that directs the economic growth of the sector, but that can not be monitored in order to ensure a stable economic growth. The state can control such factors as the volume of investments in agriculture, subsidies, customs duties on agricultural products and bank interest, while parameters of external agricultural markets and climatic natural conditions can neither be controlled nor directed by the authorities. But in spite of this, there are a number of important factors by which the state can contribute to the economic growth of the agricultural sector and the country as a whole.

Key words:*, agricultural sector, economic growth, economic mechanism, investment, productivity*

INTRODUCTION

Economic development is a concept that characterizes all direct and indirect economic effects, which propagates to the level of a national economy as a result of quantitative, structural and qualitative changes taking place in the economic life of a country in a given period of time under the conjugated influence of a system of factors. Economic development is associated with industrialization of the country and modernization of the agricultural sector.

Between the economic growth and economic development there are some differences that distinguish them and justify their use in current scientific theoretical system.

Economic growth is a quantitative and positive change, meaning an increase in production, at any reference level, based solely on quantitative change of direct or primary production factors. Economic development, in turn, is the qualitative change of direct factors, with or without production increase, transformation being performed through economic progress.

Economic growth is a quantitative process and economic development is predominantly qualitative. The processes of economic growth and development occur simultaneously, so they are studied at the same time. Both growth and economic development are aimed at increasing the living standards of population.

The role of agriculture in the national economic development and economic growth of the state is fundamentally through the participation of agriculture in the GDP growth, through agricultural production itself, through its participation in the market exchanges and in the mechanism of economic functioning of the state. The economic mechanism is a set of processes, techniques, and tools for regulating social and economic activity. The economic mechanism with all methods and economic levers act on farmers in order to motivate the production and investment activity. The main elements of the economic mechanism are: investment, subsidies, taxes, loans, insurance, export, etc. As an economic category, economic mechanism is: the process of organizing

social production through relationships, forms and methods of influence on the production and management of the organizational structure, occurring from the market relations [8].

The purpose of this research is to argue for inclusion in the mechanism of funding and stimulating economic growth of the agricultural sector the use of financial flows from public-private partnerships (PPP) and identification of their possible benefits.

MATERIALS AND METHODS

The data of the Ministry of Agriculture, Agency for Payments and Intervention in Agriculture, Ministry of Finance and other financial and economic structures in the country and abroad have been used as information sources in the performed analysis. The basic methods of research are analysis and synthesis, comparison, graphical method.

RESULTS AND DISCUSSIONS

The close relationship between the financial development and the economic growth is well grounded in the literature and in practice. In recent years, debates have expanded to include the notion of financial "exclusion" which is a barrier to the economic development and points to the need to develop inclusive financial systems. Recent empirical evidence that has used the databases on households shows that the access to basic financial services such as savings, payments and credits can be a significant contribution to improve poor people's lives. The access to funds is often the main obstacle to the growth of economic agricultural entities, and individual farms, small and medium-sized enterprises in particular.[3]

Agricultural enterprises and farms difficulties in conducting and one of the major obstacles that slow development of the agricultural sector continues to be the lack of access to finance.

The share of investment in agriculture requires limited additional pressure on long-term competitiveness of the agricultural sector. Although the share of agricultural investments in Moldova total investments increased lately, this capital increase is not enough to stem the depreciation of agricultural assets. The share of foreign capital in the total investment remains constant, indicating that only national resources attract investment (Figure 1).

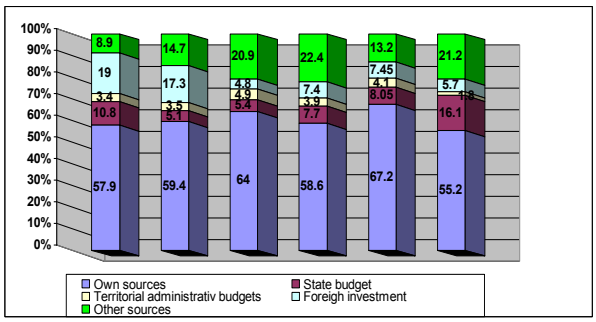

Fig. 1. The sources of fixed capital investment, source of funding for the period 2009-2014,%
Source: authors based on data from annual reports of NBM

The data presented in Figure 1 demonstrates that the means of economic agents and the population is at 57.9% - 67.2% or increased by 9.3% and in 2009-2013, but decreased by 12% respectively compared to 2013 by 2.7% compared to 2009.

There has also been an increase of 0.7% from the budgets of the territorial administrative sources and other sources with 4.3 p.p account in 2009-2013, but which shrinks by 2.3% to 2013.

In the analyzed period there has been a steady increase other sources of investment financing. These changes are the result of political situation is precarious Moldova lately. Situation has reduced the volume of investments for the agricultural sector of Moldova.

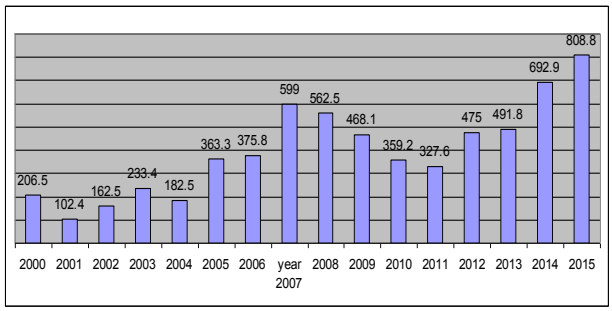

Fig. 2. Costs for the agricultural sector of the Republic of Moldova during 2000-2015, Million lei in current prices
Source: [9, 11]

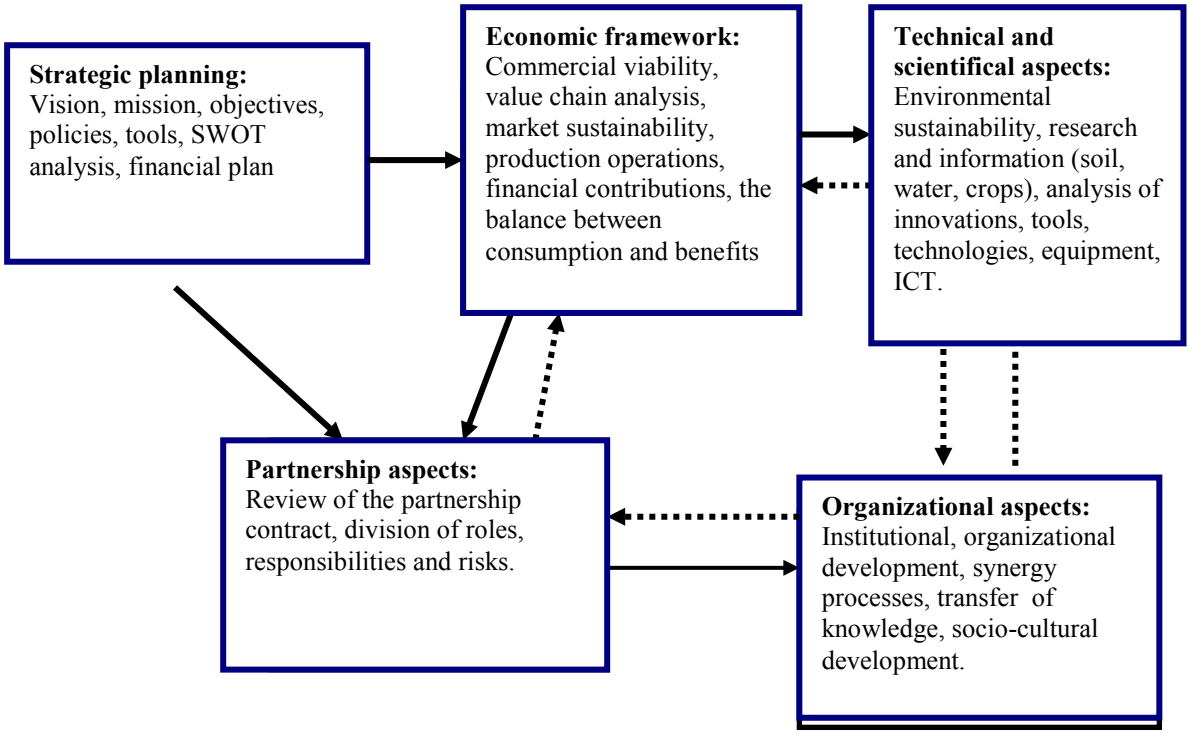

Fig. 3. Relationship strategy within a PPP
Source: [4]

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During the period 2000 - 2015 costs of agriculture in Moldova amounted to 6,411.3 million lei in real values, of which 2,652.8 million lei (2010-2015) constituted state subsidies. Costs related to agriculture increased by 602.3 million lei in 2015 compared to the same period of 2000.

In an agricultural financial system we can find the same elements as in the general financial system that comprises: institutions, instruments, markets and regulations. Agricultural financial mechanism can be treated as a sub-mechanism of the financial system of the state economy as a whole. Of course, it has its own characteristics, which are individual for agricultural production, agrarian structure, ownership rights, etc.

Agricultural financial mechanism includes financial intermediaries such as: the state budget, international financial institutions, microfinance entities, banks which grant loans but also participate in the investment process as partners for co-financing and are also responsible for the distribution of foreign investments and state agencies that direct subsidies to agriculture.

From the above mentioned, we have structured the financing and stimulating mechanism of the agricultural sector from the Republic of Moldova (Figure 4) based on:

-existing funding sources to date: (state budget, international financial institutions, microfinance organizations, commercial banks, leasing companies), where we propose to include public-private partnerships;

-investments for the modernization of the agricultural sector (quality inputs, technical and modern technologies, information technologies (ICT), E-Agriculture, staff qualifications)[9, 10]

Parallel to the existing mechanism, we propose the use of financial flows from Public Private Partnerships. Parallel to the guarantee given by the Credit Guarantee State Fund, other alternative forms of lending and guarantees must be developed which are now particularly important to increase the volume of loans in the agricultural sector. Thus, we consider it necessary to introduce special credit lines for agricultural enterprises, which will be aimed at developing alternative forms of credit and other guarantees, for example through Public Private Partnerships.

There are various definitions of public-private partnerships (PPP) in literature dealing with this subject, because a single definition

of the public-private partnership, i.e. the cooperation between the public and private sector in public services provision, is not easy to formulate for many reasons.[6]

Public-private partnership (PPP) is a viable way of interaction Institutional between the state and the business sector, the introducing private management

public services, including through links long-term contract between an operator Private and public authority. partnership ensure public-private fundamentally, achieving all or part of the service designed public, calling on the know-how and private-sector resources.[1]

Through these instruments the indirect supply of financial resources for investments are being aimed, especially encouraging the participation of private investors among the public ones.

The objective of the usage of the innovative financing instruments is to attract private investments in domains considered risky by them. [12]

PPP goal is to use complementary assets with a maximum advantage. Partners need to agree objectives, roles, responsibilities and incentives. They will also have to work closely to achieve a greater productivity.

Why do PPP become important? Public investment in strengthening the agriculture is declining in many countries in the world and private investments continues to grow.

This trend opens up new partnerships opportunities that bring together property of investors and farmers.

The small number of financing instruments available to financing institutions of the state fails do not meet the extensive and diverse requirements of the agricultural sector, thus taking into account other types of instruments through public-private partnerships (PPP), which should be regarded as an innovative tool in investment financing. PPP is a way that will allow utilization of financial resources of various domestic or foreign companies as investments in the agricultural sector (Figure 3).

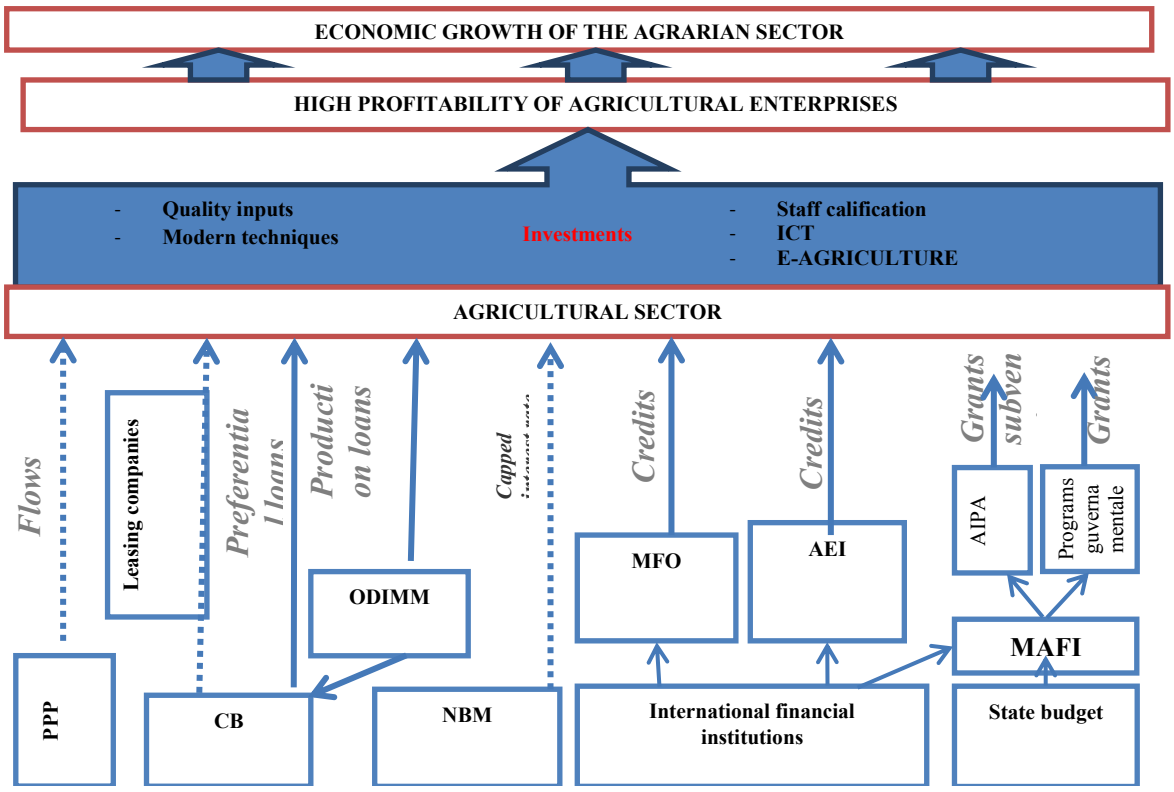

Fig. 4. The funding and stimulation mechanism of economic growth of the agricultural sector in the Republic of Moldova

Source: Developed by authors.

Public-private partnerships are essential to the

development of agriculture to meet the challenges of global food security.
They broaden access to technology and markets. By combining strengths, partners can achieve any progress better than on their own. This tool will allow the entry of private foreign capital, but also of Moldovan migrants in the Moldovan agricultural sector.
According to a market survey, 40% of Moldovan migrants are ready to invest in long term in their community through private sector partnership.
Among the priority investment sectors, agriculture occupies a prominent place.
Possible opportunities of PPP:
-Minimized risk – risk sharing occurs between members of PPP;
-Increases the volume of cash flow;
-Allows to form customers chains with high purchase potential;
-Increased Competitiveness through creation of brands;
-Allows creating links with value chain - suppliers, vendors and distributors;
-Lower rates for cost of capital when financing or guarantees are needed [4].
Another proposal is linked to interest rate ceilings for preferential agricultural loans by the National Bank to prevent the establishment of excessively high rates for credits provided to the agricultural sector.
It is also important to develop a rural financial system by expanding lending offices in rural areas, which is essential for sustaining growth and development of the agricultural sector. These offices should employ specialist consultants to facilitate the writing of business plans and forecasts required for bank loans.

CONCLUSIONS

Economic growth of the agricultural sector is not possible without the development of institutional, financial, technological and social mechanisms that would insure an increase. These mechanisms will allow sufficient and efficient funding of agricultural enterprises, increasing their competitiveness and profitability, diversifying production and increasing production volume sold domestically and increasing exports.
Modernization and economic improvement of the agricultural sector in Moldova by attracting additional investment is one of the main directions of increasing efficiency, productivity and creating jobs in rural areas. Economy sector, considered as separate system, is influenced by a multitude of restrictions, conditions of indigenous and political (external) origin. Currently, very important in the process of making efficient the agricultural sector is the knowledge factors, changes and their rational use in the growth processes of the final product of agrarian sector.
PPP are necessary for agricultural development to meet the challenges of global food security. They serve to broaden access to advanced technologies and new markets. Partners can achieve any progress better than on their own by combining strengths. PPP will also allow entry of private foreign capital, but also of Moldovan migrants in the Moldovan agricultural sector.

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INCREASING THE METHANE OUTPUT BY ADDING THE ACTIVATED

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CARBON FOR THE PRODUCTION OF BIOGAS

Marat SATAYEV, Zhanar KAIPOVA, Aigul JANMULDAEVA

M. Auezov South-Kazakhstan State University, 5, Tauke Khan Avenue, 160012 Kazakhstan, Shymkent, Mobile phone: +77014619848, E-mails: zhanar.kaipova@mail.ru

Corresponding author: zhanar.kaipova@mail.ru

Abstract

Research has shown that activated carbon can increase the production of biogas and methane from anaerobic digestion, thereby reducing the startup time. Activated carbon has raised the possibility of microbial resistance to the organic load. A more developed structure of mesoporous the activated carbon was favorable for the colonization of specific bacteria, which leads to increased syntrophic associations between bacteria and methane producers. Thus, the anaerobic reactor complemented with activated carbon would be economically efficient for the production of biogas.

Key words**:** *biogas, substrate, anaerobic bioreactor, membrane concentration, mixture quality*

INTRODUCTION

Efficient use of agricultural wastes - large and important problem of our time. [4] It is related, on the one hand, with the ability to use the vast energy potential of biomass for the production of liquid and gaseous fuel (biogas), on the other - with the need to prevent water pollution, soil contamination by pathogenic bacteria, and helminthes contained in manure runoff of livestock farms. Both of these aspects have been the object of research and experimentation.

Most common method of obtaining energy from biomass - anaerobic (without oxygen) fermentation of agricultural waste [3,6,16]. Obtained as the result products of this process - biogas and fermented semi-liquid mass of the representing a greater value as the gaseous fuel and organic fertilizer. It is equally important aspect of the use of biogas plants - prevention of pollution of air and water pollution, soils and crops through utilization of manure and deodorants large livestock farms and complexes, the production of highly effective organic fertilizers disinfected.

In today's world there is strong interest in the problems of methane fermentation of manure and other organic waste. To construct biogas plants designed for the processing of manure and agricultural waste [8,12]. In addition to the plant itself, which includes the fermentation chamber, gas holder and storage for the fermented mass (slurry), built a pumping station to pump the slurry to the fields and power plant that runs on biogas. Thus biogas preparation (cleaning it from CO_2, H_2S and subsequent compression dehydration with for storage and distribution to customers) using membrane techniques as compared with conventional, such as absorption and adsorption may provide significant economic benefits [8,12,13].

Biogas is produced by anaerobic decomposition of waste, contains methane (≈60% (vol.)) and carbon dioxide (≈40% (vol.)). The gas contains hydrogen sulfide, ammonia, water vapor; its calorific value is low - 19,5-19,8 MJ/m^3. After cleaning and drying gas should contain at least 98% (vol.) CH4 (calorific value of at least 33.0 MJ/m^3) H2S concentration should not exceed (5.3) 4 10% (3.5 million -1). There are several possible options for the process for each of which determine the required membrane surface, the cost of compression, the degree of extraction of methane from the feed mixture under different conditions (pressure, number of stages and the degree of separation in recycling schemes recycle) [5, 9,15].

This paper presents the results of studies on the addition of the activated carbon with different pore sizes in the anaerobic reactor. Reactor productivity and methane were determined.

MATERIALS AND METHODS

The paper used the classical and modern physical and chemical methods of research; you always get the full characteristics of the objects of research.

Cultivation of anaerobic methanogenic conditions. Methanogenic bacteria - strict anaerobes, the growth of their possible during the initial a redox potential of the environment below - 300 mV. The temperature optimum for the growth of the mesophilic - in the region 30-40°, with the optimum pH in the region 6.5-7.5.

Waste analysis: content of carbon and nitrogen. Organic and inorganic part of the waste was analyzed separately by various methods. Since the process of anaerobic digestion are involved in mainly organic waste, then, in terms of biotechnology, more efficient to operate the process only with their participation.

Branch inorganic waste component carried by calcinations in a muffle furnace at a temperature of - 350 ^{0}C. The inorganic part is determined only by the contents of N, Ca, K, Na, P, Mg, Fe, etc, the most important elements for feeding the microorganisms according to [1, 11]. Elemental composition of the organic part to the carbon and nitrogen content was determined using a mass spectrometer as described in [7,17]. Fraction content (water-soluble compounds, which are soluble in alcohol, protein, hemicelluloses, cellulose, lignin, ash) was determined as described in [14].

RESULTS AND DISCUSSIONS

Parameters of the porous structure of the modified activated carbon obtained by thermal activation are shown in Figure 1. Raising the temperature from 573 K to 773 K leads to poor development of the porous structure, wherein the total pore volume is from 3.8 to $5.0 \cdot 10^{-4}$ m^3/kg. Increased activation temperature from 873 K to 973 K is accompanied by increased pore volume to a maximum value ($8,5 \div 11,0 \cdot 10^{-4}$) m^3/kg. A further increase in temperature from 1,073 K to 1,273 K do adversely affects the quality of the activated carbon, as hydrocarbons contained resin and decompose to form inactive carbon deposited on the surface of the coal and also leads to sintering pore.

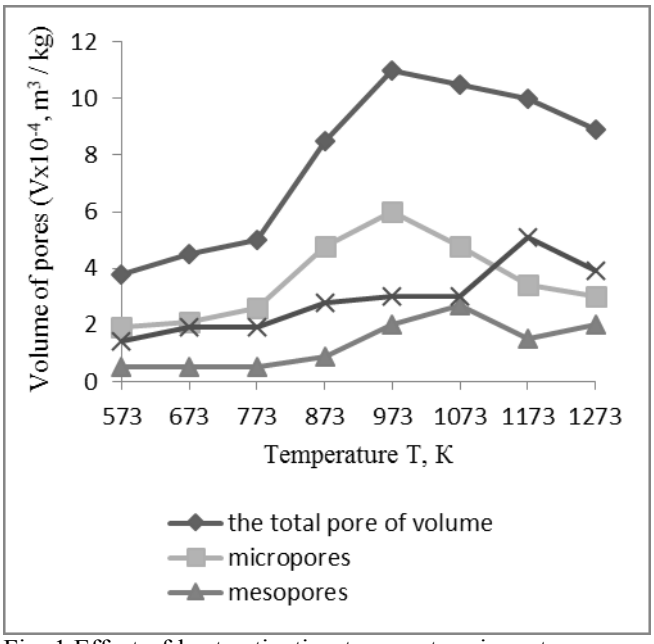

Fig. 1.Effect of heat activation temperature in a stream of CO_2 at a pore volume of bones of the shell

The experimental results show the effectiveness of the thermal treatment of the shell of apricot stones, which have a large volume of micropores and moderately advanced transition porosity provides an intense diffusion of the adsorbate into the adsorbent grains.

The process of chemical activation adsorbent of natural origin - one of the important processes of high quality activated carbons used in various sectors of the economy. It is known that in the case of adsorption of substances from solutions to large molecules, which practically inaccessible micropores is the main importance of transition pore surface. In this regard, the study features a chemically-activated shell apricot kernel is the aim of this part of the work and the conditions for the further studies of their use in the production of biogas.

The parameters of porous structure the shell of apricot stones activated zinc chloride ($ZnCl_2$) with impregnation ratio 0.2; 0.3; 0.4; 0.5; 0.6, followed by activation in a quartz furnace in an atmosphere of carbon dioxide (CO_2) at temperatures from 573 K to 873 K

are shown in Figure 2. The figure shows the same as in the previous example, with the increase in the coefficient of impregnation of 0.2 to 0.4 is the development of coal porosity, and at the expense of increasing the total pore volume of $6,8 \cdot 10^{-4}$ m^3/kg to $12.0 \cdot 10^{-4}$ m^3/kg.

If the value of the coefficient of impregnation of 0.5 to 0.6 decreases the volume of micropores of $4.0 \cdot 10^{-4}$ m^3/kg to $3.0 \cdot 10^{-4}$ m^3/kg and the volume of mesopores $5.5 \cdot 10^{-4}$ m^3/kg to 5.0 10^{-4} m^3/kg and the development of macro porosity begins from $1.5 \cdot 10^{-4}$ m^3/kg to $2.0 \cdot 10^{-4}$ m^3/kg. When the impregnation ratio of 0.4 increase in temperature from 573 K to 773 K leads to a significant development of the porous structure (the total pore volume of from $7.0 \cdot 10^{-4}$ m^3/kg to $12.0 \cdot 10^{-4}$ m^3/kg). Further increase in temperature to 873 K adversely affect the pore structure, which reduces the volume of the micropores of $4.2 \cdot 10^{-4}$ m^3/kg to $4.0 \cdot 10^{-4}$ m^3/kg and a mesopore volume of $6.5 \cdot 10^{-4}$ m^3/kg to $5.7 \cdot 10^{4}$ m^3/kg.

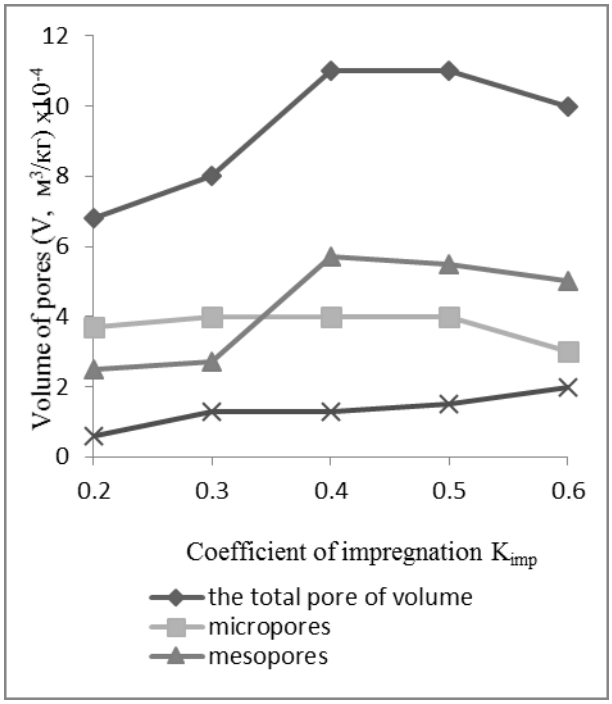

Fig. 2. Effect of the coefficient of impregnation of zinc chloride ($ZnCl_2$) followed by activation in a quartz furnace in an atmosphere of carbon dioxide (CO_2) on the pore volume of the shell bones

For samples treated of $ZnCl_2$, optimal parameters of activation modes are: infiltration coefficient – 0.4; time - 3 hours. For samples treated with $ZnCl_2$ followed by activation with CO_2 optimum parameters are: CO2 temperature - 773 K; impregnation ratio of 0.4.

Modifying the surface of the sample affects the change in pore spaces, which essentially depends on the adsorption capacity of activated carbon. This requires the severity of an individual approach to each sorbent with the obligatory account of its structure, effectively defining the size and shape of the pores. The transitional pore adsorbents at high relative pressures phase transition occurs through the mechanism of capillary condensation.

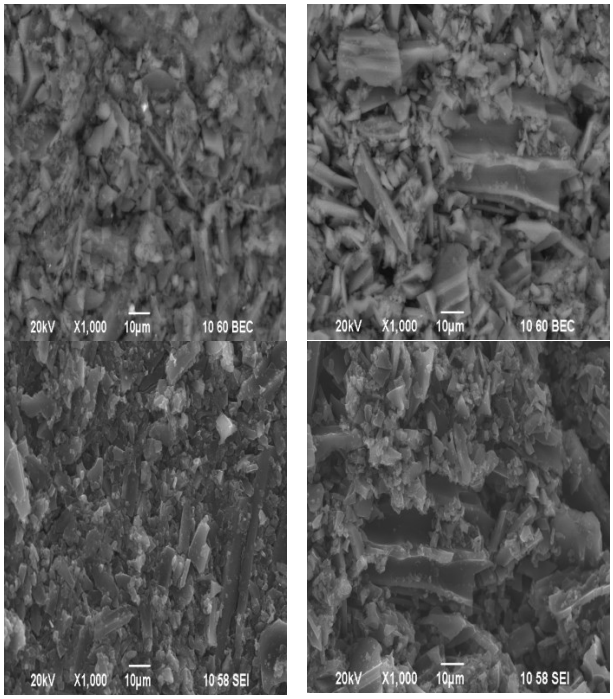

Photo 1. Microorganisms attached to the activated carbon was observed by a scanning electron microscope (JSM-6490LV).

The above results show that adding the activated carbon, a high level of methane production was observed in the anaerobic reactor with natural microorganisms. Increased productivity can be attributed to an increase in the microbial population producents of methane bacteria and syntrophic bacterial metabolism. The absorbed microorganisms that have a high level of metabolic capacity have increased pores of AC. It has been found that activated carbon showed extensive colonization within

the porous structure. Activated charcoal ensures the development of mesoporous structure for the methane producers that use bacteria to colonize.

CONCLUSIONS

The obtained complex structural and adsorption data indicate that the samples chemically activated seed shells on the physical and chemical adsorption, and structural characteristics are not inferior to the applicable industrial activated coals and will be able to find a practical application as adsorbents in obtaining biogas. Thanks to advanced (transition) mesoporosity and a large specific surface area is effectively large-scale colonization of micro-organisms for which the micropores are practically inaccessible.

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DROUGHT STRESS TESTING ON THREE GRASSES SPECIES IN

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CONTROLED CONDITIONS

Camelia SAVA

"Lucian Blaga" University from Sibiu, Faculty of Agricultural Sciences, Food Engineering and Environment Protection, 7-9 Dr. Ioan Ratiu Street, 550012, Sibiu, Sibiu County Romania,
E-mail: camelia.sand@yahoo.com

Corresponding author: camelia.sand@yahoo.com

Abstract

Climate change effects on agriculture are estimated to be dramatically affected for the next 20 years [15]and up to 2050 and therefore it is a great need for increasing diversity in crops species for improving their ability to deal with drought, floods and harsh conditions generally. The scope of this article was to evaluate three grasses perennial species for their development under experimental drought conditions. Thus, Dactylis glomerata, Festuca pratensis and Lolium perenne were selected for this experiment as they are very important for Romanian grasslands. There have been used two types of seeds for each species: control, certified seeds and regenerated after in vitro cultivation on polyethylene glycol of these three species and obtained in a previous study [2]. Our results revealed that the plants regenerated upon in vitro cultivation on PEG are better adapted to drought conditions.

Key words**:** *Dactylis glomerata, Festuca pratensis, Lolium perenne, drought stress, dry matter, fresh weight*

INTRODUCTION

Droughts, heat waves and floods are the main challenges which will need to be answered through adaptation measures. Southern regions of the country are already exposed to desiccation phenomenon that will continue in the future. The trend of reducing the thickness of the snow, already observed in the west and northeast of the country, which could amplify in the future creates problems in management of water reserves, that are threatened by the future evolution of climate change effects. Hilly and mountainous regions are also exposed to the impact of climate change, the frequency of avalanches and landslides may change dramatically. In the context of global warming, there is a tendency in recent decades, winters in Romania become less harsh, with higher temperatures and reduced snow cover, the trend will continue in coming decades [16].
Based on the Report of the Intergovernmental Panel for Climate Change (February 2007), the average global temperature will increase until the year 2100 by about 3° C, which will cause a trigger early cycle of vegetation spring and an extension of its fall [6].
The National Soil Quality Monitoring showed that about 7.1 million hectares of farmland are affected by "frequent drought" as a major limiting factor of production [8]. Based on these authors podzolic soils, characterized by the very low natural fertility, because of the negative physical-chemical and biological traits, occupy about a quarter of the arable land, especially in regions of Carpathians such as Transylvania and Moldova, depressions foothill areas in the north, Piedmont west plateau Suceava, etc. Closely linked to the podzolic is developing the upper layers of soil acidity by removing bases from primary minerals and then clay-humic complex. Podzolic soil of high acidity, with adverse effects on crops, is accompanied by a deficiency in nutrition elements, giving a low fertility.
Due to the high content of clay, acid soils cannot store nor in wet periods than some of the water precipitation, water supplies are so scarce. In areas with podzolic soils, livestock has been and must remain the most important sector of agriculture, the share of fodder is made up of permanent pastures or meadows sown, which should provide 60-65% of the areas of perennial crops [14].
Perennial grasses and legumes are the main components of grasslands of the vegetation of meadows. The total area of grassland in Romania is 4.9 hectares, representing about 21% of the total area of the country and 34% of

agricultural land, of which 3.4 million ha are pastures and 1.5 million ha are grassland. From this point of view Romania ranks the 5th in Europe after France, England, Spain and Germany [4].

Cultivation performance, adapted to climatic and how to use them are the main means of increasing forage production, together with respect for culture technologies. Drought resistance varieties and unfavourable soil conditions is a basic element of stability production in areas affected by these phenomena.

Using a valuable germplasm and applying biotechnological technology for "in vitro" cultivation and selection and continuing with greenhouse technology for fields, is providing premises to obtain resistant varieties of perennial grasses with an increasing productivity in grasslands as a valuable alternative to harsh living conditions [5].

The main characteristics based for selection and improvement of fodder plant species are: the biomass and seed production; obtaining forage of high quality, expressed by chemical composition, energy-protein ratio, suitability to different conservation method such as: palatability, fibre content, resistance to diseases and pests, repeated harvesting resistance, resistance to limestone, adaptability to natural factors of stress. Among the environmental factors that have significant impact on the level and quality of production are water and soil pH [12].

The situation created as an effect of enhancing global warming confronts livestock farmers with new challenges. The value of forage grasses and legumes species of wild flora and their ability to exploit different production conditions were the top criteria in the selection of the most valuable biotypes and have increased the importance of a reduced number of 10 to 12 species that are part of more than 400 botanical families of two important forage base [15].

Perennial grass species that participate substantially (30-90%) to the composition of the vegetation in natural grasslands are *Festuca pratensis*, *Festuca arundinacea*, *Lolium perenne*, *Phleum pretense* and *Dactylis glomerata* [17]. Among the most valuable are perennial legumes such as *Medicago sativa*, *Trifolium pratense* (red clover) *Trifolium repens* (white clover), *Lotus corniculatus* (trefoil) and *Onobrychis viciifolia* (sulla) [10].

The scope of this article is to present our results obtained for testing in greenhouse conditions the resistance to drought of three fodders species *Dactylis glomerata, Festuca pratensis* and *Lolium perenne* that have been previously under water stress into *in vitro* conditions [2]. Fresh weight and dry matter are used as major indicator in assessing the adaptation ability of these species.

MATERIALS AND METHODS

Plant material. Certified seeds of *Dactylis glomerata* 'Intensiv', *Festuca pratensis* 'Pradel' and *Lolium perenne* 'Mara' as well as five clones of each species originating from previous *in vitro* experimentation after four years. These seeds are originating from regenerated plantlets upon their *in vitro* cultivation on polyethylene glycol (PEG) as a water stress factor [2]. After acclimation, these plants complete their life cycle and produces seeds that have been used in these experiments.

Experimental scheme Healthy seeds from all three species have been sown in plastic boxes for 14 weeks. Plants have been transferred after 14 weeks on pots of 15 cm in diameter. Plastic boxes and pots have been filled with field soil where these species are cultivated for more than 25 years to obtain reliable data towards control plants. The experiment was conducted in greenhouse prepared for controlling drought. Temperature was similar with that of the summer of 2014 and air drought was maintained under 10%.

Laboratory analysis were realized at the end of experiment. 15 repetitions of each were used to evaluate fresh wright (g and %) and dry matter (g and %). Dry matter was conducted in the lab oven at 60°C up to constant weight for two days.

RESULTS AND DISCUSSIONS

Most important species bear low temperatures in winter and high in the summer if vegetate on

a land use enabling them to achieve a balance between the minerals that compose them. Less resistant protective layer in case of lack of snow are *Lolium perenne* and *Dactylis glomerata*. Forage grass species are generally sensitive to temperature drop during early spring time. Also, special attention should be paid to physiological phases when come in winter if sowing is performed early in autumn. The number of active grades when it is generally active ranks at around 1,000, with a higher need for species *Dactylis glomerata*. More sensitive to high temperatures is *Lolium* a perennial species in which there are varieties in very hot summer months enters vegetative rest and resume their growth in September when the temperature drops and improves the soil's water regime [11].

Important as forage, grasses species have higher water consumption with an average of 50-100% more compared to cereals due to longer vegetation period, production of biomass, evaporation during the periods after sew or grazing, large leaf surface and perspiration rate, and so on. Plants need more water with increasing elongation straw and ambient temperature. Because of this small root system plants with low capacity to absorb water, production quantitatively and qualitatively reduces. Water consumption is higher in the case of grasslands that capitalize mowing than those that grazed in which case the need is water and water more evenly throughout the growing season [1].

Analysing spreading area of forage' species it can be appreciated that they have reduced requirements to soil. However, the plants grow well in soils with medium texture, clayey or sandy loam, with a deep fertile layer with groundwater at a depth of more than 70-120 cm lower in the case of grasses and higher in vegetables. Towards the soil pH, grasses don't have outstanding claims, although they are growing the best on soils with values close to neutral, supporting wide limits the value of this indicator.

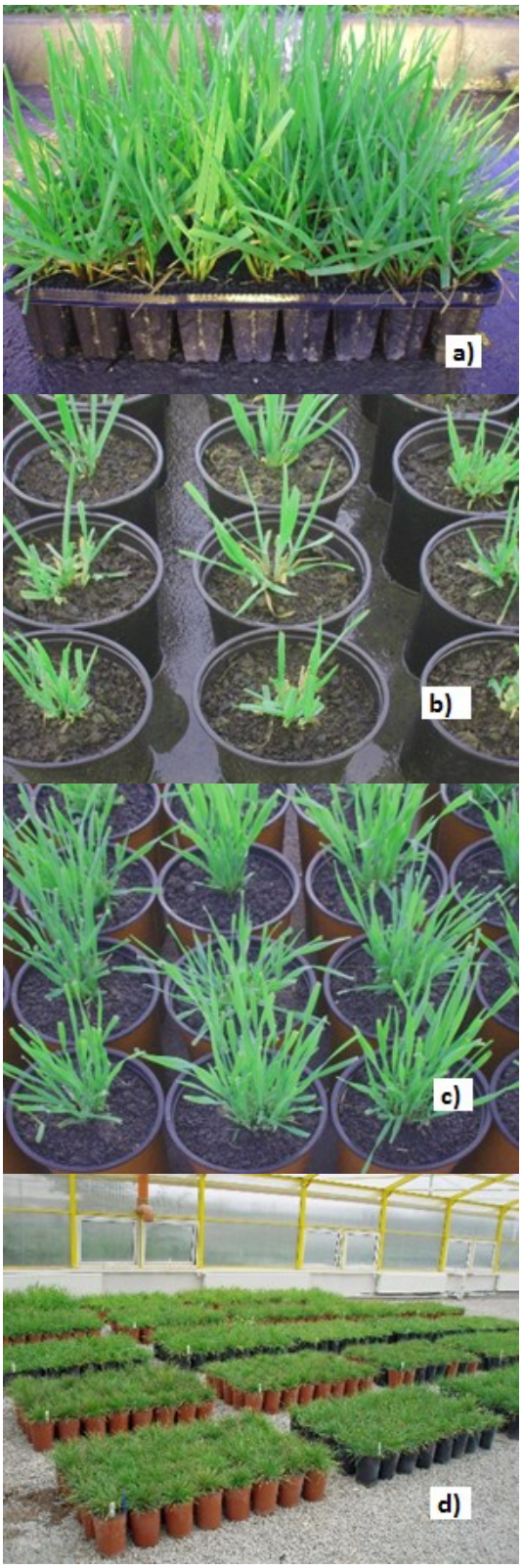

Fig. 1. Plants during the preparing of experiment: a) at 6 weeks of sowing; b) at 12 weeks; c) at 14 weeks before starting the experiment and d) after 16 weeks of starting the experiment.

Towards nutrients, grasses have moderate requirements, they managed to extract nutrients from the soil solution. Of

macronutrients, grasses have high demands towards nitrogen and legumes towards phosphorus, potassium and calcium. Ensuring nitrogen supplements may increase productivity, on one hand and increasing the protein content in legumes on the other hand [9].

Table 1. The effect of drought conditions on three species *Dactylis glomerata*, *Festuca pratensis* and *Lolium perenne*

Species	Repetition clones 15 plants	Fresh weight (g)	Fresh weight (%)	Dry matter (g)	Dry matter (%)
Dactylis glomerata	1	8.60	95	4.5	123
	2	7.33	85	3.31	89
	3	7.88	90	3.45	93
	4	10.20	118	4.20	113
	5	8.65	100	3.70	100
	Average	**8.515**	**98.25**	**3.665**	**98.75**
	Control	**7.2**	**82**	**3.12**	**82**
Festuca pratensis	1	9.93	131	4.23	107
	2	7.36	97	3.25	82
	3	7.39	97	3.37	86
	4	6.94	91	2.89	73
	5	7.59	100	3.94	100
	Average	**7.842**	**103.2**	**3.532**	**89.6**
	Control	**5.32**	**81**	**2.35**	**62**
Lolium perene	1	4.94	77	2.60	75
	2	7.38	115	4.12	119
	3	7.54	117	3.85	112
	4	7.60	118	4.19	121
	5	6.44	100	3.45	100
	Average	**6.784**	**105.4**	**3.642**	**105.4**
	Control	**5.23**	**82**	**3.02**	**88**

The entire experiment started with a total of 1500 seeds: 250 of each variant and species (250 as control and 250 as treated with PEG). Each group of 250 seeds of each species have been sowed in plastic boxes filled in with soil taken from the experimental filed. The seedlings have been watered at 10 days with a nutrient solution 5% and treated with Previcur 607SL [7]. After 6 weeks of sowing, the experiment started with 200 plants presenting one or two sprouts for pot culture. 50 seeds were ensuring the success of our experiment in case of diseases or pests, or difficulties in germination. Pots have been filled with the same soil taken from our experimental field. Up to the next movement these plants have been watered at each two day and treated with nutrient solution at each 10th day up to 14 weeks (Fig 1 a, b and c). At 14 weeks of sowing all plants of each of the three species were transferred for testing the drought stress (Fig 1 d).

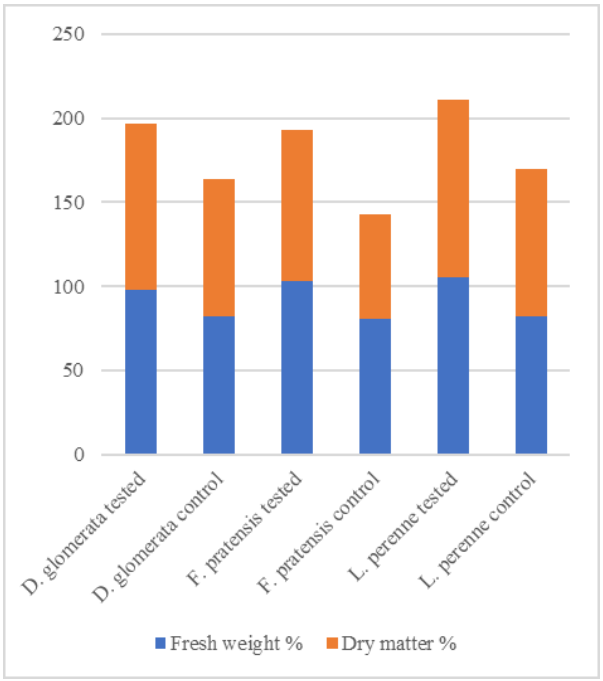

Fig. 2 Effect of induced drought on fresh weight (%) and dry matter (%) for *D. glomerata, F. pratensis* and *L. perenne* previously treated *in vitro* for water stress compared to control

All pots have been randomly disposed in five repetitions with 40 plants. Each repetition was considered a lot of plants that was placed differently inside the greenhouse. Before the drought stress, in the first stage, all plants have been abundantly watered similar with the filed conditions after heavy raining. This period was followed by an induced drought when no watering was applied and furthermore, the moister level inside the greenhouse was kept at 20%.

After 6 weeks of artificial drought induced conditions obvious effects on plants were observed such as the plant colour, vigour, turgescence and the ratio between dry leaves and shots. These preliminary observations were very important because based on them it is possible to continue new experimentations. The main indicator was dry matter for randomly selected individual plants. All results are presented in Table 1 and Fig. 2.

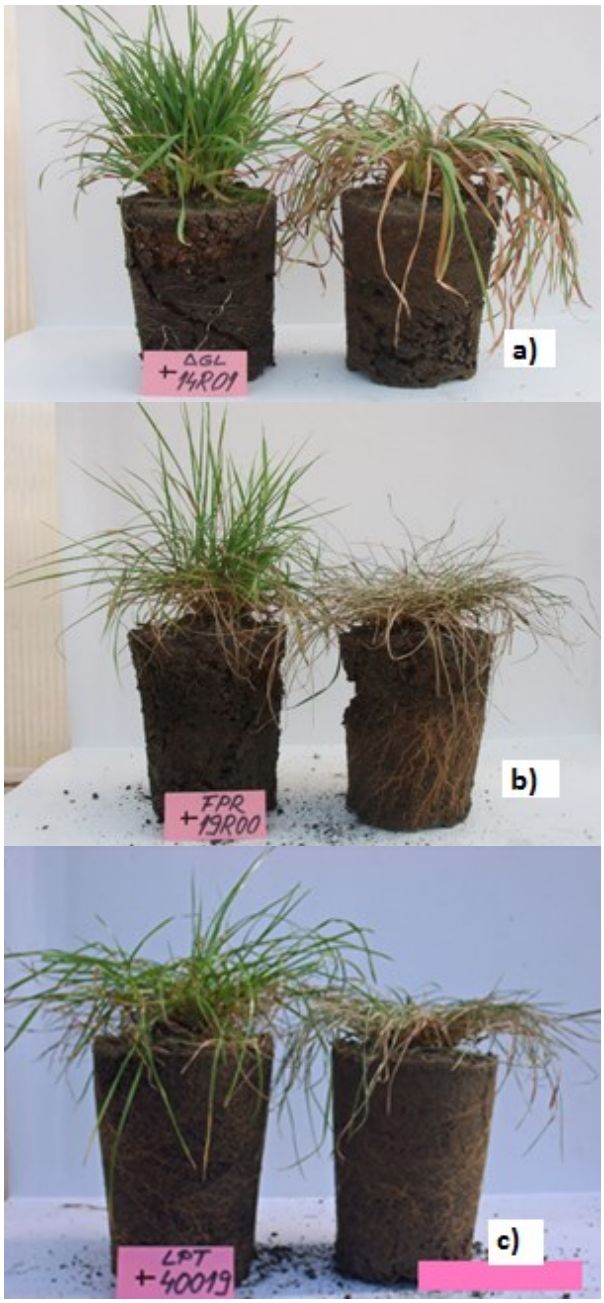

Fig. 3. General aspect of plants affected by drought: a) *Dactylis glomerata* plants after 6 weeks of drought stress (tested in left and control in right); b) *Festuca pratensis* plants after 6 weeks of drought stress (tested in left and control in right) and c) *Lolium perenne* plants after 6 weeks of drought stress (tested in left and control in right).

Based on our results all clones derived from *in vitro* experimentation presented high adaptability to experimental drought conditions compared to the control seeds using the same soil in the experiment like that of filed. Net differences between plants (i.e. vigour, colour, general appearance) of *in vitro* culture origin and control are presented in Fig. 3.

As a general result for all three species, dry matter was higher in case of seeds originating from *in vitro* testing on PEG compared to control. Thus, in case of *Dactylis glomerata* the dry matter was more than 16% higher compared to control, in case of Festuca pratensis it was recorded an increase of over 26% and in case of *Lolium perenne* over 17%. Such results are in line with previous studies [13]. Moreover, our studies support the national politics on climate change and biodiversity conservation especially for ensuring food security for long term [3].

CONCLUSIONS

Testing the effect of drought on three perennial grasses species proved that a previous testing using *in vitro* culture is beneficial in plants adaptation for ex vitro conditions after more than four years. These results further support the idea that *in vitro* techniques are valuable tools for increasing the biological diversity in species, especially related to the increase of adaptability to harsh environmental conditions.

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GOVERNMENT SKELETAL FARM MECHANIZATION PROGRAMMES: ASSESSMENT OF THE IMPACT AND LEVEL OF SATISFACTION OF RURAL FARMERS IN NIGERIA

Paul Osu SIMEON, Hemen Emmanuel JIJINGI, D.I. ADAMU

Federal University Wukari, Department of Soil Science and Land Resources Management, P.M.B 1020, Wukari, Taraba State – Nigeria Postal Code; 67001, Phones: +2348062536780, +2348069451802, +2347030354920, Emails: posimeon@yahoo.com**,** hijijingihemen@live.com, yunusadanfulaniadamu@gmail.com

Corresponding author: posimeon@yahoo.com

Abstract

The farming population in the rural areas of Nigeria is in continuous decline due to ageing and the rural-urban migration of the youth in search of education and modernity for a presumably better life style. The governments at national, states and local government areas levels have ill-conceived and ill-operated many agricultural mechanization schemes/programmes extended only to arable crops production and complete exclusion of livestock production, though with the right intentions of mitigating the effects of the scare of drudgery associated with tillage, cereal grains threshing, etc and also for the expansion of production in agriculture. The scare of hard labour is not helped by absence of modern amenities in the rural areas. The "skeletal" appellation is due to the schemes' great limitation to very narrow aspect of farm mechanization and coincidentally, this study has been limited to South of Taraba State which lies within the Guinea Savannah geographical area of Nigeria. The method adopted is use of structured questionnaire administered by paid agricultural extension agents who were able to have good interactions with the farmers and governments' machinery service centres (Tractor Hire Units) operators/managers. Descriptive analysis was adopted for the discussion. The outcome reveals a negligible impact of less than 6 % admitted by only 4.6 % of the respondents; and great dissatisfaction among farmers, greed and incompetence among operators as well as bad technical quality plus inappropriate and incomplete machines and implements provided by the governments. This paper highlights points missed by government as well as the areas of abuses due to corrupt tendencies and usual Nigerian factor. The paper ends with call on the government to change the ways the programmes are pursued so as to improve on the situation in view of the food supply and climate change threats to humanity and its possessions.

Key words**:** *skeletal, mechanization, satisfaction, farmers, rural and government*

INTRODUCTION

Nigeria is a country of over two hundred and seventy four (274) tribal groups and over seven hundred (700) dialects are spoken. The major tribal groups and the administrative states are presented in figures 1 and 2 respectively.

In the administration of projects/programmes and recruitment of manpower, ethnicity/tribalism besides other negative vices play significant role, especially since the introduction of "Federal Character" or "Quota System" into the Nigerian legal framework and Constitution. As good as the real intentions are for loyalty of all the peoples of Nigeria, the abuse in failing to maintain standard and merit within the quota system or federal character seems to have galvanized failures and promoted backwardness rather than progress.

The attempt at mechanization is not an exception but a reflection of the negativities that have come to be associated with the implementation of the noble policy.

Without meticulous study, proper understanding and conscientious approach that provides for differentiated application of mechanization nationwide, failure will continue to await any attempt at mechanization in view of the factors that influence the possibility and extent of mechanization. These factors include the geography, education and technical skill level for the needed expertise, genetical engineering, development of other

fundamental inputs and sustainable management of the exposed soil, more so now, that climate change has created huge challenge for mankind, particularly to equatorial rain forest and the semi-arid/arid areas of Nigeria.

Fig. 1. Map of Nigeria showing the ethnic groups
Source: [6]

Fig. 2.Map of Nigeria showing the administrative state.
Source: [6]

A very close study of the skeletal mechanization schemes/programmes of the governments shows that it extend only to arable crops production and the complete exclusion of livestock production, tree crops production and other aspects of agricultural production. Another skeletal nature of the skeletal programme is also very obvious in this regard. However, few farming entrepreneurs have been able to purchase small rice milling, maize shelling, grinding machines and several other types of machines with petrol engines for commercial service rendering.

The level of western education and technical expertise in Nigeria is as varied as its geography (including the tribal/ethnic nationalities within). This further explains why mechanization programmes/schemes ought to be designed and operated deeply differentially even within a State. The approach that makes it look like any machine can be used all over the northern part, or all over the southern part or all over the country is a grievous error. It is one of the reasons several machines bought and supplied to some areas have never been used for once and are packed in the open air under the intense sunshine and rainfall and are rotting away, despite the great agricultural potentials of Nigeria. Out of about 98 (ninety-eight) millions hectares of land, roughly Seventy-four (74) million hectares is arable, that is, Seventy-Six percent (76 %). But the agriculture is still rain fed and only about forty percent (40 %) of the available farmland is cultivated in over seventy percent (70 %) by rural farmers. How can machinery stock be left to rot away? It is un-economical, non-developmental, worrisome and heart-aching for conscientious professionals who are sidelined and helplessly watching greed and avarice being flagrantly displayed to the detriment of the socio-economic growth and development of the society. In average, the country Nigeria is blessed with large technical expertise in great proportion of areas of human endeavors but the harmonization, coordination and control (that is, the proper leadership) that will sustainably maintain drive on the right path of growth and development has been lacking, is lacking and may continue to lack except there is a sharp turn around now.

According to [1] Operation Feed the Nation (OFN) started in March 1976 with the aim of campaigning to Nigerians to grow more food on any available land even in the urban centres. Though the campaign succeeded in raising awareness, the efforts of the government were, however, directed at the wrong people. Instead of concentrating on the rural farmers, the government paid more attention to urban dwellers. Investments on

farm implements and other facilities were not adequately utilized because they were given to the wrong people.

The situation then is not different from what it is today and it has even become worse. Furthermore, [1] stated that the River Basin Development Authority (RBDA) was initially created to provide irrigation water especially in the North but grew from two (2) in 1973 to thirteen (13) in 1979 perhaps to satisfy the spirit of "Federal Character". The RBDA did not perform well. The authors of this paper would like to say the situation is very unfortunate in view of the known fact that irrigation installation is among the fundamental conditions for effective and economic mechanization in farming (economic engineering in agriculture).

The National Centre for Agricultural Mechanization (NCAM) near Ilorin in Kwara State was established by Decree No. 35 of 1990 with the general objective of accelerating mechanization in the agricultural sector of the economy in order to increase the quantity and quality of agricultural productivity in Nigeria, [1]. The present state of agricultural mechanization in Nigeria is, however, still far from increasing farm earning and productivity at any minimal level of satisfaction among the farmers. Large scale attempted mechanized farms have collapsed with ease few years after takeoff, usually less than five (5) years. Thus, the impact of the government programme/scheme has not been felt whether by large scale or local farming communities.

According to [7], in Europe, China, India, etc their methods of farming is more scientific, therefore more productive. In these countries, mechanization brought about growth in the use of agricultural chemicals (herbicides, insecticides, fungicides and fertilizers) though along with their hazards. They also develop high yielding species that leads to intensive farming on land with sufficient rearing of cattle and poultry. They went further into genetic engineering method for hybridization and embarked on pests control by use of chemicals.

The Taraba State Government and Local Government Councils Tractor Hiring Programmes and Units in the study area have long collapsed for reasons tied to corruption and flagrant display of development ignorance and selfness (that is, lack of statesmanship). This ugly situation exit in over 90 % of Nigeria, and it has been massive failure despite the colossal investments of local and foreign currencies. Hence the country's agriculture has remained largely subsistence, semi-subsistence and under-developed, while the country depends on massive food and agro-allied materials/products importation.

What we have been experiencing as a nation and witnessing as concerned professionals is **un-economic engineering in agriculture** and therefore wasted efforts and resources. The main objective of this paper is to add to awareness campaign and to draw the attention of government at all levels that the same thing cannot continue to be done with expectation of different results, and also to draw attention to the plight of the intended consumers (rural/local farmers) of the reckless skeletal services called "tractorisation", a term that has now been introduced into our lexicon in an attempt to justify the failures of governments in rendering skeletal mechanization services instead of pursuing real mechanization content.

[8] said it all when he stated "it is almost 40 years ago, 1973 that I was covering the assignment of the Permanent Secretary, Federal Ministry of Agriculture, I was incharge of the Agricultural Research Councils, as well as the extension field workers of River Basin Development Authorities at the federal level and was relating closely with international Institute of Tropical Agriculture (IITA), West African Rice Research Council, the FAO and was collaborating well with a host of donor countries for agricultural promotion, everybody was contributing his quota judiciously. I was in the middle of it. **After this long period of time, I noticed that the hopes and wishes for agriculture being pronounced now are virtually similar to those expressed four decades ago. This means that there is no noticeable progress in the sector.** Is the sector not accepting improvement or change? This time, we have

to have sense of purpose to accept dramatic change. Change is inevitable.

The most recent of the continued ugly experience of farmers and wasted efforts plus resources by the Federal Government of Nigeria was the programme of Mini-Mechanisation Service Station in all the 109 Senatorial Districts of Nigeria. This was introduced in year 2013/2014. **Taraba South** was one of the beneficiaries through the Consultancy Service Unit of the Federal University Wukari. As always, it was a colossal failure nationwide, despite the involvement of Bank, Manufacturers and Manufacturers' Representatives under the leadership or coordination of government officials. It was the shameless supply of incomplete parts of machines, engine power units and implements that were new in mixture of others that were poorly refurbished by whosoever and supplied as new products. This was worsened by poor storage in open field under rainfall and sunshine before distribution to the various Senatorial Districts that were able to have the custodians that could pay the stipulated counterpart fund in a rigorous process of unproductive lobbying of the government officials in charge. Over 80 % of the facilities are already scraps and never used at all as some Photos shall reveal.

Consequently, the local farmers have been given heart-ache rather than amelioration of the hardship in their works. The ill-state machinery and implements were also recklessly and greedily exploited by the managers and operators without regard to the socio-political and economic impact factors that necessitated the programme. It was naked greed, avarice and all forms of corruption, and thus, nothing other than anti-developmental vices for personal gains.

The agricultural system has remained characterized by semi-subsistence and subsistence, low inputs and low productivity, use of simple farm tools and ill-managed simple mechanical tillage aggregate (where available), shifting cultivation and bush fallowing, lack of conservation awareness, etc. [2] stated that "the Nigerian agriculture sector is an industry of perceptual toiling and indignity, plagued with drudgery, aged and ageing farming population. These small holder farmers therefore remain impoverished, still depending on manual labour to carry out their various farming operations.

MATERIALS AND METHODS

Study Area

The study area is Southern part of Taraba State, also referred to as "Taraba South Senatorial District." Taraba State lies within the Guinea Savannah area of Nigeria. It is predominantly a farming based rural economy as well as state economy. Gentle sloping and flat arable land is abundant. The land is well drained by numerous big and small rivers that exist all seasons. High rain forest conditions exist in its south-eastern fringe in Ussa and Takum Local Government Areas. The Southern Taraba has a population of about six hundred and fifty-five thousand and six hundred and three (655, 603) according to [4] figures. The figures for the five (5) Local Government Areas are Wukari (238,283), Takum (134,576), Donga (133, 105), Ussa (90, 889) and Ibi (58,150).

The Taraba State Government and Local Government Councils Tractor Hiring Programmes and Units in the study area have long collapsed for reasons tied to corruption and flagrant display of development ignorance and selfness (that is, lack of statesmanship).

Fig. 3. Map of Nigeria showing the Population
Source: [6]

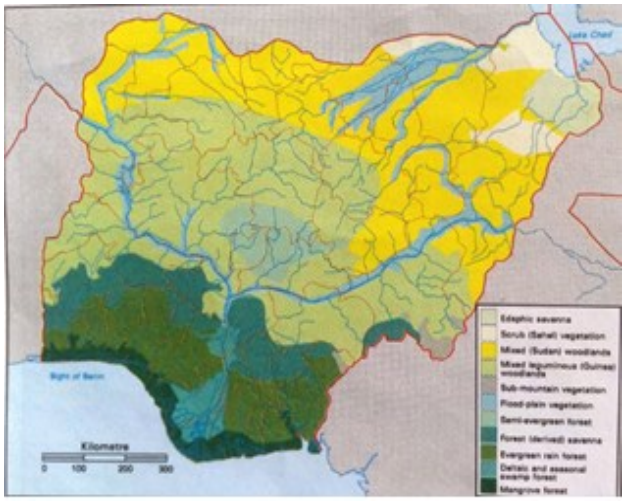

Fig. 4. Vegetation Map of Nigeria
Source: [6]

Fig. 7. Food Crops Map of Nigeria
Source: [6]

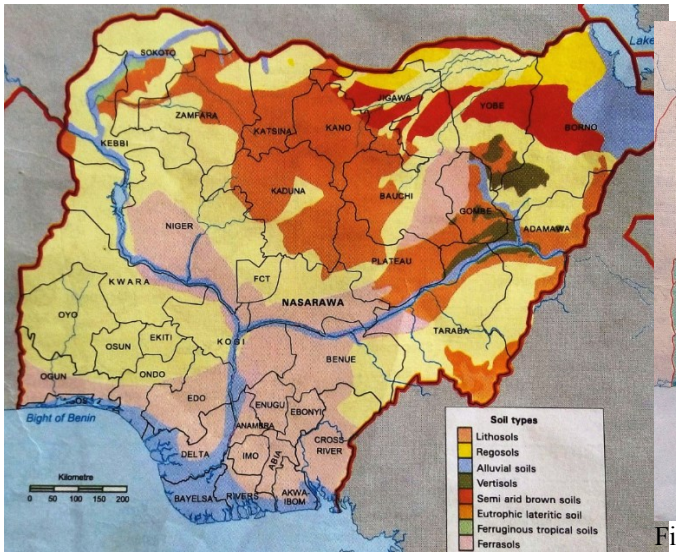

Fig. 5. Soil Map of Nigeria
Source: [6]

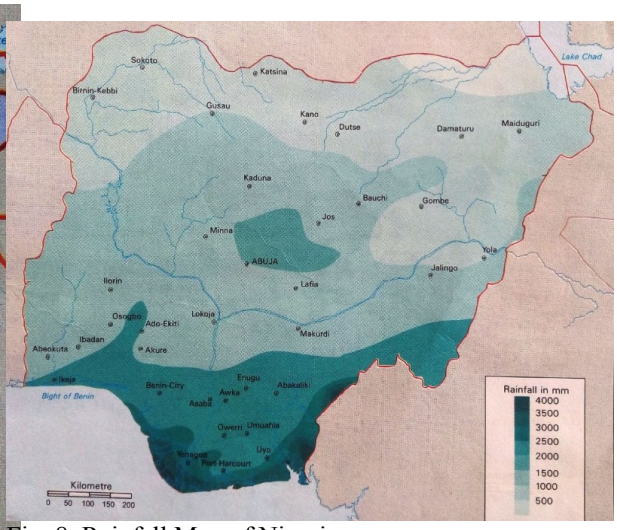

Fig. 8. Rainfall Map of Nigeria
Source: [6]

Fig. 6. Livestock Map of Nigeria
Source: [6]

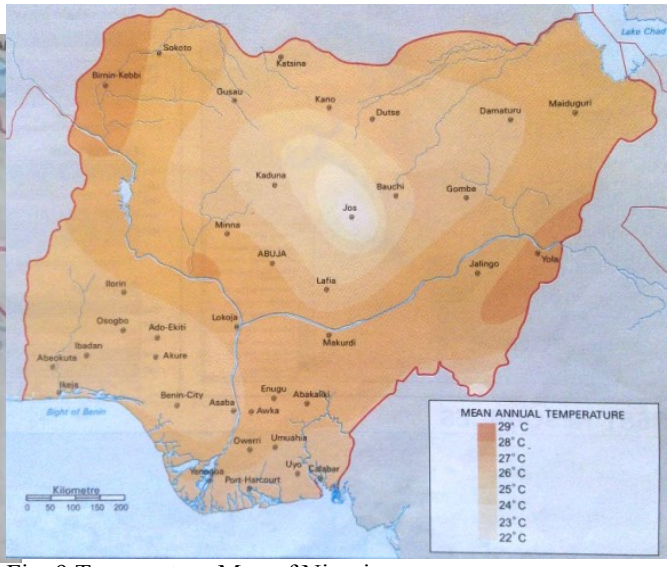

Fig. 9.Temperature Map of Nigeria
Source: [6]

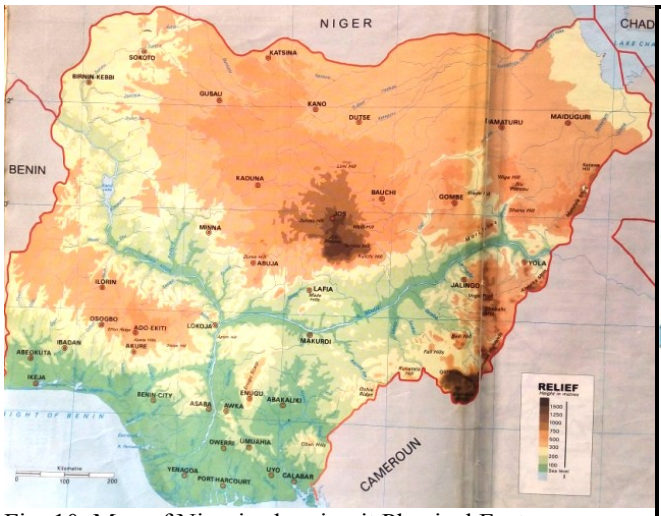

Fig. 10. Map of Nigeria showing it Physical Feature
Source: [6]

Fig. 13. Administrative Map of Taraba State.

Fig. 11. Map of Nigeria showing Agro- industries
Source: [6]

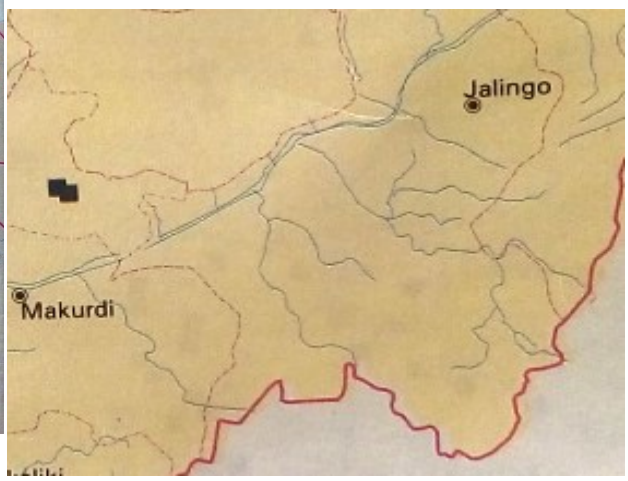

Fig. 14. Network of Major River in Taraba state

Fig.12. Map of Nigeria showing other industries
Source: [6]

Over 80 % of the population are engaged in farming and dependent on farming for livelihood, fully or partially, and all the farmers can be categorized as local farmers or rural farmers as the agricultural industries and other industries are yet to take off (see figure 11 and 12). The bulk of the farm produce are carted away at point of harvest by wholesale traders/buyers from the south-eastern Nigeria. The major food crops include yam, maize, cassava, guinea corn, millet, rice, soya beans, plantain (in Takum and Ussa Local Government Area), vegetables etc.

The geography of South of Taraba State favours an efficient mechanization of farming activities without or with just minimum effort on land leveling and land clearing in both wet and dry seasons. The underground water table is reasonably near surface at about nine

meters (9 m) and varies from location to location to about forty five meters (45 m) generally with cases of nearer and deeper levels. The soil is predominantly regosols and eutrophic laterite with sandstone appearing in the horizon from about one meter (1 m) depth and is loose/friable at the surface level. The sources for fresh water for irrigation are abundant. There are several long high volume rivers that never dry up in and out of the wet season (see figure 14). A very good and strong mechanized agriculture based economy can be built in Taraba State in general and Southern Taraba in particular if the resources can be well planned, harnessed and managed.

Despite these facts, the farming technique and method currently accessible to the generality of the farmers are bush fallowing and shifting cultivation involving use of simple farm tools, poor soil utilization practices, unprofessional applications of some quantities of chemicals (fertilizer, herbicides, fungicides and insecticides) without regard to compatibility with soil solution reaction (pH), lack of conservation agriculture consciousness, easy setting of farmland on fire at the end of rainy season, bush clearing by slashing and burning and constant re-heaping of topsoil with bighead short handle hoe to make heaps and ridges for planting. Agricultural industrial production is still lacking.

Methodology.

Well structured sixty (60) questions questionnaires were administered twelve (12) copies in five (5) farming communities in each of the five (5) Local Government Areas of the Senatorial District. Also, twenty (20) copies were administered in each of the Local Government Area headquarter towns, which are themselves farming communities. These are Wukari, Takum, Ussa, Donga and Ibi towns which also are the names of local government areas (see figure 13).

Trained agricultural extension agents were engaged for the purpose by the researchers and they were properly instructed on what to do, which of course, is part of their training for duties in their state employment. About four hundred (400) questionnaires were processed, result presentation is in tables and descriptive analysis is employed for the discussion of the socio-economic characteristics, the level of impact of government skeletal mechanization programmes and level of farmers satisfaction in the study area.

RESULTS AND DISCUSSIONS

The pictorial view of ill-state supplied and ill-exploited Taraba State Senatorial District Skeletal Mechanization Service Station si presented in Photos 1-6.

Photo 1. Recklessly explorted Disc Plough

Photo 2. New Tractor without the complete parts of the Cabin

Photo 3. Never Used trail parked in the open air rottening away

Photo 4. New improperly fittened supposed Disc Rigder

Photo 5. New Non-funtional Power tileings resulting from supply of incomplete components and left under direct sunshine and rainfall

Photo 6. Heap of machineries parts (that could not be coupled) enclosed in ploythene wrapper

Table 1.Age grouping and their percentage in farming population from the average response (%)

No.	Local Government Area	15-24 Years	24-45 Years	Above 45 Years
1	Wukari	27	45	28
2	Takum	25	48	27
3	Ussa	27	49	22
4	Donga	21	50	29
5	Ibi	18	51	31
	Average	**23.60**	**48.60**	**27.40**

Table 2. Gender Participation in Farming Population Expressed, in Percentage (%)

No.	Local Government Area	Female	Male
1	Wukari	30	70
2	Takum	40	60
3	Ussa	25	75
4	Donga	20	80
5	Ibi	30	70
	Average	**29**	**71**

Table 3. Availability of Machines, in average response in Percentage (%)

No.	Local Government Area	Not Available	Hardly Available	Available but not Reliable	Available
1	Wukari	93	05	02	-
2	Takum	94	04	02	-
3	Ussa	96	04	-	-
4	Donga	95	05	-	
5	Ibi	98	02	-	
	Average (%)	**95.20**	**04.00**	**0.80**	

The results as processed in the tables in average response in percentages (%) show clearly that, the farming activities are predominantly of male (71 %) in the age bracket of 22-45 years. Farming machinery is not available responded about 95 % of the farmers and available though not reliable was the response of about 0.80 % of the farmers. The accessibility of machine aggregate due to cost factor is very low as only about 0.60 %

have access, 2.6 % responded hardly accessible and 96.80 % responded not accessible.

Table 4. Accessibility of Machine in Average Response in Percentage (%)

a.Cost factor

No.	Local Government Area	Not Accessible	Hardly Accessible	Accessible
1.	Wukari	95	03	2
2.	Takum	96	03	1
3.	Ussa	98	02	-
4.	Donga	97	03	-
5.	Ibi	98	02	-
	Average (%)	**98.80**	**2.60**	**0.60**

b. Factor of inadequacy of supply against demand

No.	Local Government Area	Not Accessible	Hardly Accessible	Accessible
6.	Wukari	99	01	-
7.	Takum	99	01	-
8.	Ussa	100	-	-
9.	Donga	99	01	
10.	Ibi	100	-	-
	Average (%)	**99.40**	**0.60**	**-**

c. Cannot work without breaking down factor

No.	Local Government Area	Hardly Available	Available but not Reliable
1.	Wukari	98	02
2.	Takum	99	01
3.	Ussa	100	-
4.	Donga	99	01
5.	Ibi	100	-
	Average (%)	**99.20**	**0.80**

Table 5. Where simple machine aggregate is available, level of satisfaction with job for money; average response in percentage (%)

No.	Local Government Area	Very poor quality (Unsatisfactory)	Average quality (fairly satisfactory)	Good quality (Satisfied)
1.	Wukari	96	04	-
2.	Takum	97	03	-
3.	Ussa	97	03	-
4.	Donga	98	02	-
5.	Ibi	99	01	-
	Average (%)	**97.40**	**02.60**	**-**

Table 6. Bad quality work but satisfied that huge part of tillage drudgery is removed; average response in percentage (%)

No.	Local Government Areas	Not satisfied	Fairly satisfied	Satisfied
1.	Wukari	60	37	3
2.	Takum	61	36	3
3.	Ussa	68	30	2
4.	Donga	63	35	2
5.	Ibi	66	32	2
	Average (%)	**63.60**	**34**	**02.40**

Table 7. Impact of use of machine in your farming activities; Average response in percentage (%)

No.	Local Government Areas	None	Very low ≤ 5 %	Low 6-10 %	Fair 11-20 %	Good ≥ 21 %
1.	Wukari	93	05	02	-	-
2.	Takum	94	04	02	-	-
3.	Ussa	96	04	-	-	-
4.	Donga	95	04	-	-	-
5.	Ibi	98	02	-	-	-
	Average (%)	**95.40**	**03.80**	**0.80**	**-**	**-**

Table 8. Availability and Accessibility of fertilizer; average Response in Percentage (%)

No.	Local Government Area	Not Available	Available not Accessible (Small Quantity + High Cost)	Available + Very Accessible (Cost Indifference)
1.	Wukari	10	82	08
2.	Takum	10	85	05
3.	Ussa	20	78	12
4.	Donga	20	78	13
5.	Ibi	20	77	03
	Average (%)	**16**	**79.80**	**06.20**

Table 9. Average response, in percentage (%), to yield of improved varieties used

No.	Local Government Area	Did not use	Poor yield lower than local variety	Poor yield better than local variety	Good yield
1.	Wukari	78	05	12	05
2.	Takum	82	04	09	05
3.	Ussa	82	07	09	02
4.	Donga	81	11	07	01
5.	Ibi	85	09	05	01
	Average (%)	**81.60**	**07.20**	**08.40**	**02.80**

Table 10. Level of Satisfaction with present farming techniques and methods; average response in percentage (%)

No.	Local Government Area	Very unsatisfied wish to leave if there is option	Very unsatisfied but wish to stay on	Fairly satisfied	Satisfied
1.	Wukari	45	30	22	3
2.	Takum	41	32	23	3
3.	Ussa	47	35	18	4
4.	Donga	44	35	17	4
5.	Ibi	37	38	20	5
	Average (%)	**42.80**	**34**	**20**	**03.80**

The accessibility of machine aggregate due to the factor of inadequacy of supply against demand is also very low, about 0.60 % said machines are very hardly accessible as against 99.40 % who said aggregates are not

accessible. And according to non-accessibility due to frequent breakdown of any available aggregate during operations, 99.20 % said the machines are hardly available, 0.80 % said that aggregate are available but not reliable.

Where simple mechanical aggregate is available for work, the very few farmers that are able to access them are not satisfied because of the poor quality of work done compared to the money paid. This is about 97.40 % while the remaining 2.60 % are only fairly satisfied. Table 6 shows the response to the factor of bad quality of work but satisfied because huge part of tillage drudgery is removed. About 63.60 % are not satisfied 34 %, fairly satisfied and only 2.40 % said they are satisfied. The reasons given are that they spend huge money and also have to still do much work to be able to have better planting field. On the impact of the use of machines in their farming activities, about 95.40 % responded that machine has not influenced or impacted their farming activities while 3.80 % admitted it has impacted less than 5 % and 0.80 % responded that they enjoyed low impact of 6 – 10 %..

Availability and use of fertilizers and other chemicals are essential requirements for meaningful mechanization. An average of 16 % of farmers in the study area responded that fertilizers are not available, 79.80 % said they are available but not accessible because of the short/small supply and high cost while 6.20 % said fertilizers are available and very accessible because they are indifferent to the cost at which the products are offered. Availability and use of improved variety of crops and species of animals is another essential requirement for meaningful mechanization. In table 9, the average response of 81.60 % do not use improved varieties/species, 7.20 % said they used improved varieties but got lower yield than the local varieties, 8.40 % said they got poor yield though better than the yield of local varieties while the remaining 2.80 % said the yields they got were good.

Table 10 presents the average response with level of satisfaction with the farming system (techniques and methods) currently available to them. About 42.80 % responded that they are very unsatisfied and would wish to leave farming if they have options better that the difficulties city life offers illiterate migrants from rural areas, 34 % responded they are very unsatisfied but wish to remain on the farming because it is what they grew to learn in practice from their parents (ancestors), and difficult living in the cities for illiterate migrants from rural areas, 20 % said they are fairly satisfied because they have no alternative while a meager 3.80 % said they are satisfied.

Flowing from forestated, it is obvious that the colossal amount of money governments in Nigeria have spent on skeletal and very limited farm mechanization have neither been properly managed nor has it inspired people to go into farming as prideful/satisfying occupation in Nigeria. It is not surprising, therefore, that the population of the candidates seeking admission into agricultural study in tertiary institutions (colleges and universities) has continue to drop every year that passes that today, majority of persons admitted into agricultural study are spill over from other science courses; and it is also not surprising that the population of farmers is rapidly declining and ageing in the study area in particular and Nigeria in general. Governments must act to change the ways they have been approaching agricultural development programmes, if food and basic raw materials shortage crisis is not to catch up with the country much earlier than one can imagine.

CONCLUSIONS

This study shows the South of Taraba State as an agriculturally rich environment where meaningful mechanization can be successfully implemented because of the favourable geographical conditions. The skeletal mechanization also referred to as "tractorisation" has wasted colossal resources of governments without impacting or having very low impact of less than 5% on the farming activities of vast majority of the rural farmers in Nigeria in general and the study area in particular. This has left the farming at subsistence or at best semi-subsistence which

has not given the farmers labour, material and social satisfaction. This must not be allowed to continue. And in the words of former Nigerian Head of state (1976 – 79) and former present (1999 – 2007), Retired General Chief [5]: in "1999 most people grossly under-estimated the extent of social, political and economic decay of the country. Nigeria has immense potential waiting to be unleashed and talents to be tapped. We all look forward to a better future and we all have a role to play in it. If everyone plays it well, Nigeria will surely be great and soon".

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ANALYSIS OF THE ELEMENTS OF THE PRODUCTION COSTS

Daniela SIMTION

Lucian Blaga University, Faculty for Agricultural Sciences, Food Industry and Environmental Protection, 7-9, Dr. Ion Raţiu, Sibiu, Romania, Mobile: +40721435221, Email: simtiondaniela@yahoo.com

Corresponding author: simtiondaniela@yahoo.com

Abstract

Classical methods for calculating costs underlay the organization activity of measuring costs and have maintained due to the existence of basically the same technical, technological and organizational production structures. Of course, technical progress has brought a number of changes in the productive structure, this is the reason due to which the classical methods of calculation have evolved while preserving their essence and becoming basic methods of cost management. This paper present a study case regarding analysis of the items of production costs in order to set the strategy of the company for reducing production cost.

Key words**:** *cost, production, expenses, incomes, result*

INTRODUCTION

Cost analysis represents an important area in the effective functioning of the enterprise in conditions of limited resources, its task consists in supplying the information required by managers in order to develop strategic decisions.[2]
The relative cost position of a company is dependent on "the forces driving significant cost" [3]. "The measuring function of expenses necessary in order to obtain production and the correlations that may arise between efforts - costs and effect - produced goods. Through this function, cost expresses its character of important economic quality indicator. [1]

MATERIALS AND METHODS

In order to analyze the cost elements and the production cost, we have studied data from the annual financial statements of SC "BETA" SRL whose main activity is printing standard and untyped prints, the production of this firm consists of printed sheets.
The analysis of company indicators is being realized based on "The profit and loss account" that allows determining the final outcome of the activity by measuring the effect reflected in net turnover with the effort reflected in the costs of consumption of material resources and manpower. "The profit and loss account" brings together over a given management period all economic flows that generate revenue (as a source of enrichment) and expenses (as a source of impoverishment).

RESULTS AND DISCUSSIONS

Material expenses and other direct material expenses, direct wage expenses and indirect expenses are those components of cost of production whose evolution over the analyzed period 2013-2015 is presented in Table 1.
The largest share in the production cost structure have material and other direct material expenses for the entire period taken into account, recording the following values: in the fiscal year 2013 the level of 70.51% was above average with 7.53%, in 2014 it registered a value of 66.02%, which was below average by 3.38%, reaching in 2015 62.04%, close to the average of the three years analyzed by 62.98%.
We note that the company followed constantly to reduce material costs by modernizing and upgrading production (purchase of modern machinery), which led to lowering expenses determined by the loss through scraps recorded by the manufacturer.

The rate of direct wage expenses on production cost reached in the analyzed period an average value of 14.01%. In the years 2013 and 2015, the rates have recorded values below the average value, respectively 13.12% and 13.70%, in contrast to 2014 when the rate has reached the value of 15.09%, higher than the average of the period by 1.08 %. Even if turnover and production cost have evolved proportionate in the three years, the share of direct wage costs in the production cost has increased in 2014 compared to 2013 by 1.97% due to the higher number of directly productive employees from 25 to 32 (28%) and is higher than in 2015 by 1.39%, but the reason behind this high value was the protection and social security policy, which had as an objective reducing the employer's contributions in 2015.

Table 1.The production cost elements

Nr. crt.	Indicators	Period			Average value
		2013	2014	2015	
1	Net turnover	13,858	20,840	34,634	23,111
2	Material expenses and other direct expenses	6,560	9,378	14,569	10,169
3	Direct wage expenses	1,221	2,144	3,218	2,194
4	Indirect expenses	1,524	2,683	5,697	3,301
5	Production cost	9,305	14,205	23,484	15,664
6	Gross profit related to net turnover	4,553	6,635	11,150	7,446
7	Administrative and distribution expenses	557	762	2,019	1,113
8	The exploitation result	3,996	5,873	9,131	6,333
9	(Full) Commercial cost	9,862	14,967	25,503	16,777
10	Commercial rate of return	28.84	28.18	26.36	27.40
11	**The weight of the cost elements in the production cost**				
	Material costs and other direct expenses / production cost	70.50	66.02	62.04	64.92
	Direct wage expenses/ production cost	13.12	15.09	13.70	14.01
	Indirect expenses/ production cost	16.38	18.89	24.26	21.07
	TOTAL	100,00	100,00	100,00	100,00

Further we explore the direct wage expenses. If we apply the lowest rate of 13.12% to the average production cost for the three years analyzed (15,664 thousand lei) an estimate of the direct wage expenses would be 2,055 thousand lei, instead of an actual of 2,194 thousand lei with a shortfall of 139 thousand lei or in percent 6.8%.

If we apply the highest rate of 15.09% to the average production cost for the three years, the result would be 2,363 thousand lei, which means a plus of 169 thousand lei or 7.16% over the real direct wage expenses. This indicates that the lowest estimated rate would be below 6.8% and the highest rate would lead to an increase of 7.16% of the production costs. These factors represent the maximum limit in the use of calculating rates in the estimation/ planning process based on existing data.

Analyzing indirect expenses as they appear in the table, we determined their average rate on the production cost of 21.07% for the period of three years. We note that in the first two years analyzed developments have not increased dramatically compared to 2015 when the share was 24.26%, being with 3.19% above the average. If we analyze the indirect expenses of the financial year 2015, we see an increase in depreciation expenses due to the acquisition of tangible assets according to the modernization and refurbishment production policy.

The lowest rate was with 4.69% below the average period, and the highest rate was with 3.19% above average.

Analyzing the relationship between indirect expenses incurred over a period of three years and the total production cost in the relevant period of time provides management with a basis to design indirect expenses as a percentage of the total cost if that value is predicted in advance and overall as a share sales; if indirect expenses are budgeted (planned) in detail (which takes place before finalizing the budget), then the total budget of indirect expenses can be compared with historical experience, as a percentage of the production cost for determining the allowable character based on the past.

Considering these two points of view

regarding indirect expenses, we can say that determining the rate indicates management:
• if the rate is too high related to the market (or possibly too low);
• usefulness in predicting and fixing the price for the products / contracts;
• main items to be revised in the budget plan of indirect expenses;
• controls are needed for certain indirect expenses;
• projections of indirect expenses available within operational objectives.
The objective of using the rates of indirect expenses is to determine their usefulness in cost analysis, to determine and establish variations compared to the planned budget for indirect expenses and their cause, and to provide a realistic basis for planning future indirect expenses.

CONCLUSIONS

Information obtained from cost analysis are used in developing company strategy. The strategy of domination through costs is the most widespread of all strategies at microeconomic level. The aim of this strategy is determining a lower cost and therefore finding those ways of achieving savings in the costs field.

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THE POSITION OF AGRICULTURE, AGRO-FOOD SYSTEM AND NATIONAL ECONOMY

Daniela SIMTION

Lucian Blaga University, Faculty for Agricultural Sciences, Food Industry and Environmental Protection, 7-9, Dr. Ion Raţiu, Sibiu, Romania, Mobile: +40721435221, Email: simtiondaniela@yahoo.com

Corresponding author: simtiondaniela@yahoo.com

Abstract

Modernization of agriculture had the effect of income transfers to other sectors and the boost of overall economic development but also led to a relative decline of agriculture in favour of the food industry. The industrialization of agriculture was realized by increasing inputs from industry through the expansion and generalization of industrial production processes in many agricultural activities. Gradually the share of intermediate consumption and capital per active person in agriculture has increased. For example the total industrialization of pig and poultry farming, as a result of the production of compound feed, a starring role in this process have the upstream industries from agriculture and the technical - commercial services. Food industry based on scale economies have developed and diversified as a result of major investments, food technologies were adapted to the new nutrition models thus diversifying food products and satisfying the demands of mass distribution. Food industry has grown at a different rate from that of agricultural production, as a result of the evolution of consumer demand and consumer behaviour, corresponding to the growth of their incomes. So from a simple activity of processing agricultural products, food industry has become an industry that produces more and more developed food products which highly increases added value compared to agriculture.

Key words**:** *agriculture, gross domestic product, incomes, market economy, trades*

INTRODUCTION

Definitions and characteristics of the agricultural activity are also contained in the International Financial Reporting Standards (IFRS) [9], namely IAS 41 Agriculture.
According to IAS 41, Agriculture, agricultural activity represents the management made by an entity of the transformation of biological assets in order to sell in agricultural production or additional biological assets.
Agriculture in modern economies is more and more being approached as a component of the food sector, and this in turn as an important component of the national economy. Modernization of agriculture had the effect of income transfers to other sectors [5] and the boost of overall modernization.
In advanced economies, agricultural exploitations, food industry and distribution of food products enterprises are dependent on each other in the process of organizing the market and increasing economic efficiency. As technological modernization is happening, they establish strong links with upstream enterprises producing technical means and other inputs. [6] Thus the process of food sector integration is being developed, at branch, activity sector, national, regional level based on the increase of economic globalization worldwide.
Trade liberalization, increased geographical area of free markets following the collapse of the communist bloc [3] led also to the internationalization of agricultural markets and diversification of foreign trade with agricultural products. Thus it occurred and continued a process of rapprochement between different forms of organization of food economies created throughout history in different countries.
As an effect of general economic modernization agro-food systems know fundamental changes at national level the present effect being a decline of agriculture's place in modern economies, an objective process in the efforts to increase economic and social efficiency.

In developed countries agriculture occupies a small share in GDP and in employed labor force, but its contribution to gross fixed capital formation, superior to the two indicators, shows the important role played in overall economic development and in the formation of modern agro-food system.

Instead the share of agriculture in employed population, higher than its share in GDP, shows a lower economic power and a weak position of farmers on the market in order to impose a higher level of prices for agricultural products than those of industrial products and services.

MATERIALS AND METHODS

The relative decline of agriculture in modern economies and the implications of this are discussed in detail by Letitia Zahiu. *The processing activities and services in the final amount of food products have high shares in developed countries and in those with developing economies the largest percentage is held by agriculture. The increase of population incomes produces structural changes at the demand level for food consumption of the population. Gradually there is an increase in the demand for highly industrial processed food products and organic products, as well as public access to various services, in particular serving meals outside their homes.* [7]

The French economist Louis Malassis provides a clear delimitation of the agro-food economy, the food economy, the agricultural economy and the rural economy:

Agro-food economy includes all activities which contribute to achieving the food function in a given society. There are seven sectors involved: agriculture; agricultural and food industries, agricultural and food distribution, restaurants, industries and services offered (which provide to the agro-food sector, the intermediate consumption and equipment necessary for their operation), international trade and also socio-economic units of consumption.

Food economy focuses the activities related to meeting the nutritional needs manifested through the ratio between biological needs and capabilities to access food, in parallel with the food offer and the capacity offer. The whole of this field can represent also a finality of the agro-food economy.

Agricultural economy deals with a branch economy, having as a sphere of connected activity related to the extent of their importance, the upstream and downstream branches, including also the intermediary activities and having priority openness towards rural economy.

Rural economy, a much broader field which includes all economic processes, their social extra-economic connotations deployed in the rural perimeter and especially in rural communities. Agriculture generally represents the main rural activity.

Agro-food economy is dependent on the level of general economic development of the given society, on the food policies, the state of agriculture and the development of agrarian structures, on the economic and social processes in rural communities.

There are three types of agro-food economy:

1. *agro-food agricultural economy;*
2. *agro-food transition economy;*
3. *agro-industry.*

These types of agro-food economy are found in different historical stages and in different combinations, demarcation criteria are:

- The share of agriculture, the processing and distribution activity in the final goods amount;
- The share of agriculture in the value added structure on the three sub-sectors;
-The share of agriculture in final consumption and in external trade etc.

In determining indicators of value creation with major significance in their company activity, **value added** is the basic element, since it presents many facets in order to measure and evaluate performance.

As a measure of **which the enterprise adds to the economic cycle via its activity, by using the production factors, namely the contribution of value added created by the enterprise** this indicator is being used to assess the size and structure of production.

The added value is a result of combining the production factors; it is the source of their remuneration and their behavioral

determinant, ensuring the maintenance of the enterprise on the market.

The basic indicator used in the analysis in order to determine the added value consists in the production of the exercise, given that the activity of the enterprise during the exercise is represented by the production of the exercise for which it has used external services in the form of various intermediate consumptions. The difference remaining after deducting these consumptions from the achieved production during a financial year represents the part of production that finds its origin in the operation of the organization by the contribution of the production factors and it represents *the produced added value*. [4]

The main methods used to determine the added value are: the subtractive method and the additive or analytical method.

a) Through **the subtractive (synthetic) method** value added is being calculated as the difference between the production exercise (Pex) plus the trading margin (Mc) and the inputs coming from third parties (Ci): **Vad = Pex + Mc-Ci** calculated based on this method, the value added is placed between purchases (upstream market) and sales, being the measurement instrument of the enterprise's autonomous means of action that characterize more accurately than turnover, the company's performance.

Calculating the value added according to the subtractive method with the difference: Vad = (Pex-Ci) + Mc has the advantage of highlighting the correlations that should exist between the dynamics of the production year and the dynamics of the material and energy costs reflected in the material expenses that are favourable to the growth of the value added:

►The exercise production should grow faster than material expenses;

►With the same material expenses to obtain a larger production;

►At the same production volume material expenses should be reduced.

Thus the share of value added in the exercise production is even greater than the intermediate consumptions have a lower share.

b) **The additive (analytical) method** involves an opposite approach in the sense of encapsulating the structural elements of the new created value:

► Staff expenses (Chp);
► Taxes without VAT (I);
► Financial expenses (Chf)
► Amortization and adjustments for the depreciation of fixed assets (Ai), other operating expenses (with the decrease in records of the fixed asset, damages, others) and the net result (Rn) Vad = Chp + Che + I + Ai + Rn.

Eliminating amortization and adjustments related to the depreciation of assets we obtain **the net added value**.

RESULTS AND DISCUSSIONS

In judging the degree of integration of the company, the ratio between added value and the exercise production is an indicator reflecting the dependence or independence of the enterprise towards the external social economic environment. Basically the closer the value of this ratio is to 1, the more is the company vertically integrated.

In developed countries the new created value resulting from agricultural activity has a lower share in the final value of goods respectively of the obtained revenues compared to the other two sub-sectors, processing and distribution. Modernization of agriculture had the effect of income transfers to other sectors and the boost of overall economic development but also led to a relative decline of agriculture in favour of the food industry. Thus in the final amount of food products, the processing activities and services have high shares in developed countries and in those with developing economies the largest percentage is held by agriculture.

If in the state of food agricultural economy the spill over effects of the agro-food sector are low, in the agro-industry stage these effects are important because of its integration in the national economy. In the agro-industry stage the final demand multiplier of the food sector is high, which has a direct effect on agriculture which produces about 80% of intermediate consumptions of the agro-food system.

Agro-food firms, small in number, but with significant turnovers, have expanded in recent decades being organized as groups of companies dependent on a parent and technology control company based on patents and licenses (for eg. Danone, Hochland, Friescland Group etc.) [2].

Such private companies are less specialized in the agricultural field (livestock, intensive production of fruits and vegetables) and especially integrating agricultural production with processing and sale (vertical integration). It often uses the labor of small farmers and the production of peasant households or family farms, which they integrate based on delivery contracts (for eg. Danone in Romania).

In Romania, agriculture is still one of the most important branches of the Romanian economy. [1] Romanian rural economy dominated by agriculture, is still poorly integrated into the market economy.

Contribution of agriculture in gross domestic product is about 5%, while their contribution to GDP other EU countries is approximately 1.7%. [8]

The share of agriculture in GDP has declined in recent years by at least 15 percentage points. Thus, if in 1995 the share of agriculture in GDP was about 18%, today its share has reached 4-5%, according to Eurostat.

The decrease in share of agriculture in GDP was due on the one hand to the decrease of population's and investors' interest to activate in the field as a result of lack attractiveness through the correlation effort-result, and the effort to cope with the fierce competition of agro-food products coming from the EU market which are heavily subsidized, failure in implementing rural development programs.

In terms of total value, agriculture, forestry and fish have contributed in 2015 with the amount of 24,018.4 million lei, going down from the level recorded in 2014, namely 31,582 million lei, according to MADR.

Romania's agriculture contribution to GDP has always been high, Gross Added Value (GAV) of agriculture has represented 6,45 % from GDP and 7,2 % from the total GAV [8].

Tabel 1. The share of agriculture, forestry, hunting, fishing and fish in the GDP in evolution.

Year	1995	2000	2001	2004	2007	2011	2012	2013	2014	2015
% from GDP	18.1	10.8	13	12.5	4.8	6.4	4.7	5.4	4.4	4.6

Source: MADR, 2016

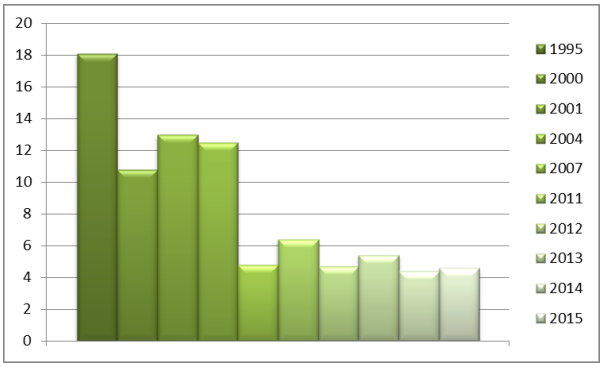

Fig.1.Evolution of the share of the GDP created in agriculture forestry, hunting, fishing and fish in Romania's GDP

Source; Own design based on MADR data, 2016

But even in these circumstances, it is still low considering the resources unused and reported to the share of employed population in this area (34%) reflecting unemployment and low labor productivity.

Due to the fact that most rural inhabitants are self-employed in agriculture, productivity and average incomes continue to remain low, as indicated by the share of employment compared to this sector's contribution to GDP.

Lack of competitiveness is reflected in low production, low economic growth and a deficit of the agro-food trade balance as agriculture and food industry fail to keep pace with increasing demand for food, driven by a rapid overall economic growth and which can not cope with foreign competition, especially that in the EU.

CONCLUSIONS

Although Romania has been one of the countries in Central and Eastern Europe which recorded the smallest decline in agricultural production since the beginning of the transition period, however, as a branch of the national economy agriculture is declining.

In the past years Romanian agriculture has suffered greatly because of the inability to cope with adverse weather conditions.

During the whole transition period, agriculture has played a very important social role, acting as an occupational "buffer" against socio-economic effects of the transition, absorbing a significant part of the workforce dismissed by urban industries.

Romanian rural economy, mostly dominated by agriculture, is still poorly integrated into the market economy. In today's market economy, the welfare of rural and urban citizens, as well as the welfare of farmers depends on the way marketing techniques are being understood and applied.

In the first year of transition GAV from agriculture has registered an inferior decline than the one in industry, but in 2000, the industrial sector had a continued growth, while the agricultural sector has fluctuated significantly due to vulnerability to droughts.

The structural changes that have occurred during the transition period have turned Romania into an importer of food products. Livestock numbers fell drastically during the transition period. Abolishing or privatizing agricultural cooperatives and state farms have resulted in the emergence of significant structural changes. Unable to use the former intensive production units, small farmers have relied mainly on animal breeding mainly for self-consumption.

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MAIN TENDENCIES IN THE LABOR MARKET IN THE CENTRAL REGION OF ROMANIA

Elena SOARE, Irina-Adriana CHIURCIU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, Zip Code 011464, Bucharest, Romania, Phone: +40213182564, Fax: +40213182888, Emails: soare.elenausamv@gmail.com, irina.chiurciu@yahoo.ro

Corresponding author: soare.elenausamv@gmail.com

Abstract

The paper presents and analyzes the main trends on the labour market manifested in the Central Region. The period on which this analysis is focused is 2010-2015. To capture a more realistic development of the employment in the Central Region were analyzed several indicators, such as labour resources; civilian labour force; activity rate of labour resources; employed civilian population; average number of employees; the number of unemployed and the unemployment rate. The analysis of specific indicators of the labour market recorded oscillations from year to year. It is noted that, in 2015, both nationally and at Central Region level resources have declined compared to 2010, with over 11%. A positive aspect is the unemployment rate decreased in 2015 compared to 2010. The statistical data which led to the realization of this study were taken from the national websites.

Key words: *labor resources, employed civilian population, average number of employees, unemployment rate, Central Region, Romania*

INTRODUCTION

Central Region of Romania is located in the South-Eastearn part of the European Union. The Central Region is well positioned geographically as it intersects with six regions. This region consists of the following counties: Alba, Brasov, Covasna, Harghita, Mures and Sibiu. It must be recalled that due to mountainous terrain in some areas of the Central Region of Romania there are difficulties in terms of economy, social and territory [4].

After 1990, there were significant socio-economic transformations in Romania, who have made their mark on the evolution and structure of the workforce. In the developing regions of Romania's labor market was expressed differentially, depending on many factors.

In the Central Region in 2010-2015, the indicators characterizing the labor market have evolved differently from one year to another. According to studies published on the labor market in the Central Region, differences persist between residential environments. In urban areas, the overall rate of activity and the activity rate of the working age population, are higher compared to those recorded in rural areas.

This is due mainly in urban areas where there is a large number of companies, which turns on in various industries and addressing both internal and external markets.

In the Central Region, in terms of sectoral composition of the workforce have been noted some changes in the sense that the construction sector and services have developed and the primary and secondary sectors have limited activity.

In the analyzed period, the Central Region has managed to attract a lot of investments that have led to job growth in this region. It must be remembered that attracting investment contributed directly to the concentration of labor in big cities [3].

Many of the jobs newly created address people with higher education and highly qualified. In a territorial plan, substantial differences between counties in the Central Region, in terms of employment levels [5].

Brasov county is the leader in terms of average number of employees due to industrial restructuring by retraining and attracting investments[11].

MATERIALS AND METHODS

In order to accomplish this work, a number of specific labor market indicators were analyzed, such as labor resources; civil active population; activity rate of labor resources; civilian employment; average number of employees; the number of unemployed and the unemployment rate. Statistical data and information needed for the analysis of the labor market in the Central Region were taken from the National Institute of Statistics; Ministry of Regional Development and Public Administration; National Agency for Employment and the National Commission of Statistics. In order to accomplish this work was consulted a number of specialty materials.

RESULTS AND DISCUSSIONS

Starting with 1990, Romania was marked by deep socio-economic transformations that have made their critical mark on the evolution of labor nationally and regionally.

It requires, to mention a few specific features of the labor market:

-In the short term, the demand for labor does not change, because creating jobs involve extending existing sectors and the emergence of new sectors;

-The job offer impacts the satisfaction mode of the labor demand;

-The job offer is formed in a certain period of time;

-The low level of labor mobility;

-The job offer is determined on one hand of a number of economic factors and, on the other hand is influenced by: people psychology; health status; age, etc;

-Heterogeneity of labor supply and demand [8].

The labor market is a very sensitive market registering changes in this market which occurred due to changes on other markets. Because labor is a factor of production, it generates a series of specific traits of supply and demand [2].

In Table 1 it is presented the evolution of labor resources, both in Romania and in the Central Region in 2010-2015.

In general, labor resources reflect the part of the population that has all the physical and intellectual capacity that allows it to perform useful work in a sector of the national economy. It must be remembered that, labor resources include more specific components: population of working age; fit to operate and persons under and over working age who work [12]. From the data presented it can be seen that the labor resources in Romania, in the period 2011-2015 were within a downtrend. In 2011, nationwide there were the largest labor resources (14,047.7 million people). Labor resources recorded an insignificant increase in 2011 compared to 2010. Nationally, there was a decrease of labor resources in 2015 (-11.2%) compared with 2010.

In the Central Region, in the analyzed period labor resources have followed a downward path. 2010 was highlighted by having the largest labor resources (1,669.4 thousand people). In 2015, we notice a decrease of labor resources by 11.4% compared to 2010. Central Region in 2015 held a share of 11.8% of the labor resources of Romania.

At county level, in 2015, there was a decrease of labor resources compared with 2010.This decrease of labor resources, ranged between 10.0%-15.8%.

Mures and Brasov counties hold the most important labor resources in the Central Region. In 2015, Brasov County held a share of 25.4% of the labor resources of Central Region and 2.8% of the labor resources of Romania.

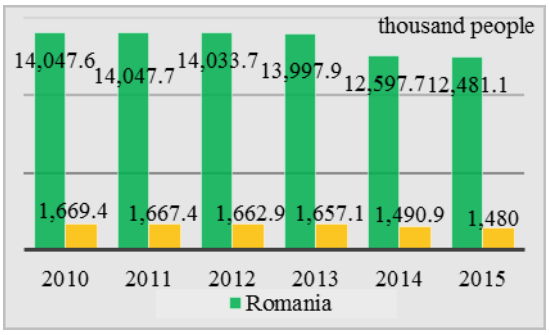

Fig. 1. Dynamics of labor resources in Romania and Central region

Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12].

Table 1. Employment developments, nationally and in Central Region between 2010-2015 (thousand people)

No.	Specification	2010	2011	2012	2013	2014	2015	2015/2010 (%)
1.	Romania	14,047.6	14,047.7	14,033.7	13,997.9	12,597.7	12,481.1	88.8
2.	Central Region	1,669.4	1,667.4	1,662.9	1,657.1	1,490.9	1,480	88.6
3.	Alba	244.3	243.4	242	240.3	208	205.8	84.2
4.	Brasov	415.9	413.4	410.9	408.4	357.5	356.4	85.6
5.	Covasna	145.9	145.3	144.6	144.2	130.8	129.3	88.6
6.	Harghita	209.9	210.6	210.3	209.9	195.6	193.7	92.2
7.	Mures	371.8	371.7	372.3	372	343.8	341.1	91.7
8.	Sibiu	281.6	283	282.8	282.3	255.2	253.7	90.0

Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016 [12]; own calculations .

Civil active population of Romania is the potential of potential demand and employment for the population. Civilian labor force includes two components: the employed population and the unemployed who are registered [12].

Table 2 provides the evolution of civil active population registered in Romania and in the Central Region in 2010-2015.

Table 2. Active civilian population trends, nationally and in the Central Region, during 2010 – 2015 (thousand people)

No.	Specification	2010	2011	2012	2013	2014	2015	2015/2010 (%)
1.	Romania	8,998.3	8,826.5	9,063.4	9,042.9	8,910	8,776.8	97.5
2.	Central Region	1,089.3	1,071.8	1,109.4	1,110.6	1,086.7	1,076.9	98.8
3.	Alba	174.3	171.3	178.3	181.8	172.1	168.6	96.7
4.	Brasov	245.8	241.5	249.9	253.5	251.4	253.3	103.0
5.	Covasna	89.7	89.6	91.4	89.8	88.7	88.3	98.4
6.	Harghita	145.2	141.2	145.5	144.3	138.8	136	93.6
7.	Mures	247.9	243.6	250.7	246.9	244.2	236.9	95.5
8.	Sibiu	186.4	184.6	193.6	194.3	191.5	193.8	103.9

Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12]; own calculations .

Period 2010-2015 is characterized by active civil population decrease both nationally and in the Central Region.

In the analyzed period differences between counties in the Central Region are remarked, in terms of registered civil active. In 2015 compared to 2010, there were increases in Sibiu (+3.9%) and Brasov county (+3.0). By 2015, the largest civil active population is registered in Brasov (253.3 thousand people). Covasna County recorded the lowest civil active in the analyzed period. In this county, civil active population suffered a drop of 89.7 thousand people (2010) to 88.3 thousand people (2015).

This reduction registered in the Central Region is lower compared to the one recorded nationally during the same period.

Nationally, civil active population was reduced from 8,998.3 thousand people (2010) to 8,776.8 thousand people (2015) (Fig.2).

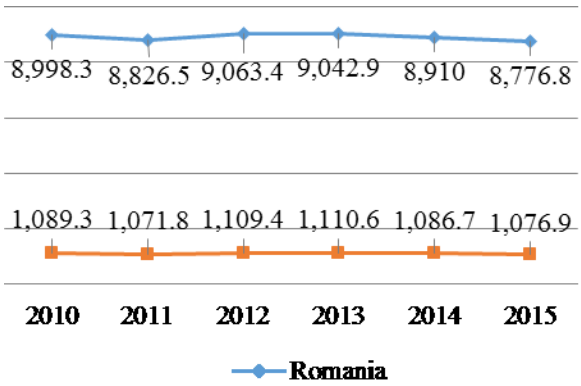

Fig. 2. -Active civilian population dynamics in Romania and in the Central Region, 2010-2015
Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016 [12].

In Romania, in 2015, the civil active population was reduced by 2.5 percentage points compared to 2010.

Central Region in the period under analysis, reveals a differential evolution from one year

to another. In 2015, it is noticed an active civil population decline by 1.2 percentage points compared to 2010.

By 2015, in the Central Region is observed that the civil active population accounts 12.2% of the registered civil active population nationwide.

Table 3 presents the activity rate of labor resources nationally and in the Central Region in 2010-2015. Activity rate of labor resources is determined as the ratio of Active civil population and labor resources. Activity rate of labor resources is expressed as a percentage [12]. Nationally activity rate of labor resources has often varied from year to year, in the analyzed period. This rate ranged between 62.4% -70.7%. The highest rate of activity was recorded at national level in 2014 (70.7%).

In the Central Region, between 2010-2015, we see a differentiated evolution of the activity rate of labor resources. The lowest rate of activity was registered in 2011 (64.3%), while the highest was recorded in 2014 (72.9%). In 2015, we have an activity rate of labor resources by 72.8% higher compared to 2010 (65.3%). It is imposed to emphasize that in the analyzed period, in the Central Region, the activity rate of labor resources is superior to that accomplished nationwide.

From the data presented, it stands differences between counties in the Central Region, in terms of activity rate of labor resources in 2010-2015. The highest rate of activity was recorded in Alba county. In this county, the activity rate ranged between 70.4% -82.7%. In 2010-2012, in Brasov county, it stands the lowest rate of activity. By 2015, in Brasov, the activity rate of labor resources has increased, reaching 71.1%, which resulted in placing on the third place, after Alba and Sibiu.

Table 3. The evolution of the activity rate of labor resources, nationwide and in the Central Region during 2010-2015 (%)
Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016 [12].

No.	Specification	2010	2011	2012	2013	2014	2015
1.	Romania	64.1	62.8	64.6	64.6	70.7	70.3
2.	Central Region	65.3	64.3	66.7	67	72.9	72.8
3.	Alba	71.3	70.4	73.7	75.7	82.7	81.9
4.	Brasov	59.1	58.4	60.8	62.1	70.3	71.1
5.	Covasna	61.5	61.7	63.2	62.3	67.8	68.3
6.	Harghita	69.2	67	69.2	68.7	71	70.2
7.	Mures	66.7	65.5	67.3	66.4	71	69.5
8.	Sibiu	66.2	65.2	68.5	68.8	75	76.4

The evolution of occupied civilian population nationally and in the Central Region in 2010-2015, it is presented in Table 4 (fig.3). According to the balance of labor the employed population is: all persons who have an occupation that generates income, which performs regularly in one of the activities of the national economy; people who are enclosed in an economic or social activity based on a labor contract or independently in order to achieve income [12].

The employed population nationwide in 2010-2015, has fluctuated from year to year. In 2015,

civilian employment has diminished very little (-0.4%) compared to 2010. The year 2012 is distinguished by the highest number of civilian employed population (8,569.6 thousand people).

In the Central Region, in the analyzed period we are witnessing a civil employed population oscillation from one year to another. In 2015, in this region we are witnessing a civil employed population growth by 2.4 percentage points compared to 2010. By 2015, Central Region accounts a share of 12.3% of the employed civil population nationwide.

In counties in the Central Region, reveals a different pattern of civil employed population

from year to year. In 2015, Brasov County recorded the highest civilian employment in the Central Region. Brasov County, in 2015, held a 23.7% share of total employment in the Central Region civil and a share of 2.9% of total employment nationwide existing civil.

Table 4. The evolution of civil employment, nationally and in the Central Region during 2010-2015 (thousand people)

No.	Specification	2010	2011	2012	2013	2014	2015	2015/2010 (%)
1.	Romania	8,371.3	8,365.5	8,569.6	8,530.6	8,431.7	8,340.6	99.6
2.	Central Region	1,001.8	1,006.8	1,040.7	1,040.8	1,026.4	1,026.6	102.4
3.	Alba	156.8	158.1	163.4	163.3	159.6	159.2	101.5
4.	Brasov	228.1	229.2	237.6	241.7	240.5	243.6	106.7
5.	Covasna	80.7	81.9	84.4	83.2	83	83.2	103.0
6.	Harghita	132.4	132	134.9	134.2	130.5	128.5	97.0
7.	Mures	228.2	229	235.6	233.4	230.2	225.5	98.8
8.	Sibiu	175.6	176.6	184.8	185	182.6	186.6	106.2

Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12]; own calculations.

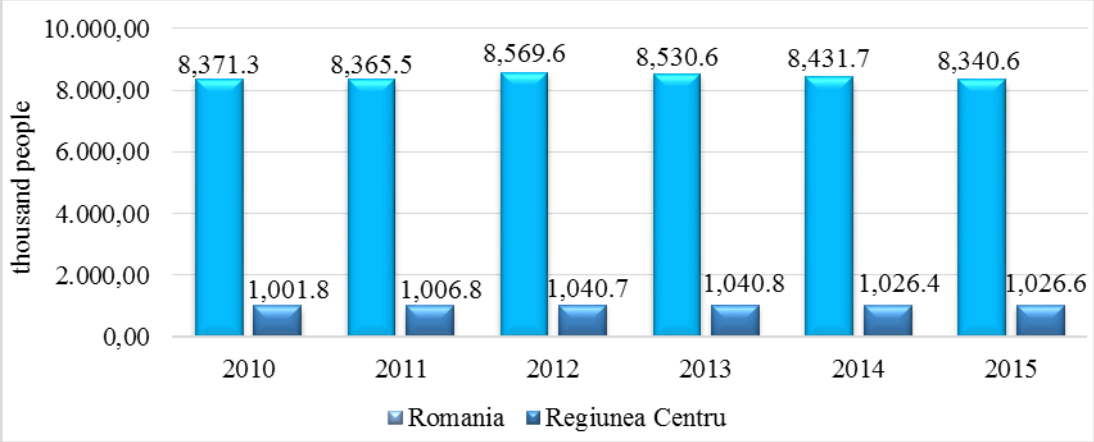

Fig. 3. - Occupied civilian population dynamics in Romania and in the Central Region, 2010-2015
Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12].

The average number of employees nationally and in the Central Region in 2010-2015, is presented in Table 5 (fig.4). In general, the average number of employees is made up of people who are employed by work contract / service report on a limited or unlimited period [12].

Table 5. Average number of employees, nationally and in the Central Region, during 2010-2015 (people)

No.	Specification	2010	2011	2012	2013	2014	2015	2015/2010 (%)
1.	Romania	4,376,044	4,348,739	4,442,865	4,443,554	4,507,729	4,611,395	105.3
2.	Central Region	544,191	546,445	567,851	573,807	579,874	590,125	108.4
3.	Alba	74,577	73,983	77,467	77,320	79,006	80,782	108.3
4.	Brasov	145,465	145,274	151,324	154,690	157,160	160,470	110.3
5.	Covasna	40,858	41,964	44,533	44,666	45,355	47,500	116.2
6.	Harghita	59,403	59,506	62,478	61,050	59,700	59,423	100.0
7.	Mures	114,826	114,551	115,815	11,7940	118,991	12,2045	106.2
8.	Sibiu	109,062	111,167	116,234	118,141	119,662	119,905	109.9

Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12;] own calculations .

In Romania, in the period under review, the average number of employees has changed from one year to another. In 2015, the average number of employees increased by 5.3% compared to 2010. Nationally, the highest average number of employees was recorded in 2015 (4,611,395 people).
In the Central Region, in 2015, we are

witnessing a rise in the average number of employees by 8.4% compared to 2010. In the year 2015, this region accounts 12.7% of the average number of employees registered nationwide. In 2010, it recorded the lowest average number of employees (544,191 people), and in 2015 was recorded the highest number of employees (590,125 people).

The average number of employees in the counties of Central Region have evolved differently from one year to another. Brasov County is the leader in terms of average number of employees in 2015 (160,470 people), followed by Mures county (122,045 people) and Sibiu (119,905 people). In contrast, we find lowest average number of employees in Covasna County (47,500 people) in 2015.

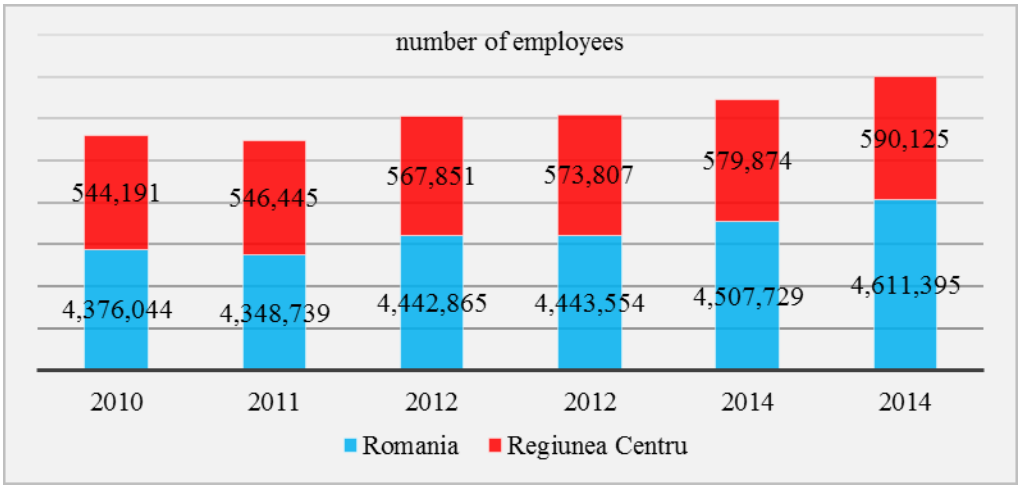

Fig. 4 Dynamics of average number of employees in Romania and in the Central Region, 2010-2015
Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12].

According to data published by the National Commission for Prognosis in Romania, the average number of employees per total economy will register an upward trend during 2017-2019, as follows: 4,925 thousand people (2017); 5,070 thousand people (2018) and 5,210 thousand people (2019). In 2019, the average number of employees per total economy will grow by 5.7% compared to 2017.

Regarding the evolution of the number of employees in the Central Region in the period 2017-2019, is forecast as follows: 645.0 thousand people (2017); 668.0 thousand people (2018); 690.0 thousand people (2019). The data expected, it may be noted that the average number of employees in the Central Region will grow in 2019 compared to 2017 [7].

Market economy is an economy marked on one side, a number of positive phenomena and on the other hand, negative phenomena. Unemployment is a negative phenomenon that affects some people of a country. Share of population affected varies from country to country, depending on a variety of factors. Unemployment specific market economy is a phenomenon that cannot be stopped, but the economic measures taken by the state can be controlled [1].

In Romania, due to socio-economic conditions, special attention should be paid to unemployment, especially through the development and implementation of programs that aim retraining. This conversion aims accomplishing the transfer of workforce will be redundant at a time without needing shift in unemployment [1].

In table 6 it is provided the evolution of the number of unemployed people in Romania and in the Central Region in 2010-2015. Nationally, the number of unemployed people had a different evolution from one year to another. The highest number of unemployed nationwide was recorded in 2010 (626,960 thousand people). In the Central Region, one can observe a decrease in the number of unemployed from 87,504 thousand people (2010) to 50,232 thousand people (2015) (Fig.5).

Table 6. The number of unemployed people, nationally and in Central Region, during 2010-2015 (people)

Specification	2010	2011	2012	2013	2014	2015	2015/2010 (%)
Romania	626,960	461,013	493,775	512,333	478,338	436,242	69.5
Central Region	87,504	64,959	68,656	69,915	60,251	50,232	57.4
Alba	17,506	13,228	14,924	18,557	12,508	9,394	53.6
Brasov	17,742	12,271	12,255	11,780	10,850	9,734	54.8
Covasna	8,959	7,690	6,981	6,613	5,746	5,048	56.3
Harghita	12,777	9,196	10,567	10,128	8,256	7,509	58.7
Mures	19,740	14,568	15,144	13,517	14,039	11,384	57.6
Sibiu	10,780	8,006	8,785	9,320	8,852	7,163	66.4

Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12]; own calculations.

This is due to the economic development of urban centers at the expense of investments in the Central Region, and a majority of the population migration in other countries. In all counties in the Central Region, the number of unemployed fell substantially in 2015 compared with 2010.

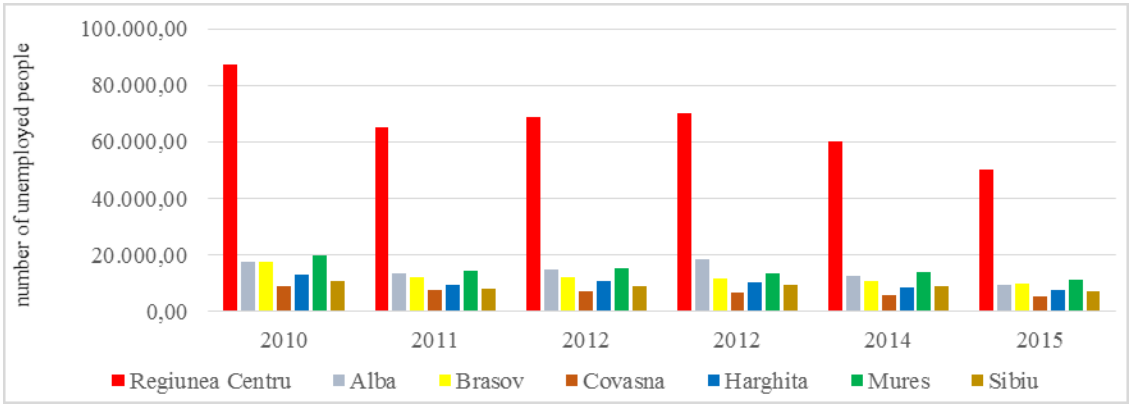

Fig. 5. Dynamics of unemployment in the Central Region, 2010-2015
Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016 [12].

In the period 2017-2019 is forecasted a drop in the number of unemployed, as follows: 430 thousand people (2017); 410 thousand people (2018); 405 thousand people (2019). This decrease in the number of unemployed will be recorded along with the increasing number of employees. In the Central Region number of employees will fit on a downtrend in the period forecasted as follows: 2017 (57 thousand people); 2018 (52 thousand people) and 2019 (51 thousand people). In 2019, in the Central Region will drop by 11.0% in the number of unemployed people as compared to 2017.

In Table no. 7, is presented the unemployment rate in Romania and in the Central Region in 2010-2015. It can be seen easily that the unemployment rate both nationally and also in the Central Region in the analyzed period has changed from one year to another. Nationally, in 2015, is observed a decrease in the unemployment rate compared with 2010. Another significant aspect for 2015 is the lowest level for the unemployment rate (5%) of the entire analyzed period. In the Central Region, the unemployment rate had fluctuated in the period under review. The highest unemployment rate was recorded in 2010 (10%) and the lowest in 2015 (4.7%). In 2015, the Central Region unemployment rate was below the average achieved nationwide. This situation demonstrates that, the Central Region is characterized by a higher investment degree compared to other regions. In the counties of the Centre Region there are differences in terms of the unemployment rate. The lowest unemployment rate was recorded in 2015 (3.7%), in Sibiu, and the highest rate was in Covasna, 5.7%. According to data from the National Forecast

Commission, between 2017-2019, the unemployment rate will be 4.7% (2017); 4.4% (2018) and 4.3% (2019). For the Central Region is projecting an unemployment rate of 4.5% (2017) and 4.4% (2018 and 2019).

Table 7. Unemployment rate, nationally and in the Central Region, during 2010-2015

Specification	2010	2011	2012	2013	2014	2015
						%
Romania	7.0	5.2	5.4	5.7	5.4	5.0
Central Region	8.0	6.1	6.2	6.3	5.5	4.7
Alba	10.0	7.7	8.4	10.2	7.3	5.6
Brasov	7.2	5.1	4.9	4.7	4.3	3.8
Covasna	10.0	8.6	7.6	7.4	6.5	5.7
Harghita	8.8	6.5	7.3	7.0	6.0	5.5
Mures	8.0	6.0	6.0	5.5	5.8	4.8
Sibiu	5.8	4.3	4.5	4.8	4.6	3.7

Source: http://statistici.insse.ro/shop/, TEMPO-Online, 2016, [12].

In Romania, for placing on labor market, persons who are registered at the National Agency for Employment benefit of customized package of measures, which directly contributes to stimulating employment [6].
Regional Operational Programme 2014-2020 provides for the development regions in Romania, stimulating investment, in order to simulate employment [9, 10].

CONCLUSIONS

After analyzing the labor market in the Central Region of Romania can be drawn:
-in 2015, labor resources have registered a decrease of 11.4% compared with 2010;
-civil active population was lower in 2015 compared to 2010;
- in 2014, it was recorded the highest rate of activity in the analyzed period;
-employed civilian population increased by 2.4% in 2015 compared to 2010;
-2015, this region has held a share of 12.7% of the average number of employees registered at national level;
-in 2015 was significantly reduced the number of unemployed in all counties in the region, compared to 2010;
-the lowest unemployment rate was recorded in 2015 (4.7%).
An important and positive impact on the economy of the Central Region is the fact that in 2019, the average number of employees will grow compared to 2015.

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THE LEPIDOPTERA PEST SPECIES (INSECTA, LEPIDOPTERA) ON CABBAGE CROPS IN THE VILLAGE SIBIEL (SIBIU COUNTY) ROMANIA

Cristina STANCĂ-MOISE

"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, Sibiu, Romania, Phone: 0040269234111, Fax: 0040269234111, E-mail: cristinamoise1@yahoo.com

***Corresponding author*:** cristinamoise1@yahoo.com

Abstract

This paper is only a part of one two years long study about the knowledge of parasitoide insects that control the populations of the Lepidoptera pest species on the cabbage crops in the inhabitants gardens from the village Sibiel (Sibiel county), Romania. They were analysed some aspects about biology, behaviour and ethology of the phytophagous lepidoptera species on the cabbage crops.The results could help in order to establish a monitoring methodology and management concerning the four Lepidoptera species identified in the cabbage crops: Pieris brassicae (Linnaeus, 1758), Pieris rapae (Linnaeus, 1758), Mamestra brassicae (Linnaeus, 1758), Autographa gamma (Linnaeus, 1758).

***Key words*:** *Lepidoptera, capturing, Pieris brassicae (Linnaeus, 1758), Pieris rapae (Linnaeus, 1758), Mamestra brassicae (Linnaeus, 1758), Autographa gamma (Linnaeus, 1758), Sibiel-Sibiu county, Romania*

INTRODUCTION

Pieris brassicae (Linnaeus, 1758), in the climatic conditions of our contry has 2-3 generations in one year [14]. The most numerous damages produced the larva in the second generation, one the autumn cabbage crops. The first butterflies appeared in Mai month, layed down their eggs in group of 50-100. Incubation last till 12 days and the larvar stage 25-30 days, with five times sheding their coats.

In July appeared the second generation of butterflies. Their larvas are major pests in July-August. The young caterpillars attacked in group the inferior face of leaves, gnawing at the epidermis and parenchim tissue; the older ones, in 3-rd and 4-th stages attacked the leaves first in the edge, then they nourished on whole leave, except the nervures. *Pieris rapae* in the studied climatic conditions has 3-4 generations in one year.

Mamestra brassicae [33, 34], has two generations in one year in our country. It attacked the leaves in the larvar stage and the caterpillars are green or gray. Because of their colour they were hided by green leaves of cabbage and they were more difficult to be identified [32, 35-38].

The caterpillars feeding on cabbage could make very extended large holes and so, the leaves became fade and died.

The caterpillars exceeded the larvar stages and they became whitish moths flying around the cabbage.

Autographa gamma is a bivoltin species [15] and hibernate in soil in the complet developed larvar stage or as a nymph or a caterpillar on II_{nd} or III_{rd} stage [13]. Being a poliphagous pest, it could attack not only cabbage but also rape, mustard, cauliflower, peas, beet and tobacco.

Larvas gnawing at the epidermis and parenchim tissue perforated the leaves in form of irregular holes. In case of an serious attack, all leaves could be destroyed. At cabbage, after ist complete development, the caterpillars penetrated inside and let their rests, excrementa and so it could no more be a commercial product [1-3].

The damages could be as much as 70-80%. In this paper I present some biological aspects of these species and also the ecological analysis of these studied lepidoptera populations.

MATERIALS AND METHODS

The observations and collecting the material of study were made during a period of two years: 2015-2016 on the cabbage crops in the different private property plots of the Sibiel village, Sibiu county, Romania (Foto 1). The species *Pieris brassicae* was signaled in 15 plots, *Pieris rapae* in 19 plots, *Mamestra brassicae* in 15 plots, and *Autographa gamma* in 11 plots.

During the period of two years of study they were investigated 547 plants. The Lepidoptera pest species were collected in the stage of eggs, in the larval stages 2-4 and nymphs. Their presence could be identified also on the base of specific parasitoids found on plants. In case of the eggs, the percentage of parasitized ones was of 34,2% at *Pieris brassicae*, 11,5% at *Pieris rapae*, 47,3% at *Mamestra brassicae* and 52,4% at *Autographa gamma*, so we mentioned only the number of possible hatched larvas.

During our investigations on field, the first stage of pest larvas was not collected, but the number of the specimens was noticed. The data obtained by collecting the material on field, were analysed, sinecological, being calculate the abundance, constance, dominance between the ecological analytical indicators and the index of ecological signification and cenotic affinity between the synthetical indicators.

Photo 1. Meadow of 200 m^2 in the village of Sibiel (orig.)

RESULTS AND DISCUSSIONS

On the base of the field observations and of the study of the biological material collected, we identified a number of 4 Lepidoptera species, pest of the cabbage crops: *Pieris brassicae* (Linnaeus, 1758) (Photo 2)., *Pieris rapae* (Linnaeus, 1758) (Photo 5)., *Mamestra brassicae* (Linnaeus, 1758) (Photo 4)., *Autographa gamma* (Linnaeus, 1758) (Photo 3)., some of them producing the important damages.

In the climatological conditions from county Sibiu, we identified at *Pieris brassicae* (Linnaeus, 1758), three generations. The first generation developed from Mai month till July; the second generation was in July-August and during the September-Octomber appeared partial the third generation, their nimphs hibernating.

Photo 2. *Pieris brassicae* (https://www. Pieris+brassicae&biw=1829)

For the species *Mamestra brassicae* [33] in the conditions of the years 2015-2016, we identified two generations. The first one evoluated from Mai to July, followed by the second generation that flyed from August till in the spring time, next year. Hibernating was in form of a nymph in the soil. The observations on field showed us that the adults of the first generation appeared in Mai month, in the moment when was the biological development threshold of 9°C.

The freqvency of the attacks in case of the four Lepidoptera species on the cabbage crops in the village Sibiel (Sibiu county) registered a medium of 57% for the all studied periods with less values in the year 2016 comparative with the year 2015.

Photo 3. *Autographa gamma*
(https://www. aphotofauna)

Table 1. Dynamics of the Lepidoptera populations, the data obtained were processed by mean of synecological analysis

Nr. Crt	Pest species	Abundance	Dominance	Constance	Index of ecological semnification
1	*Pieris brassicae*	275	32.4	50	14.8
2	*Pieris rapae*	121	23.7	72.4	11.7
3	*Mamestra brassicae*	105	16.5	64.3	7.8
4	*Autographa gamma*	97	13.2	32.5	0.5

In the majority of the plots we observed a mixt attack with some dominante species. The most important weight among the four pest Lepidoptera species was of *Pieris brassicae* with 37,8% in 2015 and 73,6% for the year 2016, followed by *Pieris rapae* with 24,3%. *Mamestra brassicae* and *Autographa gamma* registred 4,2% and respectively 0,5%.
Concerning the ratio between the attacked plants by the pest species, on could observe that the mixt attack of the four mentioned species in 2015 was relative compact, with a majority of plants attacked by *Pieris rapae.*

Photo 4. *Mamestra brassicae*
(https://www. Mamestra+brassicae&biw=1829&bih)

In order to follow the dynamic of the Lepidoptera populations (Table 1), the data obtained were processed by mean of synecological analysis [4-12, 16-31].

Photo 5. *Pieris rapae*
(https:// Pieris+rapae&biw=1829&bih)

The abundance hierarchy of the studied pest species during two years represents the sum of the more or less oscillations of this index, registered in the studied period.

CONCLUSIONS

After the centralization of the results, on can conclude that Lepidoptera captured and studied are eudominant species in the cabbage crops in our studied zone. The species of *Pieris brassicae, Mamestra brassicae, Pieris rapae*, represent 64% from the total species and 87,9% from the total specimens. Species *Autographa gamma* is a recedent species with a percent of 17.6% from the total species and 1.3 % from the total specimens collected.
In comparison with the constance of species in the studied plots, *Pieris rapae* were euconstante, *Mamestra brassicae*-constante, and *Autographa gamma* and *Pieris brassicae* are only an accessory species in the studied zone.
The index of the ecological significance emphasized as characteristic species for the studied crop on *Pieris brassicae, Mamestra brassicae* [33,34] and *Pieris rapae.* The species *Autographa gamma* is only an accessory, accompanying species.
This ecological analysis permit afterwards the establishing of the relations between the pest dynamic and the parasitoids species that intervennes in their limitation and facilitate the complex interpretation of the parasitoide bio cenosis and their role in the control in the natural way of the Lepidoptera populations studied in the cabbage crops in the village Sibiel.

In order to have a biological control of these pests, we recommend that in the plots, where the attacked plants are not very numerous, the pest could be limited by periodical control, by collecting and destroying the eggs and larvas. The pest populations also could be limited by mean of some beetles of pray species from *Carabidae* Family and also by the parazitation of eggs, lervas and nymphs from the species of Family: *Ichneumonoidae, Braconidae* and *Trichogrammatidae*.

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RISK ASSESSMENT OF PROJECT MANAGEMENT IN WATER SECTOR IN BULGARIA

Zornitsa STOYANOVA

University of National and World Economy, Students city, 1700, Sofia, Bulgaria,
Phone: +35928195460, E-mail:zori_stojanowa@yahoo.de

Corresponding author: zori_stojanowa@yahoo.de

Abstract

The projects in water sector can be defined as public, investment and infrastructural or combined. In order to be implemented a project like so one of the requirements is to be prepared risk assessment of project management in water sector, which is the main aim of the paper (to assess the risk of project management in water sector). On this basis are made generalized conclusions for the level of risk in the sector and possible recommendations to reduce it. The first part of the paper presents literature review of risk assessment in project management. The second part of the paper assesses the risk of project management in water sector based on opinion of project beneficiaries of the Operational Programme Environment 2007-2013, axis 1. The main results connected with risk assessment present that neither indicator could be defined as system risk. Most of the indicators are defined as irrelevant risks. Made by the experts classification of the possible risk shows that some indicators are defined as critical risks. Recommendations are connected with management of all types of risk, involvement of project manager and project team members in identification and evaluation of the risks, monitoring of risk etc. The conclusions in the paper are based on the results of university research project "Project management of sustainable development in water sector" (UNWE).

Key words**:** *management of water projects, risk assessment, risk profile*

INTRODUCTION

The projects in the water sector can be defined as public, investment, but often they are also infrastructural. They are determined as public projects because they are oriented to natural resource of public interest and by their implementation the public objectives are achieved. This type of projects is investment and requires considerable resources and time scale for implementation. They require also highly skilled team of professionals. Water projects are often classified as infrastructural projects. They spend large-scale investment resources and there is a need of significant time scale. They are characterized with a high risk. The effects of their implementation are needed for development of the sector and they are not only economic but also have social and environmental.

The inclusion of environmental and social aspects in purpose, scope and / or conditions of the project requires the assessment of potential risks of the project realization. In this regard, under the risk of an investment project is understood accidental event that impacts negatively or positively on the indicators of the project – time periods, cost and content (quality) [6]. The project risk is an objective phenomenon in the functioning of any organization. Unlike uncertainty, the risk has measurable parameters - probability of occurrence and impact on several stages [1]. Some authors [8] consider there is a high risk and uncertainty realizing a project, because most of the activities are not repeated and they are not routine. Some authors [7] define risk in the context of a project as potential impacts on project objectives such as cost and time. They also characterize risk by its probability of occurrence and its uncertain influence on project objectives. Project risk management is based on the analysis and assessment that use scientific approaches and advanced technologies. The main task of risk management is to reduce the risks in the process of projects implementation and to neutralize the negative effects of risk factors [2]. Project risk assessment in water sector support decision making that contributes to

public safety and clarifies project expectations [11]. At the same time assumptions for risk assessment are project-specific and are influenced by the size and complexity of the project environment. According [3] risk analysis has two stages: qualitative analysis that focusses identification and subjective assessment of risk and quantitative analysis that pay attention on objective assessment of the risk. A qualitative analysis allows the main risk sources to be identified and the quantitative involves more specific techniques. Risk assessment discloses the sensitivity of the project to its participants to ensure that all threats are fully understood. As a result, targets and contingencies can be set at correct levels, contracts can be negotiated with an accurate understanding of potential challenges and risk mitigation strategies can also be created in advance. Risk assessment also improves teamwork by increasing openness, honesty, and understanding within the project team [5]. In carrying out large and complex investment projects the human factor is significant because the attitude of staff may affect the accuracy of risk assessment and undertaken action by occurrence of risk events. In this regard the organization should have a common approach to risk management based on wide open communication for realizing management decisions, searching the balance between risk assessment and prevention throughout the life cycle of the project. [10]

MATERIALS AND METHODS

The main aim of the paper is to assess the risk of project management in water sector. On this basis are made generalized conclusions for the level of risk in the sector and recommendations to reduce it.

In terms of risk assessment are evaluated 1) the probability of occurrence in relation to the implementation of the project 2) the level of expected impact as a result of the occurred event. Both components are evaluated based on the following indicators of risk: Change of legislation in the water sector; Failure of part of the contract by the beneficiary; Incorrect selection of technologies for project realization; Incorrect budgeting; Leaving the staff of the project team; Incorrect selection of project team; Default in the deadline for implementation of the project; Delay in key stages of the project; Inefficient communication; Insufficient information provision; Inefficient allocation of project resources; Delay in payments on the project by the managing authority; Environmental risk; Climate risk.

Each individual risk is evaluated on a scale from 1 to 3, as indicated in Table 1.

Table 1. Scale for a risk evaluation

Scale	Probability of Occurrence	Impact
1	Low probability (0 -35 %)	Insignificantly impact
2	Middle (36 - 70%)	Critical impact
3	High probability (up to 71 %)	Catastrophic impact

On the basis of risk assessment is carried out a risk matrix which contains a combination of probability and impact, and allows risks ranking. (Figure 1)

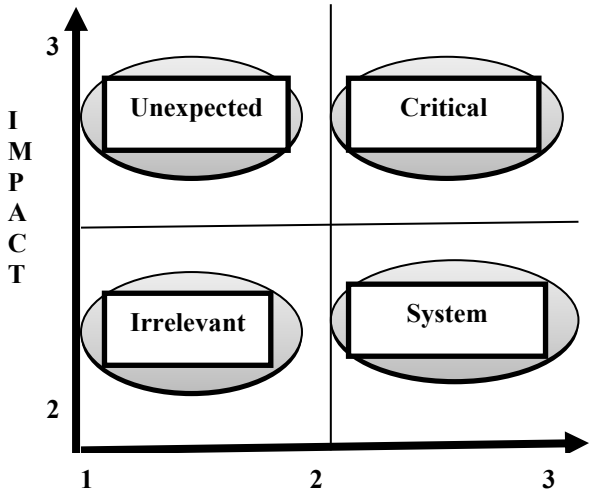

Fig. 1. Matrix of risk
Source: adapted by [4]

Based on the classification of risk it could be different types as follows:

-Critical risks: possess both factors, valued at around 3. Usually this is a group of risks that require immediate attention and monitoring of activities related to risk management.

-Unexpected risks must be controlled before "systemic risks" because their impact can be significant, although probability for their

occurrence is less than the critical risks. In these cases are usually taken precautions.
-System risks. The probability for occurrence of these risks is high, but their impact is relatively low. In this matter are usually taken precautions. It should be taken in account rather the cumulative effects (for example a series of small problems with major impact on accumulation or systematic violation).
-Irrelevant risks are those where both factors were assessed around 1. Based on the level of risk tolerance, these attract attention or don't. It depends on the resources available and the requirements of stakeholders.
Conclusions in the paper are based on the results of university research project "Project management of sustainable development in water sector" [9].

RESULTS AND DISCUSSIONS

Table 2 and Table 3 present assessment of probability and impact of some indicators that support the risk assessment in project management in water sector. Around half of the respondents consider that indicators as "Failure of part of the contract by the beneficiary" (45%), "Incorrect selection of technologies for project realization" (50%), "Incorrect budgeting" (40%), "Leaving the staff of the project team" (45%), "Incorrect selection of project team" (45%), "Insufficient information provision" (60%), "Inefficient allocation of project resources" (45%), "Environmental risk" (55%) and "Climate risk" (50%) have low probability to occur (Table 2). The evaluation shows that 50 % of the experts consider that "Delay in payments on the project by the managing authority" has high probability to occur. Around 50 % of the experts consider that most of the indicators have middle probability to occur. A small part of the respondents (5 – 30%) share the opinion that assessed indicators have high probability to occur.

Table 2. Assessment of probability

Indicators	*Low probability*	*Middle probability*	*High probability*
Change of legislation in the water sector	20	55	25
Failure of part of the contract by the beneficiary	45	45	10
Incorrect selection of technologies for project realization	50	35	15
Incorrect budgeting	40	55	5
Leaving the staff of the project team	45	45	10
Incorrect selection of project team	45	35	20
Default in the deadline for implementation of the project	25	50	25
Delay in key stages of the project	20	50	30
Inefficient communication	45	45	10
Insufficient information provision	60	35	5
Inefficient allocation of project resources	45	45	10
Delay in payments on the project by the managing authority	15	35	50
Environmental risk	55	30	15
Climate risk	50	35	15

Source: [1]

Most of the experts (from 40 up to 80 %) find that the assessed indicators will have critical impact. Respectively 80 % and 70 % of them have the opinion that "Failure of part of the contract by the beneficiary" and "Delay in key stages of the project" have critical influence. "Delay in payments on the project by the managing authority" is evaluated from 45 % of the experts as indicator with critical impact and also 45 % of them consider that it will be with catastrophic impact for the project realizing. One third of the respondents share a view that indicators as "Incorrect selection of technologies for project realization", "Incorrect budgeting", "Default in the deadline for implementation of the project" will have catastrophic impact. A relatively small part of the experts (10 %) state that indicators "Failure of part of the contract by the beneficiary", "Incorrect selection of technologies for project realization", "Default in the deadline for implementation of the

project", "Delay in key stages of the project", Delay in payments on the project by the managing authority" will have insignificant impact for the project management.

Table 3. Assessment of impact

Indicators	*Insignificant impact*	*Critical impact*	*Catastrophic impact*
Change of legislation in the water sector	30	65	5
Failure of part of the contract by the beneficiary	10	80	10
Incorrect selection of technologies for project realization	10	60	30
Incorrect budgeting	5	65	30
Leaving the staff of the project team	50	45	5
Incorrect selection of project team	25	65	10
Default in the deadline for implementation of the project	10	60	30
Delay in key stages of the project	10	70	20
Inefficient communication	40	55	5
Insufficient information provision	55	40	5
Inefficient allocation of project resources	21	58	21
Delay in payments on the project by the managing authority	10	45	45
Environmental risk	30	45	25
Climate risk	30	50	20

Source: [1]

Matrix of risk presents (Figure 2) the types of risk for the analyzed indicators. The classification of respondents according to analyzed indicators shows that they define "Delay in payments on the project by the managing authority" and "Delay in key stages of the project" as critical risks.

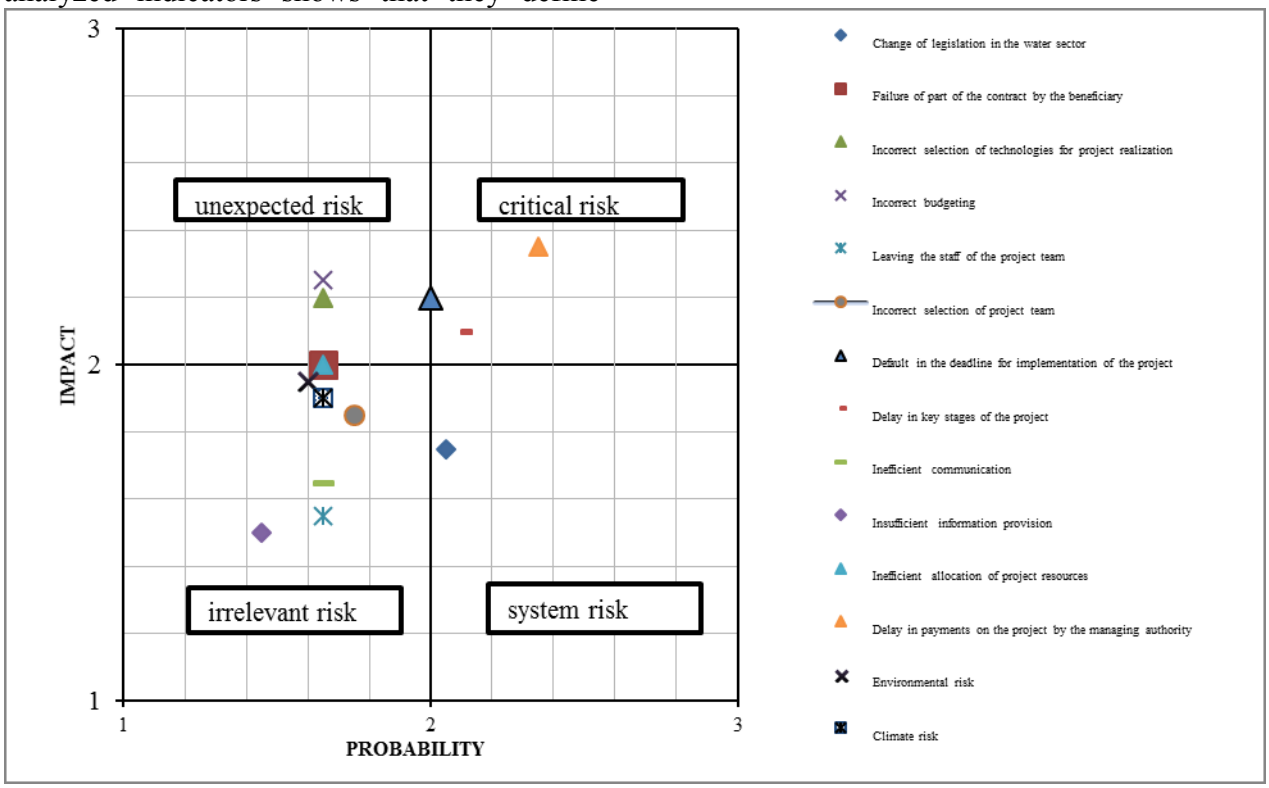

Fig. 2. Matrix of risk
Source: [1]

"Delay in payments on the project by the managing authority" is determined as risks with high impact and probability of occurrence. "Delay in key stages of the project" is with high probability occurrence but with less impact. In this point of view they

require immediate attention and monitoring of activities related to risk management. "Inefficient allocation of project resources" is evaluated from the experts as indicators with middle impact and low probability occurrence and it falls on the line between unexpected and irrelevant risks. "Default in the deadline for implementation of the project" is evaluated from the experts as indicators with middle influence and also middle probability occurrence and it falls on the line between unexpected and critical risks.

"Change of legislation in the water sector" is defined from the respondents as system risk. The experts consider that "Insufficient information provision", "Leaving the staff of the project team", "Inefficient communication", "Incorrect selection of project team", " Environmental risk", "Climate risk" are irrelevant risks. "Insufficient information provision", "Leaving the staff of the project team", "Inefficient communication" are indicators with low probability and impact. "Incorrect selection of project team", "Environmental risk", "Climate risk" are defined with low probability and middle impact. The indicators that fall in quadrant of unexpected risks are "Incorrect budgeting" and "Incorrect selection of technologies for project realization". They are indicators that have more than middle impact and less then middle probability.

CONCLUSIONS

Based on the risk assessment of project management in water sector could be made general conclusions and recommendations as presented below.

Conclusions:

-Indicators defined as system risk are missing. In this point of view the main state is that there is not such type of risk with high probability for occurrence and relatively low impact.

-Most of the indicators are determined as irrelevant risks that include risks where both factors have low or less then middle assessment. They attract attention or don't, depending on resources available and stakeholders.

-Around a half of the experts consider that most of the indicators have middle probability to occur and a small part of the them (5 – 30%) state that assessed indicators have high probability to arise.

-Most of the experts consider that the assessed indicators will have a critical influence (40-80 % from the experts for different indicators). "Delay in key stages of the project" have a critical impact. One third of the respondents are on the opinion that indicators as "Incorrect selection of technologies for project realization", "Incorrect budgeting", "Default in the deadline for implementation of the project" will have catastrophic effect. A relatively small part of the experts (10 %) state that most of the indicators will have insignificant impact for the project management.

-Made by the experts classification of the possible risk shows that indicators as "Delay in payments on the project by the managing authority" and "Delay in key stages of the project" are defined as critical risks. "Insufficient information provision", "Leaving the staff of the project team", "Inefficient communication", "Incorrect selection of project team", "Environmental risk", "Climate risk" and "Change of legislation in the water sector" are determined as irrelevant risks. The indicators that fall in quadrant of unexpected risks are "Incorrect budgeting" and "Incorrect selection of technologies for project realization". At the same time neither of the indicators is defined as system risk.

Recommendations:

It is necessary all types of risk to be managed through certain procedures in the initial phase of water projects as well as in the other phases, describing the possible events, their consequences and implementation of the most appropriate activities. This would help to minimize the negative effects and maximize the positive results.

-The identification and evaluation of the risks are able to affect the project and documenting their characteristics is significant for the project management. Project manager and project team members, such as experts in different areas and stakeholders have to be

involved in this activity. It is appropriate to create a department or managing body that will be responsible for risk assessment and risk management.

-Monitoring of risk is from significant importance for its reduction. In this regard it is necessary planned actions included in the management plan to be implemented throughout the lifecycle of the project. Continuous monitoring and control leads to the discovery of new risks and change the identified ones.

-"Delay in payments on the project by the managing authority" and "Delay in key stages of the project" defined as critical risks require immediate attention and monitoring of activities related to risk management.

-"Insufficient information provision", "Leaving the staff of the project team", "Inefficient communication", "Incorrect selection of project team", "Environmental risk", "Climate risk" and "Change of legislation in the water sector" are irrelevant risks. These types of risks could be managed through identifying the ones that will be from significance for the success of the project according to available resources and requirements of stakeholders. This could be performed by the project manager and the team involved in risk assessment.

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QUALITATIVE ASPECTS CONCERNING CERTAIN MINCED MEAT PRODUCTS FROM ROMANIAN MARKET

Radiana-Maria TAMBA-BEREHOIU[1], Luminiţa VIŞAN[1], Mira TURTOI[1], Vasilica SIMION[1], Ciprian Nicolae POPA[2]

[1]University of Agricultural Sciences and Veterinary Medicine, Bucharest, 59 Marasti, District 1, 011464, Bucharest, Romania, Phone: +40 21 318 25 64/232, Fax: + 40 21318 28 88, E-mails: radianatamba@yahoo.com; l_visan@yahoo.com turtoi_m@yahoo.com, vali_sim13@outlook.com
[2]S.C. Farinsan S.A., Grădiştea Village, Comana Commune, Giurgiu County, Romania, Phone:+40 727 27 78 40, Fax: +40318156038, Email: cipnpopa@yahoo.com

Corresponding author: cipnpopa@yahoo.com

Abstract

*The paper aimed to analyze the quality of some minced meat assortments, namely: pork minced meat, beef minced meat, pork-beef minced meat mixture and traditional sausages paste, which are often sold on the Romanian market. Moisture (%), fat (%), easily hydrolysable nitrogen (NH3), total nitrogen (% protein), collagen content (%) and the C/P (collagen/protein) ratio were analyzed during experiments. Differences with varying degrees of significance were identified between quality parameters of minced meat assortments (Student test). Significant differences were found between the samples of minced meat and traditional sausages paste, regarding humidity (%), fat (%), easily hydrolysable nitrogen (NH3) and total nitrogen (protein%).Traditional sausages paste has significantly elevated values of fat (%) and easily hydrolysable nitrogen (%) when compared with pork minced meat (3.369**, 16.010***), beef minced meat (9.255***, 16.979***) and pork-beef minced meat mixture (7.277***, 17.364***); instead, it has the lowest protein content when compared with pork minced meat (6.677***), beef minced meat (13.174***) and pork-beef minced meat mixture (5.983***). We find that all the formed significant correlations have particularized minced meat assortments, because of the fact that some of the assortments did not show significant correlations between the same quality parameters, for example in the pork – beef minced meat mixture, where fat correlated to collagen (r = -0.621*) and to C/P ratio (r = 0.731**), easily hydrolyzable nitrogen (NH_3) correlated to C/P ratio (r = 0.538*) and also protein correlated to collagen (r = 0.604*). All observed correlations, with varying degrees of significance, constituted peculiarities of minced meat assortments taken for analysis.*

Key words**:** *quality parameters, minced meat, statistical evaluation, traditional sausages paste*

INTRODUCTION

Meat is one of the most important sources of trofins with high biological value of human nutrition.

At the same time it is the basis of one of the most dynamic sectors of the Romanian bioeconomy, the place where traditional consumption elements collide with research and top innovation.

Meat intake in Romania was estimated in 2015 to about 54 kg/capita/year, below the European average of 90 kilograms. In the structure of meat intake, poultry prevail, followed by pork and far away by beef or mutton. It is estimated that a Romanian consumer eats about 6 times less beef than an European consumer. [1] Underlying this behavior are both traditional elements and constraints related to purchasing power. Much of the meat sold on the Romanian market are imported, the import volume of meat in 2015 is estimated at 408,000 tonnes, corresponding to a trade deficit of about 280 million euros [4, 5].

The quality of meat eated by the Romanian consumer is the subject of many disputes. There is a reticence of consumers regarding the informations available on the product's label because manufacturers hesitate to clearly inform on relevant issues of products quality, namely: water addition, the amount of meat in products, the use of mechanically deboned meat or of some disputed substitutes or additives. At the same time, meat quality is influenced by a great number of factors:

species, breed, fattening, anatomic region, feeding, type and size of animal shelters, movement, age at slaughtering, health, stress before slaughtering etc. [2,3].
In this context, the objective of our research was to analyse some meat assortments on the Romanian market, in order to differentiate their quality profile and the variability of some quality parameters.

MATERIALS AND METHODS

There were analyzed four minced meat assortments coming from a local producers, as follows: pork minced meat, beef minced meat, pork – beef minced meat mixture (1:1) and traditional sausages paste (pork – beef mixture, 1:1). Of each assortment were taken a variable number of repetitions as seen in table 1. For each assortment were analyzed the main quality parameters, according to the methods described in Table 1.

Table 1. Quality parameters and methods used to analyze different assortments of minced meat

Parameter	Analysis method
Moisture (%)	STAS 756/3-85
Fat (%)	SR-EN ISO 659:2009
Easily hydrolyzable nitrogen (NH_3)	SR 9065-7:2007
Total nitrogen (protein %)	SR ISO 937/2007
Collagen (%)	SR ISO 3496/A1:1999
Collagen/Protein	Calculation

Results were statistically interpreted using the IBM SPSS Statistics 20 computer program.

RESULTS AND DISCUSSIONS

Table 2 shows the descriptive statistics of the quality parameters for the 3 assortments of minced meat and traditional sausages paste.
It can be observed that fat content of pork minced meat greatly varied, the variation coefficient being very high (33.10%). The protein content also varied more than the other parameters, but within reasonable limits (10.38%).
Fat content of beef minced meat had the highest variation coefficient value (13.76%) compared to the other parameters, but in the normal limits (<14%).

Table 2. Descriptive statistics of the quality parameters

Para-meter	Assortments of meat	n	X±s	CV %
Moisture (%)	pork minced meat	11	67.88 ± 2.31	3.40
	beef minced meat	15	69.93 ± 2.62	3.75
	pork – beef minced meat mixture	10	68.64 ± 0.94	1,37
	traditional sausages paste	15	65.22 ± 2.05	3.14
Fat (%)	pork minced meat	14	12.54 ± 4.15	**33.10**
	beef minced meat	15	9.72 ± 1.34	13.76
	pork – beef minced meat mixture	15	11.18 ± 2.22	**19.85**
	traditional sausages paste	15	16.88 ± 2.68	**15.89**
Easily hydroly-zable nitrogen (NH_3)	pork minced meat	14	17.06 ± 0.23	1.33
	beef minced meat	15	17.01 ± 0.21	1.25
	pork – beef minced meat mixture	14	17.00 ± 0.00	0
	traditional sausages paste	14	19.97 ± 0.64	3.23
Total nitrogen (protein %)	pork minced meat	14	19.06 ± 1.98	10.38
	beef minced meat	15	20.42 ± 1.21	5.92
	pork – beef minced meat mixture	15	19,14 ± 2,27	11.85
	traditional sausages paste	4	12.18 ± 0.41	3.38
Collagen (%)	pork minced meat	14	1532.57 ± 97.75	6.38
	beef minced meat	15	1597.26 ± 68.57	4.29
	pork – beef minced meat mixture	15	1541,60 ± 90,50	5.87
	traditional sausages paste	3	1671 ± 182.518	10.92
Collagen/ Protein	pork minced meat	14	8.09 ± 0.58	7.27
	beef minced meat	15	7.84 ± 0.46	5.84
	pork – beef minced meat mixture	15	8,13 ± 0,857	10.53
	traditional sausages paste	3	13.92 ± 1.41	10.16

For pork – beef minced meat mixture, higher variation coefficients were recorded for fat (19.85%), protein (11.85%) and the C/P ratio (10.53%), without exceeding the normal limits. Considering that this sample is a mixture, it is normal to register higher variation coefficients, because the intervals between the minimum and maximum values increase.

Although the traditional sausages paste is more intensely processed, spiced and with addition of bone soup, garlic, eventually ammonium bicarbonate, it is interesting to compare it with pork – beef minced meat mixture. It can be observed that also for traditional sausages paste, higher variation coefficients were recorded for the following parameters: fat (15.89%), collagen (10.92%) and C/P ratio (10.16%). By comparison, fat content is eloquent on dietary properties of minced meat.

Easily hydrolysable nitrogen or free ammonia is an indicator of meat freshness.

It can be observed that traditional sausages paste had an increased amount of free ammonia, as compared to other types of minced meat. The reason for this might be the addition of a certain amount of ammonium bicarbonate in the traditional sausages paste, which releases ammonia, or that the traditional sausages paste was not fresh enough. The other three assortments of minced meat had comparable values of easily hydrolysable nitrogen.

Regarding the protein content, the traditional sausages paste had the lowest value, probably due to additions of bone soup, spices, garlic. The highest content of total nitrogen was recorded in beef minced meat.

Also, beef minced meat had a higher content of collagen, compared to the minced meat mixture and the pork minced meat. The traditional sausages paste had a much higher content of collagen, which can be explained by further additions of connective tissues in the meat (cartilage, tendons, ligaments, skin and blood vessels). In general, collagenous tissues should not prevail in minced meat, because they are difficult to digest and decrease quality parameters of meat.

Table 3. Significance of mean difference for quality parameters

Pairs of minced meat assortments	Mean difference	t
Significance of mean difference for Moisture		
Pork - beef minced meat	-2.05	**2.0694***
Pork - minced meat mixture	0.24	0.968
Pork - traditional sausages paste	2.66	**3.098****
Beef - minced meat mixture	1.29	1.486
Beef - traditional sausages paste	4.71	**5.482*****
Minced meat mixture - traditional sausages paste	3.42	**4.914*****
Significance of mean difference for Fat		
Pork - beef minced meat	2.82	**2.499***
Pork - minced meat mixture	1.36	1.111
Pork - traditional sausages paste	-4.34	**3.369****
Beef - minced meat mixture	-1.46	**2.181***
Beef - traditional sausages paste	-7.16	**9.255*****
Minced meat mixture - traditional sausages paste	-5.7	**7.277*****
Significance of mean difference for Easily hydrolyzable nitrogen (NH_3)		
Pork - beef minced meat	0.05	0.612
Pork - minced meat mixture	0.06	0.054
Pork - traditional sausages paste	-2.91	**16.010*****
Beef - minced meat mixture	0.01	0.178
Beef - traditional sausages paste	-2.96	**16.979*****
Minced meat mixture - traditional sausages paste	-2.97	**17.364*****
Significance of mean difference for Total nitrogen (protein)		
Pork - beef minced meat	-1.36	**2.249***
Pork - minced meat mixture	-0.08	0.101
Pork - traditional sausages paste	6.88	**6.677*****
Beef - minced meat mixture	1.28	1.927
Beef - traditional sausages paste	8.24	**13.174*****
Minced meat mixture - traditional sausages paste	6.96	**5.983*****
Significance of mean difference for Collagen		
Pork - beef minced meat	-64.69	**2.075***
Pork - minced meat mixture	-9.03	0.258
Pork - traditional sausages paste	-138.43	1.929
Beef - minced meat mixture	55.66	1.899
Beef - traditional sausages paste	-73.74	1.281
Minced meat mixture - traditional sausages paste	-129.4	1.922
Significance of mean difference for C/P ratio		
Pork - beef minced meat	0.25	1.291
Pork - minced meat mixture	-0.04	0.146
Pork - traditional sausages paste	-5.83	**12.282*****
Beef - minced meat mixture	-0.29	1.155
Beef - traditional sausages paste	-6.08	**14.598*****
Minced meat mixture - traditional sausages paste	-5.79	**9.698*****

* significant at the 0.05 level (significant)
** significant at the 0.01 level (distinctly significant)
*** significant at the 0.001 level (very significant)

It can be observed that C/P ratio was greatly increased in traditional sausages paste. The

result is consistent with the hypothesis that an excess of connective tissue was added to the traditional sausages paste.

The three assortments of minced meat and the analysed traditional sausages paste showed features which can be highlighted by Student's test (t), respectively the significance of mean difference for quality parameters (Table 3).

From the table above it can be extracted a number of observations that differentiate the assortments of minced meat and the traditional sausages paste. Moisture, protein content and collagen content are significantly increased in the beef minced meat as compared to pork minced meat (20.694*, 2.249*, 2.075*), while fat content is significantly increased in the pork minced meat as compared to beef minced meat (2.499*).

Pork minced meat is not significantly different from pork – beef mixture, regarding all parameters.

Remarkable differences are recorded between pork minced meat and traditional sausages paste. Thus, moisture is significantly increased in pork minced meat (3.098**). Also, the protein content is considerable increased in minced meat as compared to traditional sausages paste (6.677***). Fat content is significantly increased in traditional sausages paste (3.369**); ammonia and C/P ratio are considerable increased in traditional sausages paste (16.010***, 12.282***) as compared to pork minced meat assortment.

Between beef minced meat and pork – beef minced meat are no significant differences. The only difference is fat content that is significantly increased in the minced meat mixture (2.181*). This is normal, considering that the mixture contains pork minced meat, which is fatter.

As with pork minced meat, when comparing beef minced meat with traditional sausages paste, differences arise regarding beef minced meat. Thus, it can be observed that moisture and protein content are significantly increased in beef minced meat (5.482***, 13.174***), while fat content, ammonia, and C/P ratio are considerable increased in traditional sausages paste (9.255***, 16.979***, 14.598***).

The quality of pork – beef minced meat mixture is also significantly different from the quality of traditional sausages paste. Fat, ammonia, and C/P ratio are highly increased in traditional sausages paste (7.277***, 17.364***, 9.698***), while moisture and protein content are significantly increased in pork – beef minced meat mixture (4.914***, 5.983***).

Taking into account that moisture influence protein content, it can be observed that traditional sausages paste has the lowest protein content, although it has the lowest moisture content; instead, it has increased amounts of fat, free ammonia and collagen and, for this reason, is less indicated in the dietary.

There were calculated the Pearson correlation coefficients between the quality parameters of minced meat assortments and traditional sausages paste. Correlations are significant features of the respective assortment.

In the minced pork meat were established the following correlations: a distinct significant negative correlation moisture-fat (r = -0.812 **), a distinct significant negative correlation fat-protein (r = -0.754 **), a significant positive correlation fat-C/P ratio (r = 0. 634*), a distinct significant positive correlation protein-collagen (r = 0.723 **) and a distinct significant negative correlation protein-C/P ratio (r = -0.839 **).

The negative correlation moisture-fat was expected, given that with the increase of a sample humidity, decrease the value of other parameters.

However, as decreases a parameter, for example. fat, other parameters increase, for example protein.

The minced beef meat highlighted two significant negative correlations, namely: fat-protein (r = -0.586 *) and protein-C/P ratio (r = -0.586 *).

It is noted that these two correlations are found also in minced pork meat.

Pork-beef minced meat mixture is the assortment with most significant correlations between quality parameters. Thus, it can be observed the significant negative fat – protein correlation (r = - 0.886**) and the significant negative protein – C/P ratio correlation (r = -

0.586*), which are similar to those set out in pork minced meat and beef minced meat. At the same time, fat is significantly negative correlated with collagen (r = - 0.621*) and significantly positive correlated with C/P ratio, ammonia is significantly positive correlated with the C/P ratio (r = 0.538*) and protein is significantly positive correlated with collagen(r = 0.604*).

Astfel, grăsimea se corelează negativ semnificativ cu colagenul (r = -0.621*) şi pozitiv distinct semnificativ cu raportul C/P (r = 0.731**), amoniacul se corelează pozitiv semnificativ cu raportul C/P (r = 0.538*), iar proteina se corelează pozitiv semnificativ cu valoarea colagenului (r = 0.604*).

Traditional sausages paste shows only one significant correlation, namely a significant negative fat – moisture correlation (r = - 0.655**).

It can be observed that all significant correlations formed customize the minced meat assortments and the traditional sausages paste, especially those correlations that are not repeated from one meat assortment to another. It matters also the significance of the correlation, which is typical for a specific assortment of minced meat.

The regression showing the higher determination coefficient for minced pork meat, was the protein-C / P ratio regression (Fig. 1).

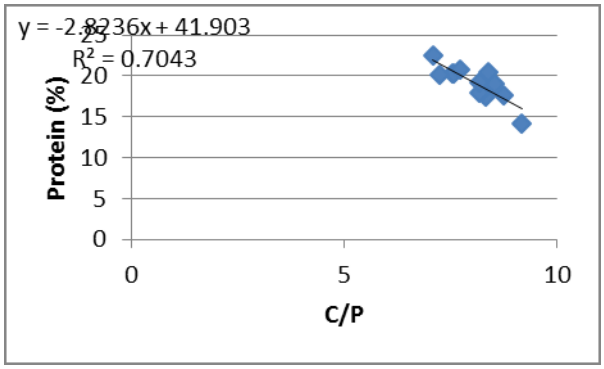

Fig. 1. Protein-C/P ratio regression

Also, the regressions: protein-fat and protein-C/P ratio in minced meat mixture showed the highest determination coefficient (Fig. 2).

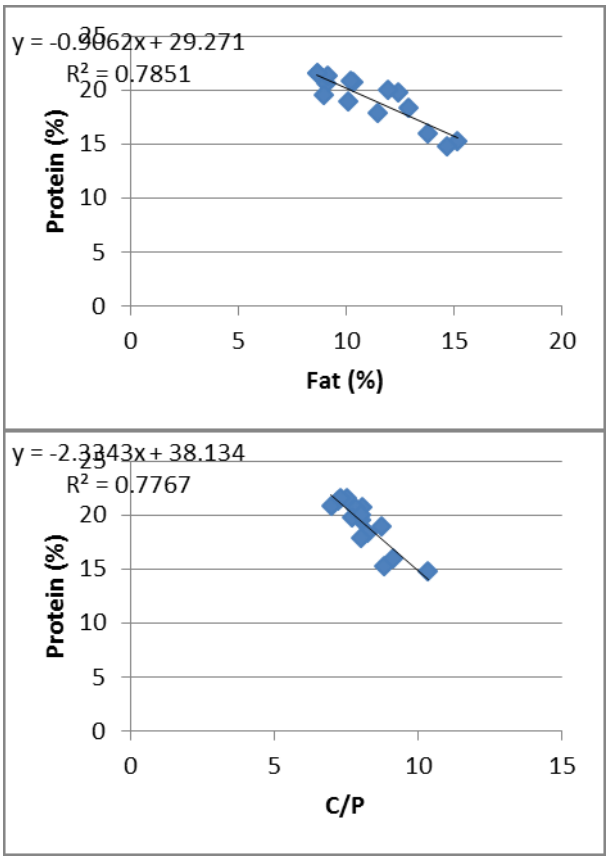

Fig. 2. Protein-fat and protein-C/P ratio regressions

The highest coefficient of determination in minced beef meat was registered by the protein-C/P ratio regression (Fig. 3).

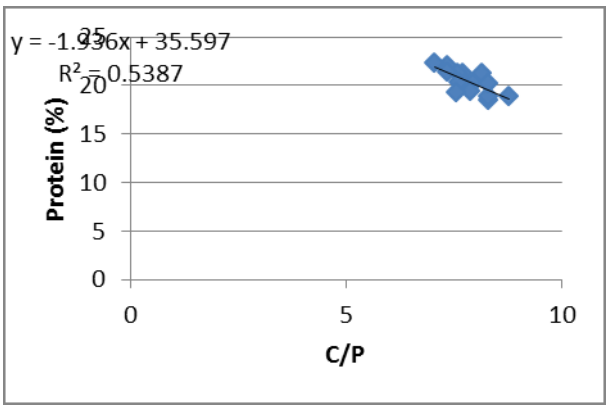

Fig. 3. Protein-C/P ratio regression

Traditional sausages paste was characterized by a moisture-fat regression with a moderate coefficient of determination (Fig. 4).

The assortments of minced pork and beef meat were individualized by the quality parameters and by the significant correlation coefficients.

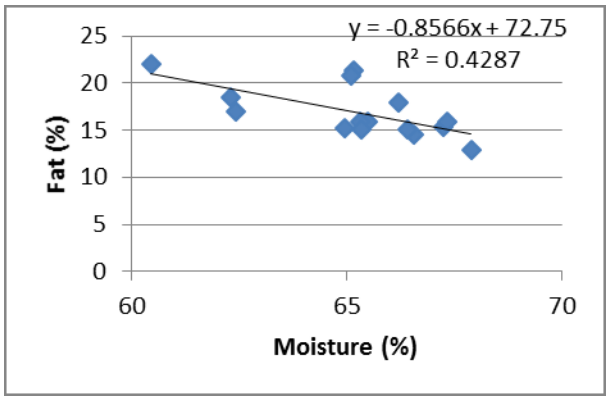

Fig. 4. Moisture-fat regression

Minced meat mixture and traditional sausages paste presented unique characteristics, not similar to pork and beef minced meat.

CONCLUSIONS

All the minced meat assortments had higher variation coefficients of Fat parameter, in particular minced pork meat and minced porc-beef mixture. The other parameters had variation coefficients in the normal range. Traditional sausages paste showed an increased moisture and fat content, to the detriment of protein content.

However, the traditional sausages paste recorded significantly higher quantities of easily hydrolyzable nitrogen (NH_3) and collagen, which indicates that either the meat was not fresh enough, either was added ammonium carbonate and connective tissues, contrary to the recipe.

The differences between the basic quality parameters (fat, protein, collagen) of analyzed minced meat assortments, recorded different degrees of significance.

Significant correlations were established between the quality parameters which characterized the assortments of minced meat and traditional sausages pasta.

The mixture of minced pork-beef meat presented a number of correlations between the quality parameters which were not found in other assortments of meat.

The degree of the correlations significance, also showed a feature of a a certain assortment of minced meat.

The value of quality parameters showed that beef minced meat is more dietary and traditional sausages paste is more indigestible, due to increased fat and collagen content.

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CHOICE OF STRAWBERRY VARIETIES BY THE ROMANIAN GROWERS

Georgeta TEMOCICO[1], Monica STURZEANU[2], Viorel ION[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd., District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax: +40213182888, Email: gtemocico@gmail.com, vioreliona@gmail.com
[2]Research Institute for Fruit Growing Piteşti, 402 Mărului Street, 117450, Mărăcineni, Argeş County, Romania, Phone: +40248278066, Fax: +40248278477

Corresponding author: gtemocico@gmail.com

Abstract

Strawberry is an early species, producing at short time after planting, according to crop technology and variety. Strawberry growing is profitable by extending the ripening and delivering periods, using economically feasible techniques and new valuable varieties. Strawberry fruit quality is defined by several characteristics and is influenced by genetic factors, crop location and growing methods. The purpose of the study was to identify the Romanian strawberry growers' needs, limitations and pathways in order to put forward the traits which can influence the choice of varieties by the strawberry growers, as a solution for their sustainability. The main limitation identified was the strawberry varieties used in their crops, beyond the dominance of unprotected consecrated crop technologies with low-density. In this respect we have highlighted some traits of strawberry varieties which can influence the future choices of Romanian growers: harvesting season, desired characteristics of fruit quality, and plant architecture related to production potential and stress factors.

Key words**:** *strawberry, variety, choice, growers.*

INTRODUCTION

Strawberry (*Fragaria x ananassa* Duch.) is a perennial herbaceous plant characterised by the adaptability to growing conditions. It is the only fruit species whose history is entirely known [9]. His appearance, as new species, is the result of interspecific crossing between *Fragaria chiloensis* L. originated from South America and *Fragaria virginiana* Duch. originated from North America [32]. According to Staud (1999), "the large-fruited garden strawberry was developed in Europe between 1714 and 1759" [34].

The strawberry is one of the most fascinating species that was spread on all continents. The reasons are connected to the agronomic success and consumer's preference. First of all, strawberry is characterised by a huge plasticity in growing and developing, which was 'exploited' over time through agronomic techniques [4]. Due to high production potential, commercial success, fruit quality, the high content of C vitamin, ellagic acid, folic acid, and other nutrients [21; 22; 23; 25], strawberries is one fruit species with important economic interests, particularly in agri-food industry and medicine, as a recent concept in health [7; 12; 21; 33].

From the end of 18th century till now a tremendous number of cultivars were created by the breeding programs over the world [14]. Mezzetti (2013) appreciates the remarkable progress in understanding this species over the last decades, and as tangible results many valuable varieties were created. Another idea highlighted by the author is that the research results regarding nutritional value of fruit and vegetables can be used to human health [27].

Strawberry is an early species, producing fruits in a short time after planting, according to crop technology and variety. Strawberry growing is profitable by extending the ripening and delivering periods, using economically feasible techniques and new valuable varieties which produce consistent and competitive [3; 5; 26; 34].

The purpose of the study was to identify the Romanian strawberry growers' needs, limitations and pathways in order to put

forward the traits which can influence the choice of varieties by the strawberry growers, as a solution for their sustainability.

MATERIALS AND METHODS

The study was carried out in 2016 and it was performed within a research project financed by the Bridge Grants Romanian Program. In this respect the qualitative research was used with case studies method - linked to the specific Romanian strawberry growing areas. The techniques used for data collection were the following: observation, documents analysis, focus group, and finally the analysis and interpretation of qualitative data.
Whether in the quantitative research there are used various tools in view to collect data, in qualitative research the main instrument is the researcher [15]. In this case, the researcher had decided what questions to ask, in which order, noting his own observations and received responses.
The entry into research space was done through a series of preliminary presentation meetings, participating in some informal activities, and giving informal technical advices in strawberry crops.
The findings of qualitative research were related to the rigor of the research process, on the quality of data collected, on the depth and complexity of data analysis, to which are added the researcher abilities [10].

RESULTS AND DISCUSSIONS

Considerations about strawberry growing and variety choosing

Even though today, strawberry growing in the world is in fully development and varietal assortment has known a continue dynamic, the area harvested in Romania for the last decade (2004-2014) registered a downtrend (-132 ha). However, the reported data for decade 1994-2004 highlight an uptrend (+954 ha) (Table 1).
Analysing the area harvested in other countries with long tradition in strawberry growing, we can highlight different specific trends. Thus, Poland has maintained his positive trend over the last 2 decades, (+6,184/+285 ha) in comparison with France which registered a downtrend over the last 2 decades (-2,528/-417 ha). It is very interesting to notice the positive trends for the strawberry area harvested in United States of America in both decades, respectively +1,041 ha for the decade 1994-2004, and +3,438 ha for the decade 2004-2014 (Table 1)

Table 1. The evolution of strawberry area harvested for the last two decades (ha)

Country	1994	2004	2014	Differences 2004-1994	Differences 2014-2004
Romania	1,600	2,554	2,422	**+954**	**-132**
Poland	46,204	52,388	52,673	**+6184**	**+285**
France	5,737	3,609	3,192	**-2128**	**-417**
United Kingdom	5,250	3,450	4,535	**-1800**	**+1085**
United State of America	19,760	20,801	24,239	**+1041**	**+3438**

Source: http://www.fao.org/faostat

Analysing the yield at the surface unit in connection with the area harvested over the last 20 years for Romania and the countries with long history in breeding and growing strawberry, we are remarking a constant increasing of the yield in each country even the area harvested has increased or decreased.
Concerning the yield of strawberry crop, it is important to notice the difference between the level of the strawberry yield in Romania, in comparison with the yield registered in France, United Kingdom and United States of America. The yield of strawberry crop in Romania has known an uptrend (+ 1.66 t/ha) for decade 1994-2004, and downtrend for the last decade 2004-2014 (- 0.29 t/ha) (Table 2).

Table 2. The evolution of strawberry yield for the last two decades (t/ha)

Country	1994	2004	2014	Differences 2004-1994	Differences 2014-2004
Romania	7.69	9.35	9.06	**+1.66**	**-0.29**
Poland	3.65	3.54	3.84	**-0.11**	**+0.3**
France	14.29	14.81	18.46	**+0.52**	**+3.65**
United kingdom	7.90	15.22	23.02	**+7.32**	**+7.8**
United State of America	37.87	48.27	56.59	**+10.4**	**+8.32**

Source: http://www.fao.org/faostat

The huge level of the yield registered in 2014 in France (18.46 t/ha), United Kingdom (23.02 t/ha) and United States of America

(56.59 t/ha) reflects the advancements in growing systems despite of many economic or environment restrictions, and also in identifying the new and durable varieties adapted to the different integrated crop management strategies (Table 2).

In Romania, according to the last official data provided by the county directorate for agriculture, the important strawberry crops are located in following counties: Satu-Mare, Vâlcea, Gorj, Dolj and Bihor, covering small areas from North-West and South-West. In 2016, the total strawberry area harvested reported for the mentioned regions was 1,723 ha.

Over the world, the most used crop system is under permanent and temporary structures like greenhouses, higher or smaller tunnels. Nevertheless, in Romania strawberry is cultivated in open field and multiannual crops. According to county directorates for agriculture above mentioned, 98.99% from total strawberry area harvested is in open field and multiannual crops. Small areas (1,01%) are harvested from protected crops in high tunnels (0.94% multiannual crops and 0.07% annual crops). The most frequent used varieties, in all regions, are the following: Elsanta, Premial, Magic, Coral, but also other few varieties were reported, respectively: Benton, Marmolada, Aiko, Talisman, Senga Sengana, Idea, Alba, Albion, Select, Portola, Elegance, Dana, Elsignore, Clery, Joly. So, the most cultivated varieties (approx. 70% of the total) were Premial and Magic (Romanian varieties), followed by Senga Sengana and Elsanta (foreign varieties). In the last decade it began to be launched in new crops other Romanian varieties like Real, along with Mira and Alba, and for small areas were registered the following varieties: Joly, Clery, and Albion.

Beyond the tradition linked to this species and the conservationism of some growers, the assortment of varieties was changed by the impact of strawberry fruits imported from other EU countries or other international markets. On the other hand, the proximity of a research or extension institutions plays an important role in grower's decisions.

Even if the range of strawberry varieties that are used in Romania seems to be substantial and appropriate, many of the varieties listed in the Romanian Official Catalogue for Varieties of Agricultural Species do not fulfil the current needs of growers and consumers, and the choice of new varieties often is a serious problem for farmers growing strawberry.

But how growers can choose the appropriate variety to their specific conditions?

A competitive strawberry variety should achieve some important overall characteristics: high yields (600 - 1,000 g per plant) of medium or large fruit (for fresh consumption respectively processing); uniformly coloured skin; regular shape and balanced taste; the edible part (false fruits) should have a good behaviour during the transportation and handlings; an advantage for June-bearing varieties is the short harvesting period (15-25 days) and uniformity of fruits size during the harvesting process; a valuable variety, grown in an appropriate crop management, preserves the shape of the fruit during the harvesting, especially for those which have conic or globose conic shape; last but not the least traits should be the resistance or tolerance to abiotic stress factors (for open field crops, e.g. sudden changes in temperature, humidity and light) and biotic stress factors (pests and diseases).

The strawberry breeders are in a permanent searching for particular characteristics of varieties, according to growers' needs and consumers' demands. Cultivar trials and germplasm collection, which involve representative strawberry cultivars and selections, are organised and managed to collect data and information or particular pathways to new varieties.

Today, three characteristics on strawberry fresh fruits quality seems to be more prioritized by the breeders and growers on one hand and preferred by the consumers on the other hand: fruit firmness, nutritional value and flavour [1; 12; 27; 31]. Each of characteristics is influenced by the regional climatic specificity. Also, the regional climatic differences can influence the preference of consumers to the skin colour, shape or aroma of the fruit [27; 34].

New created varieties/genotypes with their

superior characteristics can successfully replace those consecrated, but, unfortunately they are not known enough by growers and consumers. Strong demand for strawberries fresh-fruits in Europe or over the world has a strong impact on developing of new growing systems which can valorize the potential of the variety [26; 27; 36].

There were identified some specific influences that may define the future choice of Romanian farmers concerning the strawberry varieties.

Extending harvesting season through appropriate varieties

Strawberry varieties are classified in: June-bearing (short-day), Everbearing and Day-Neutral. June-bearing varieties produce one large harvest on the year (early, middle and late varieties), Everbearing two and sometimes three harvests on the year (spring, late summer and autumn). Day Neutral varieties produce fruits throughout the year if the growing conditions are appropriate [2].

Strawberry fruit can achieve his specific size and maturity around 30 days. The length of this period is strong dependent on the most important crop factors: soil composition, light, temperature, place of cultivation [18; 36].

Each type of variety, Day-neutral or June-bearing, has his owner specificity that contributes to the extension of harvesting period [19].

Till the present, in Romania, commercial strawberry crops are preponderant organised with June - bearing varieties. The explanation is given by the Romanian consumers' behaviour according to which the strawberry domestic commercial production provides to the market the first fresh fruit and consumers associate the strawberry fruits with the first fresh fruit ripened in the spring season. The study results shown, on the other hand, that the Romanian consumer's preference for the late summer and autumn seasons fruits like apples, peaches, grapes, seems to be the cause of June-bearing varieties growing.

Day-neutral varieties are not very much cultivated in Romania, excepting experimental trials and small areas in home gardens for domestic consume.

Beyond the sensorial characteristics of fruits and traditionalism, the Romanian consumer is opened to new products and new varieties to the extent that the market is providing. Here comes the role of Romanian breeders and growers, which may interfere with the consumer preferences or choices.

The extension of harvesting period by using new June-bearing and Day-neutral varieties with different harvesting seasonality and different growing technique, adapted to specific regional conditions, represent a package of solutions linked to the consumer satisfaction on one hand, and on another hand to the grower economic interest.

Demanded attributes of strawberry fruit quality

In Romania, the strawberry production is regional or locally marketed. As main crop type, the open field crop delivers fruits to the markets from late May to late June when the weather started to be characterised by higher temperatures. So, the fruits appearance based on firmness, size, shape, colour and flavour has to be favourable and preserved during the transportation and storage.

The fruit firmness is a specific fruit characteristic developed by the variety and strong influenced by the crop conditions, during the fruits growing, till maturity [6]. Fruit firmness is much more associated with the modern varieties. The fruits firmness is the result of flesh fruit firmness and fruit skin strength. Also the strawberry fruit firmness is an important characteristic linked to handling, transportation, shelf life and resistance to fruit [8; 20; 14]. 'Elsanta' variety has gain the better position of most cultivated varieties in Europe, and also in Romania, mainly due to its fruit firmness and acceptable appearance after transportation and storage [19; 20; 36].

In terms of influences to the fruit firmness given by the fertilizers with calcium, the research results performed in this field do not confirm the belief that the foliar supplemental applications with calcium will increase the fruit firmness. Based on these findings, the concentration of calcium from leaf and fruit cannot be used as element in prediction of fruit firmness for the analysed varieties. According to some research results, "the calcium concentrations of fruit or leaves were

not factors in firmness determination, on any of the cultivars" [13].

The genotype influences the nutritional quality of strawberry fruits and the nutritional value can be increasing by breeding [1; 11; 24; 27]. The research results show that the total antioxidant capacity and the level of antioxidants were different on fruit extracts according to genotype. Despite the importance of these findings, there were not many genotypes characterised [32; 35]. The relevant previous researches highlighted improvements in fruit nutritional quality on breeding material resulted from inter-specific crosses [12; 14; 24; 35]. According to Mezzeti (2013), the fruits of new selected strawberry genotypes with higher content of bioactive compounds can conduct to the valuable nutritional and nutraceutical fruit content [27]

Beyond the influence of growing conditions, further researches will enrich the knowledge to improving the nutritional characteristics of strawberry fruits in direct correlation with the genotypes [3; 5; 22; 23; 25].

Fruit aroma of strawberry is a unique and complex characteristic. Till now, over 360 volatile compounds have been noticed on strawberry, most of them being esters [35]. The volatile compounds, which differ as quantity and quality, are linked also to the variety and depend on the evaluation method, the maturity stage and postharvest storage conditions [16]. The aroma volatile depends on balance of sugar and acids [33]. The mechanism that make possible the aroma volatiles synthesis is not completely known. Future investigations will provide the pathways connected to the genetic and environmental interventions to improve or optimize the flavour during transport and storage [28; 30; 31]. The fruit maturation after harvest involves specific changes of aroma, in each variety investigated [35].

The various flavour of fruits is a result of strawberry genetic variability. The chemical diversity identified on fruits of different varieties is remarked and more, "certain profiles are more highly preferable" [31]. The volatile profiles of fruits of different varieties explain the consumer responses or preferences. The varieties less preferable has volatile profiles with lower level of esters and higher level of γ-decalactone and hexanoic acid [35]. The diversity of strawberry genotypes is linked to the volatile phonotypical profiles [31].

Strawberry plant architecture related to production potential and stress factors

"Plant architecture describes the spatial distribution of vegetative and reproductive organs and their developmental phase" [17].

The plant growth is influenced by the variety types, crowns types, plants ages and growing conditions [17].

The strawberry plant develops a rosette from the growing point of the short stem called 'crown'. In the early spring, young leaves, and then the inflorescences arise from the apical meristems of the crown. Branch crowns formed during the late autumn, along with the main crown, will ensure the yield of the strawberry plant. Main crowns and branch crowns are similar from structural point of view.

The varieties develop a different size of flowers and a different quality and number of flower parts, in accord with the position into the flower cluster. Bigger flowers develop bigger fruits and a good quality of floral parts shows the specific characteristic of fruit variety. Also, the number of inflorescences and their place to the crown can lead to the estimation of earliness, to the number of yields and total yield potential of the strawberry plant [29].

The quality of strawberry planting material is also an important factor that influences the strawberry yields and fruits quality, as expression of variety potential [26].

From plant propagation stage to differentiation and postharvest processes, the 'life quality' of plants belonging to different varieties is strongly influenced by biotic and abiotic stress factors. The quality of plant life, expressed in marketed potential yield of the variety, represents the balance between the level of controlled/influenced factors and stages of specific biological and physiological processes.

The main abiotic stress of strawberries plants is generated by the environmental factors. The

photoperiod influences the vegetative and reproductive growth and development. The light intensity and quality influences the bud flowers and number of inflorescences. The temperature influences the behaviour of vegetative and generative organs of strawberry plants on Short-Day and Day-Neutral varieties. Type of substrate, nutrient level and ratio between some nutrients affect the plant architecture, growth inflorescences development and number of flowers [5; 17; 28; 29]. The water supply and the salinity of water influence the number of branch crowns and flowers in strawberry plant [3].

The main biotic stress factors connected to the variety are diseases and pests. The strawberry breeding programs have continuously, as essential part, the breeding for diseases and pests [18]. The grower's 'fight' with disease and pests is expensive one if they don't understand the correlation between causes and effects in the interaction variety/plant – environment factors. Nevertheless, the choice of varieties improved with constant diseases and pests resistance successfully completes the strawberry production system.

The grower decision should be governed by following elements: crop location, growing methods, and specific abiotic and biotic stress factors.

CONCLUSIONS

Despite the fact that the strawberry crop is grown, over the world, under permanent and temporary structures like greenhouses, higher or smaller tunnels, the crop systems most used in Romania are open field and multiannual crops (98.99%), while protected crops have very small surfaces (1.01%).

The most cultivated varieties in Romania (approx. 70% of the total) are Premial and Magic (Romanian varieties), followed by Senga Sengana and Elsanta (foreign varieties). In the last few years it started to be launched in new crops other Romanian varieties like Coral and Real, along with Mira and Alba, and for small areas were registered varieties such as: Joly, Clery, and Albion.

New created varieties/genotypes, with superior characteristics, can successfully replace those consecrated, but, unfortunately they are not known enough by growers and consumers.

The specific influences that may define the future choices of Romanian growers' concerning strawberry varieties are the following: extending harvesting season, demanded attributes of fruits quality, and plant architecture related to production potential and stress factors.

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IMPROVING THE SYSTEM OF INNOVATION ACCELERATION IN THE COUNTRY: METHODOLOGICAL ASPECT

Liudmila TODOROVA

State Agrarian University of Moldova, 42 Mircesti Str., Sector Rascani, Chisinau, MD-2049, Republic of Moldova, Phone: +373 22 432387; E-mail: liudmila.tod@gmail.com

Corresponding author: liudmila.tod@gmail.com

Abstract

Acceleration of innovation activities is the basis of both economic growth and social development at the present stage of the economic process development. In order to stimulate innovation activities one needs to study the methodology of developing the country's innovation rankings. A number of indicators and indices, published during certain periods, are used in the study that evaluates innovation activities. We believe that it is necessary to develop an approach, which can serve as an impulse to make decisions and rationally use available economic resources in order to motivate people for intellectual work, train scientific researchers and establish national innovation "laboratories". For the management of innovative activity an important role is played by the expansion of the circle and improving the quality of information, on the basis of which the corresponding solutions are accepted. It is necessary along with private indicators of innovation to use in the analysis and management some consolidated, integrated, synthetic and generalizing indicators. It should be noted that the development of various types of integrated indicators and their characteristics is an extremely difficult task.

Key words**:** *innovative activity, economic processes, innovative rankings, virtual structure, innovative performances*

INTRODUCTION

Studies show that one should be guided by the leaders in all aspects of the innovation activity, but countries or regions can only occupy a leading position in a particular field of activity. Therefore, it is necessary to analyse and choose the best indices of all partners and competitors, and, based on the data received, create an absolute leader that can be called virtual.

Next, one should relate the cost structure in one's own country with the indices of the standard that has been developed. This is going to become an impulse to activate the innovation process and accelerate the innovation activity in the country.

MATERIALS AND METHODS

The methodology of scientific research is based on use of analytical and mathematical analysis tools.

In order to justify the approach nominated in the article were applied the dialectical method, system, functional, statistical and comparative analysis, as well as linear scaling and mathematical modelling.

RESULTS AND DISCUSSIONS

Let us consider innovation in the context of four real countries and one virtual standard. The organization system under the established conditions is aimed at implementing the following objectives:

-to compare the innovation performance of each of the four real countries with the performance of the virtual standard;

-to determine how the virtual structure manages to achieve the best results;

-to use the leading country's results to improve innovation activities of the four real structures.

We have selected *the USA, the EU, Japan and the Rest of the World* as the real countries that are involved in innovation activities. The selection of real structures is subjective.

The alternative choice may include all the countries, groups of the countries, regions, etc. The countries we have chosen – the USA, the EU, Japan and the Rest of the World – make up the central force of the comprehensive development for the whole humanity (if necessary, one may also choose Brazil, Russia, India and China in the studies

of this type. This is to be determined by a relevant scientific direction).

The research idea is based on the following factors: (a)Innovation activities, five blocks (driving forces of innovation); (b)Production of knowledge; (c)Innovation activities of the business sector; (d)Practical application of innovations; (e)Intellectual ability (Table 1).

Driving forces of innovation in the context of four real and one virtual structure are crucial for innovation activities inside block (1). Macro events (1) consist of five events: (1.1.) science and engineering graduates; (1.2.)the third-level education; (1.3.)the penetration rate of the broadband access to scientific and innovative information on the Internet; (1.4.)lifelong learning; (1.5.)youth education (Table 2).

Table 1. Innovation activity of the virtual structure in the context of five macro events

Macro events	USA	EU	Japan	The Rest of the world	Standard structure
	1	**2**	**3**	**4**	**5**
(1) Driving forces of innovation	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}
(2) Production of knowledge	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}
(3) Innovation activities of the business sector	A_{31}	A_{32}	A_{33}	A_{34}	A_{35}
(4) Practical application of innovations	A_{41}	A_{42}	A_{43}	A_{44}	A_{45}
(5) Intellectual ability	A_{51}	A_{52}	A_{53}	A_{54}	A_{55}

The source: developed by the author

Table 2. Innovation activities of real and virtual structures (1) in the context of five events

Events (1)	USA	EU	Japan	The Rest of the world	Standard structure
	1	**2**	**3**	**4**	**5**
(1.1) Science and engineering graduates	$A_{11}^{(1)}$	$A_{12}^{(1)}$	$A_{13}^{(1)}$	$A_{14}^{(1)}$	$A_{15}^{(1)}$
(1.2) The third-level education	$A_{21}^{(1)}$	$A_{22}^{(1)}$	$A_{23}^{(1)}$	$A_{24}^{(1)}$	$A_{25}^{(1)}$
(1.3)The penetration rate of the broadband access to innovative information on the Internet	$A_{31}^{(1)}$	$A_{32}^{(1)}$	$A_{33}^{(1)}$	$A_{34}^{(1)}$	$A_{35}^{(1)}$
(1.4) Lifelong education	$A_{41}^{(1)}$	$A_{42}^{(1)}$	$A_{43}^{(1)}$	$A_{44}^{(1)}$	$A_{45}^{(1)}$
(1.5) Youth education	$A_{51}^{(1)}$	$A_{52}^{(1)}$	$A_{53}^{(1)}$	$A_{54}^{(1)}$	$A_{55}^{(1)}$

The source: developed by the author

The virtual standard structure of Table 1 is characterized by the best performance:

$$A_{15} = max\{A_{11}, A_{12}, A_{13}, A_{14}\};$$
$$A_{25} = max\{A_{21}, A_{22}, A_{23}, A_{24}\};$$
$$A_{35} = max\{A_{31}, A_{32}, A_{33}, A_{34}\};$$
$$A_{45} = max\{A_{41}, A_{42}, A_{43}, A_{44}\};$$
$$A_{55} = max\{A_{51}, A_{52}, A_{53}, A_{54}\}.$$

Similarly, we determined the standard structure in Table 2.

$$A_{15}^{(1)} = max\left\{A_{11}^{(1)}, A_{12}^{(1)}, A_{13}^{(1)}, A_{14}^{(1)}\right\};$$
$$A_{25}^{(1)} = max\left\{A_{21}^{(1)}, A_{22}^{(1)}, A_{23}^{(1)}, A_{24}^{(1)}\right\};$$
$$A_{35}^{(1)} = max\left\{A_{31}^{(1)}, A_{32}^{(1)}, A_{33}^{(1)}, A_{34}^{(1)}\right\};$$
$$A_{45}^{(1)} = max\left\{A_{41}^{(1)}, A_{42}^{(1)}, A_{43}^{(1)}, A_{44}^{(1)}\right\};$$
$$A_{55}^{(1)} = max\left\{A_{51}^{(1)}, A_{52}^{(1)}, A_{53}^{(1)}, A_{54}^{(1)}\right\}.$$

Multiple activities for Macro events (2) include: (2.1.)public expenditures on research and development; (2.2.) expenditures of enterprises on research and development; (2.3.) the share of scientific works; (2.4.) the share of the companies, funded by the state.

The structure of innovation activities of Macro event (2) is presented in Table 3.

Table 3. Innovation activities of real and virtual structures (2) in the context of four events

Events (2)	USA	EU	Japan	The rest of the world	Standard structure
	1	2	3	4	5
(2.1) public expenditures on research and development	$A_{11}^{(2)}$	$A_{12}^{(2)}$	$A_{13}^{(2)}$	$A_{14}^{(2)}$	$A_{15}^{(2)}$
(2.2) expenditures of enterprises on research and development	$A_{21}^{(2)}$	$A_{22}^{(2)}$	$A_{23}^{(2)}$	$A_{24}^{(2)}$	$A_{25}^{(2)}$
(2.3) the share of scientific works	$A_{31}^{(2)}$	$A_{32}^{(2)}$	$A_{33}^{(2)}$	$A_{34}^{(2)}$	$A_{35}^{(2)}$
(2.4) the share of the companies, funded by the state.	$A_{41}^{(2)}$	$A_{42}^{(2)}$	$A_{43}^{(2)}$	$A_{44}^{(2)}$	$A_{45}^{(2)}$

The source: developed by the author

Where: $A_{i5} = \max_{1<i<4}\{A_{i5}\}, i = 1;2;3;4$ is the standard structure, regarding which the performance level is defined for the USA, the EU, Japan and the Rest of the world.

Indices of the innovation development can be used, as they are an integral part of theoretical models, which describe the relationship

between the innovation activity, the economic growth and international competitiveness. [2] Therefore, it is necessary to consider the interdependence of macro events and related activities.

The composition and structure of macro events and events depends on the nature and special character of the innovation activity. In this study we apply the structure of innovation events, proposed by D. Perani and S. Sirilli [4]. Let us consider the parameters of the innovation activity, which are different in different countries, depending on the attitude to the development of the knowledge economy in the country.

Innovation activities of the business sector depend on the following factors: (3.1.) the number of small and medium-sized enterprises, engaged in innovation; (3.2.) cooperation of small and medium-sized enterprises with external partners; (3.3.) innovation expenditures; (3.4.) investments at early stages; (3.5.) the cost of information and communication technologies; (3.6.) small and medium-sized enterprises that have implemented organizational innovations.

The innovation activity structure of Macro events (3) is presented in Table 4.

Table 4. Innovation activities of real and virtual structures (3) in the context of five events

Events (3)	USA	EU	Japan	The Rest of the world	Standard structure
	1	2	3	4	5
(3.1) the number of small and medium-sized enterprises, engaged in innovation	$A_{11}^{(3)}$	$A_{12}^{(3)}$	$A_{13}^{(3)}$	$A_{14}^{(3)}$	$A_{15}^{(3)}$
(3.2) cooperation of small and medium-sized enterprises with external partners	$A_{21}^{(3)}$	$A_{22}^{(3)}$	$A_{23}^{(3)}$	$A_{24}^{(3)}$	$A_{25}^{(3)}$
(3.3) innovation expenditures	$A_{31}^{(3)}$	$A_{32}^{(3)}$	$A_{33}^{(3)}$	$A_{34}^{(3)}$	$A_{35}^{(3)}$
(3.4) investments at early stages	$A_{41}^{(3)}$	$A_{42}^{(3)}$	$A_{43}^{(3)}$	$A_{44}^{(3)}$	$A_{45}^{(3)}$
(3.5) the cost of information and communication technologies	$A_{51}^{(3)}$	$A_{52}^{(3)}$	$A_{53}^{(3)}$	$A_{54}^{(3)}$	$A_{55}^{(3)}$
(3.6) SMEs that have implemented organizational innovations	$A_{61}^{(3)}$	$A_{62}^{(3)}$	$A_{63}^{(3)}$	$A_{64}^{(3)}$	$A_{65}^{(3)}$

The source: developed by the author

The relative analysis involves the comparison of the known parameters for the structures that are considered (the USA, the EU, Japan, and the Rest of the world).

Each country's position is determined relative to one country, for example to the USA, if they agree to consider this country's indices as being equal to 1.

Moreover, the introduction of innovations proceeds differently in different countries (Table 5).

Table 5. Practical application of innovations (4) in the context of five events

Events (4)	USA	EU	Japan	The Rest of the world	Standard structure
	1	2	3	4	5
(4.1) employment in high-tech services	$A_{11}^{(4)}$	$A_{12}^{(4)}$	$A_{13}^{(4)}$	$A_{14}^{(4)}$	$A_{15}^{(4)}$
(4.2) the third-level education	$A_{21}^{(4)}$	$A_{22}^{(4)}$	$A_{23}^{(4)}$	$A_{24}^{(4)}$	$A_{25}^{(4)}$
(4.3) the penetration rate of the broadband access to scientific and innovative information on the Internet	$A_{31}^{(4)}$	$A_{32}^{(4)}$	$A_{33}^{(4)}$	$A_{34}^{(4)}$	$A_{35}^{(4)}$
(4.4) lifelong learning	$A_{41}^{(4)}$	$A_{42}^{(4)}$	$A_{43}^{(4)}$	$A_{44}^{(4)}$	$A_{45}^{(4)}$
(4.5) youth education	$A_{51}^{(4)}$	$A_{52}^{(4)}$	$A_{53}^{(4)}$	$A_{54}^{(4)}$	$A_{55}^{(4)}$

The source: developed by the author

The method of innovation acceleration is considered to be a possible method to assess alternative variants of the innovation process management, develop strategies and improve the effectiveness of new technologies.

It should be based on the comparative analysis of the current and the best variants of innovation activities.

Nevertheless, the comparative analysis of innovation activities in various countries should be regarded as a multi-stage process of strategic assessment.[5]

Intellectual properties of the population serve as the basis of innovation activities and can be measured, using 5 measure units presented in Table 6.

As you can see in Tables 1 - 6, various indices of science and technology development are expressed, with rare exceptions, by means of different incompatible units of measurement. Such indices cannot be compared to each other directly.

Table 6. Intellectual properties (5) in the context of five events

Events (5)	USA	EU	Japan	The Rest of the world	Standard structure
	1	2	3	4	5
(5.1) The number of patents granted by the European Patent Office	$A_{11}^{(5)}$	$A_{12}^{(5)}$	$A_{13}^{(5)}$	$A_{14}^{(5)}$	$A_{15}^{(5)}$
(5.2) The number of patents granted by the Patent and Trademark Office	$A_{21}^{(5)}$	$A_{22}^{(5)}$	$A_{23}^{(5)}$	$A_{24}^{(5)}$	$A_{25}^{(5)}$
(5.3) The number of patents registered in the EU, the USA and Japan	$A_{31}^{(5)}$	$A_{32}^{(5)}$	$A_{33}^{(5)}$	$A_{34}^{(5)}$	$A_{35}^{(5)}$
(5.4) The number of trademarks registered in EU countries	$A_{41}^{(5)}$	$A_{42}^{(5)}$	$A_{43}^{(5)}$	$A_{44}^{(5)}$	$A_{45}^{(5)}$
(5.5) The number of industrial implementations, registered in EU	$A_{51}^{(5)}$	$A_{52}^{(5)}$	$A_{53}^{(5)}$	$A_{54}^{(5)}$	$A_{55}^{(5)}$

The source: developed by the author

The comparative method of innovation activities allows developing composite indicators to synthesize available information in the context of the countries and regions that are considered; it allows combining a number of indicators, which characterize various aspects of innovation activities.

There is no universal indicator of science and innovation development. However, it is possible to calculate specific indicators, on the basis of which we determine the positions to compare the objects relative to each other [3].

In other words, the vector of all indices is standardized relative to one of the indicators, for example: the minimum value, the maximum value, the median value, standard deviations from anything (from average values or the mathematical expectation). Innovation activities are characterized by the following indicators: real values of expenditures, driving forces of innovation activities in the context of the indices of the countries that are studied.

We use the method of deviation to measure the deviation of the structure of actual activities from the virtual standard event. According to the English manual on mathematical modeling, the dot product of two vectors (a, b) is a scalar $(a,b) = |a| \cdot |b| \cos\gamma$, where γ is the angle between two vectors a and b [1]. Then:

$\cos\gamma = \frac{(a,b)}{|a| \cdot |b|}$.

Two non-zero vectors a and b are linearly dependent only if their cross product equals zero; and two non-zero vectors are mutually perpendicular, only if $(a,b) = 0$. If $(a,b) = 1$, then vectors a and b are identical. This means that when we use the method of deviations, the value of the function $\cos\gamma = 1$ means that vectors a and b are identical.

When determining the level of deviation of the considered actual vector from the virtual model vector, we compare angle γ with angle "0": the closer angle γ to zero, the closer the considered vectors to identity.

It is necessary to identify the vectors of the studied macro-events. We can arrange the countries in terms of deviation of macro-events from the macro-events of the model structure in the following way:

$a = (A_{15}, A_{25}, A_{35}, A_{45}, A_{55})$;

$b = (A_{11}, A_{12}, A_{13}, A_{14}, A_{15})$;

Next, we find the cosine of the angle between vectors:

A_1 and A_5; A_2 and A_5; A_3 and A_5; A_4 and A_5, designated respectively by:

$\cos\gamma_{15}$; $\cos\gamma_{25}$; $\cos\gamma_{35}$; $\cos\gamma_{45}$.

$$\cos\gamma_{15} = \frac{\sum_{i=1}^{5} A_{i5}A_{1i}}{\sqrt{\sum_{i=1}^{5} A_{i5}^2} \cdot \sqrt{\sum_{i=1}^{5} A_{1i}^2}};$$

$$\cos\gamma_{25} = \frac{\sum_{i=1}^{5} A_{i5}A_{2i}}{\sqrt{\sum_{i=1}^{5} A_{i5}^2} \cdot \sqrt{\sum_{i=1}^{5} A_{2i}^2}};$$

$$\cos\gamma_{35} = \frac{\sum_{i=1}^{5} A_{i5}A_{3i}}{\sqrt{\sum_{i=1}^{5} A_{i5}^2} \cdot \sqrt{\sum_{i=1}^{5} A_{3i}^2}};$$

$$\cos\gamma_{45} = \frac{\sum_{i=1}^{5} A_{i5}A_{4i}}{\sqrt{\sum_{i=1}^{5} A_{i5}^2} \cdot \sqrt{\sum_{i=1}^{5} A_{4i}^2}};$$

The USA, the EU, Japan and the Rest of the World can be sorted depending on how close they are to the model structure in the process of innovation activities in terms of 5 macro-events.

The success of the proposed method to

accelerate innovation at the level of individual countries, regions, unions, etc. largely depends on the quality of the information used.

The method of deviation of events from the events of the model structure should be applied with some caution. Some of the maximum (or minimum) values should be changed for the parameters, based on the complexity and specificity of the problem, since in some cases they compare the results obtained at different times and in different countries without taking into account the level of scientific development.

This approach on a more effective and efficient use of available resources in innovation can be used both at the level of certain regions and countries, and at the level of companies and industries. In our opinion, the approach is defined as a comparison between the best and the present variant of innovation organization.

At the same time, it should be noted that the standard that is being developed should be theoretically and practically justified. It must be the result of the combined progress, achieved by the participants of the economic processes that are considered to be leaders in implementing innovation.

One should use the comparative method to determine the best conditions for achieving economic goals, and as a result, to achieve the progress in the development, production and realization of competitive products and services.

Thus, those who participate in the international economy can compare various indices of the manufactured products and determine the place where the corresponding product can be produced most efficiently.

The method makes it possible to compare one's own achievements with the performance of the leaders in this field → to analyze how leaders managed to reach their position → to improve one's own activities, based on the data received.

The ultimate goal of the method is to improve innovation activities, analyzing the factors that affect the efficiency.

CONCLUSIONS

Own vision of long-term development of the world economy and the role of own country is not only important in determining the innovation policy strategy of the country, but also protecting its interests during international negotiations.

Innovation components are the determining factors of a long stable growth, created ecosystems during the crisis period and market short-cuts. They are also important to ensure viability and growth of innovative ecosystems in the countries with the developing economy, such as the Republic of Moldova.

The private sector is not interested or hardly ever interested in the scientific and research development. This is explained by a number of reasons, for example: imperfect legislation regarding the innovation control, and its absence in the field of venture capital, which is the basis for innovation in many countries of the world.

Reduced costs of goods and services that are produced enhance the country's competitiveness and economic independence. All economic programs of the country's development should be developed along with the development of forecasts at the global level, international demand for goods and services produced (or potentially produced) in the country. It is necessary to support the country's competitiveness in the field of a long-term economic analysis.

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CROP FARMERS AND HERDERS CONFLICTS IN GIREI LOCAL GOVERNMENT AREA, ADAMAWA STATE, NIGERIA: CAUSES, REPERCUSSIONS AND RESOLUTIONS

Ibrahim S. USMAN, U.M BAKARI, Aliyu ABDULLAHI

Modibbo Adama University of Technology, Department of Agricultural Economics and Extension, P.M.B 2076, Yola, Nigeria, Phone: +2347067952643, +2348038091933, +2348033542046. Emails: ibrogirei@gmail.com, usmanbakari@gmail.com, aliyugylla0344@gmail.com.

Corresponding author: ibrogirei@gmail.com

Abstract

The study analyzed crop farmers and herdsmen conflicts in Girei Local Government Area, Adamawa State, Nigeria. Purposive and random sampling techniques were used to select two out of ten wards in the Local Government Area and 96 (crop farmers = 64, herdsmen = 32) respondents respectively. A questionnaire was used to collect information from respondents. The results from the study revealed that 62.5% of the respondents were below the age of 50 years the two groups exhibited differing occupational characteristics; most farmers (62.5%) were small-scale operators (1-3 hectares), most herdsmen (81.2%) operated on a relatively higher scale (more than 60 heads of cattle). Destruction of crops and crop residues by cattle and burning of rangelands and blockage of stock routes by crop farmers were the major causes of conflict. Repercussions of conflicts included loss of income (100.0%), loss of yield (100.0%) and stored product (64.0%) among crop farmers. Herdsmen reported minimal losses of their income (40.6%), yield (46.9%) and stored product (53.1%). Conflict also exacerbates insecurity, loss of quality support, self esteem, social support and food crisis particularly in rural communities with repercussions nationwide. Respondents suggested that: traditional and local leaders should be well involved in finding lasting solutions to conflict and factors of conflicts must be properly managed by institutions involved in the conflict resolutions. It is recommended that herdsmen should be made to keep to the agreed grazing reserve and routes and farmers should avoid farming across cattle routes and grazing reserve. Structures must be created by the communities to generate networks and feedback to ensure that people relate amicably for common use of resources.

Key words**:** *farmers-herdsmen conflict, conflict repercussions, conflict resolutions*

INTRODUCTION

Nigeria falls within the tropical ecological zone and enjoys the tropical climate which varies from the humid south to the semi-arid /arid zones of the north with a total land area of about 94 million hectares of which over 70% is natural grassland and over 55% is available for grazing [10]. Consequently between 80-90% of the small ruminants and cattle are concentrated in the Sudan-Sahelian ecological zone of the semi arid/arid parts of the country and depend on range for most of their fed requirements. The herds are predominantly in the hands of the nomadic pastoralists who hold over 90% of the Nigeria's livestock [6]. Transhumance is the dominant system of production. Similarly, about 75% - 80% of the people in this area are crop farmers who engaged in small (subsistence) farming and depend on farming for their survival. These two groups of farmers live together since time immemorial but they have different values, customs, physical and cultural characteristics [8]. The feeling of belongings that is among the members of the groups is focused around their economic interest, protection of values, cultures and power. The Fulani nomadic herders are always considered to be the minority in host communities (since they are always on the move) have a unique culture and strong sense of solidarity [10]. They are often isolated from farming population, and in such cases conflict between two farming population is regarded as having an ethnic colour. Therefore, the conflicts that are occurring between crop farmers and herders are not only seen as resources conflicts but sometimes represent as ethnics conflicts

involving the key groups. Hence an understanding of causes, repercussions and resolutions of conflict between pastoralists and crop farmers in host communities is an important prerequisite for the realization of the goal of agricultural development policies, to which research experts and extension agents are professionally committed. Therefore, the study was conducted to analyze the crop farmers and herdsmen conflicts in Girei Local Government Area of Adamawa State, Nigeria, with the view of identifying the causes, repercussions and resolutions.

MATERIALS AND METHODS

The Study Area

The research was conducted in Girei Local Government Area of Adamawa State, Nigeria. The area is located at the central part of the state and lies between latitude 9^0 11' to 9^0 39' North of the equator and longitude 12^0 11' to 12^0 49' East of the Greenwich Meridian with a land mass of about 2,186 km^2 [1] the population of 129,995 people [7]. The study area is distinctly divided into dry and wet season. The wet season normally commences from April and ends in October with an annual average rainfall of 762 mm. The hottest period occurs between February and March and the area has an average temperature of 44^0 C [2].

The main occupation of the people in the area is crop farming and animal rearing. Indisputably nomadic Fulani represent a significant component of the economy in the study area. They constitute the major breeders of livestock, main source of meat, the most available and cheap source of animal proteins consumed by people in the local government area and the state. The vegetation, availability and abundance of water (river Benue) and also the culture of the inhabitants influence the distribution of livestock in the area. The area is one of the principal livestock producing Local Government Area in the state [5]. Indigenous breeds of animals are the mainstay of livestock industry in the area. This is because local breeds are well adapted to the harsh environmental conditions and are also suitable for nomadic system of production being adopted by the Fulani herders [3]. The area is also well known for arable crop production and fishing.

The dominant tribe in the area is Fulani with a substantial number of Bwatiye in the villages along the Benue River Bank of Greng, Ntabo and Labondo [11].

Sampling Techniques and Sample Size

Two out the ten wards of the Local Government Area were purposely selected being the wards along the Bank of River Benue that has all year round water and vegetation also with some *fadama* areas. It is also the area where conflicts occur between livestock pastoralists and crop farmers in the Local Government Area. The list of the 429 registered crop farmers was obtained from the Adamawa Agricultural Development Programme (AADP). A total of 64 respondents were randomly selected from the list, while 32 herders were also selected for the study. This was done by randomly selecting four herders each from eight transit camps in wards selected. In all, 96 respondents were selected (64 crop farmers and 32 pastoralists) for the study. Relevant data were collected using questionnaire and scheduled interview were a respondent cannot read or write.

Analytical Tools

Descriptive statistics like frequencies, percentages were used for the data analysis.

Results and Discussions

Result on Table 1 shows that 62.5% of the respondents are below the age of 50 years which indicated that both the groups (crop farmers and herders) are at their prime age and energetic. About 88% of the crop farmers and 93.7% of herders had more than 10 years experience in their occupation. Most farmers were small-scale operators while most herders operated on a relatively higher scale. This perhaps explains the gap in their income level as in Table 1. Interestingly too, about 24.8% of the herdsmen were agro-pastoralists combining cattle-herding with arable crop production. This group of respondents is qualified to be classified both as farmers and herders, but are Fulani nomads by ethnicity. On the other hand, crop farmers, who are essentially non-Fulani, did not engage in

cattle herding as alternative occupation. Table 1 further revealed that 78.1% of the herders practiced extensive system of livestock management, moving over long distances in search of pasture and water. This may lead to indiscriminate grazing and over grazing of pasture and conflict with other resource users.

Table 1. Socio-economic characteristics of the respondents

Variable	Farmers (n = 64)		Herders (n = 32)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Age				
30-39	22	34.4	9	28.1
40 – 49	18	28.1	11	34.4
50 – 59	8	12.5	8	25.0
>59	16	25.0	4	12.5
Farm size				
< 1	22	34.4	NA	NA
1 – 3	18	28.1	4	12.5
4 – 6	15	23.4	NA	NA
> 6	9	14.1	NA	NA
Herd size				
20 – 40	NA	NA	2	6.3
41 – 60	NA	NA	4	12.5
61 – 80	NA	NA	6	18.7
81 – 100	NA	NA	9	28.1
> 100	NA	NA	11	34.4
Experience				
5 - 10	8	12.5	2	6.3
11 – 15	14	21.9	9	28.1
16 – 20	19	29.7	4	15.6
> 20	23	35.9	16	50.0
Production system				
Crop (Rain feed)	59	92.2	NA	NA
Livestock (Extensive)	NA	NA	25	78.1
Livestock (Semi-intensive)	NA	NA	3	9.4
Agro-pastoralist	5	7.8	4	9.5

Source: Field survey, 2016

Causes of Conflicts

Result on Table 2 revealed that according to herders (100%), distortion of the livestock routes by crop farmers and inadequate grazing reserve were the major cause of conflict. Other major causes of conflict according to the herders are: encroachment of cattle routes (96.9%) as a result of human activities arising increased in population; burning of range land (93.8%) and killing of family members by the farmers (81.3%). According to crop farmers, the causes of crop farmers livestock herders are: grazing of crops and crops residue (100%); destruction of water sources (67.2%) and inadequate grazing reserve (64.1%). This is in line with the opinion expressed by [10] who asserted that in most states, stock route have been blocked by farmers' crops, individual building and government development projects is the major source of conflict between pastoralists and crop farmers.

Inadequate watering Points for both human and animal consumption have also been found to be one of the sources of conflict in the area as reported 53.1 % and 43.8% of the crop farmers and herders respectively.

Repercussions of the Conflicts

Most respondents suffered various repercussions as a result of conflict. The repercussions on both sides ranged from physical, economic, to socio-psychological.

Table 3 presents the results of the repercussions of conflict among the respondents. The findings show that both crop farmers (96.9%) and herdsmen (93.4%) reported loss in quality of relationship as a result of conflict.

Table 2. Causes of Conflicts

Variable	*Crop farmers(n=64)		*Herders (n= 32)	
Cattle theft and killing	NA	NA	22	68.8
Grazing of crops and crops residue	64	100	19	59.4
Destruction of water sources	45	67.2	18	56.3
Burning of rangeland	NA	NA	30	93.8
Inadequate Water Points	34	53.1	14	43.8
Inadequate grazing reserve	41	64.1	32	100.0
Encroachment of grazing reserves	NA	NA	31	96.9
Encroachment of stock route	NA	NA	32	100.0
Inadequate pasture	9	14.1	17	53.1
Killing Family members	2	3.1	26	81.3

Source: Field Survey, 2016 * Multiple responses exist

Other non-material resources that were lost included self esteem (67.2% of farmers and 90.6% of herdsmen). [10] expressed the bitterness and ill feeling that resulted from the conflict have serious negative implication on integration, understanding and cooperation which are vital for the progress and development of the State in general. Loss of material resources were, however, more widespread among farmers. Income loss had the highest relative incidence (100.0%) among crop farmers, loss of yield (79%), household resources (95.3%) and stored products (100.0%).

On the part of herdsmen losses of material and non material were minimal. About 47%, 40.6% and 53.1% of herdsmen claimed to have suffered losses in respect of their, income, yield and stored products respectively. This corroborates the findings of [4] and [10] who stated in their studies that family instability, loss of lives, loss of properties and intense frustration are negative consequences of conflicts. The finding reveals that both crop farmers and herders suffered several negative consequences of conflicts. These effects were, however, found to be more pronounced among the farmers than herdsmen, probably because they the dominant people in the area.

Table 3. Repercussions of conflict according to respondents

Variable	*Crop farmers(n=64)		*Herders (n= 32)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Loss of yield	64	100	13	40.6
Loss Income	64	100	15	46.9
Loss Family members	13	20.3	4	12.5
Injuries	32	50.0	3	9.4
Loss of Cattle	NA	NA	19	59.4
Loss of Quality of relationship	62	96.9	30	93.4
Destruction of house and resources	61	95.3	31	96.9
Loss of self esteem	45	67.2	29	90.6
Loss of stored products	64	100	17	53.1
Loss of social support	41	64.1	32	100

Source: Field Survey, 2016 * Multiple responses exist

Conflict Resolutions

Conflicts were formerly settled through traditional and local leaders who were well involved in finding lasting solutions to conflict. All (100%) percent of the respondents revealed that, traditional rulers used settle disputes in olden days (Table 4). The village or district will investigate the cause of dispute and settle the parties involved. This is done by telling the parties to be accommodative to each other, payment of damage where crops or livestock are involved or sanction. Result on Table 4 also revealed that 78.1% of the crop farmers and 90.1% of the herders opined that factors of conflicts must be properly managed by institutions to be involved in the conflict resolutions. The conflict resolution committee according to the respondents should comprise representatives from the relevant Departments of local

government, state security services, the police, farmers and *Miyetti* Allah Cattle Breeders Association with similar committees also to be formed at the districts and wards levels. All (100%) of the herders and 20.3% of the crop farmers revealed that another method of resolving conflict is through reactivation of gazetted grazing reserve, while 50.0% and 100.0% of the crop farmers and herders respectively agreed that herdsmen must keep to agreed cattle routes and crop farmers to avoid encroaching the routes.

Only 21.8% of the crop farmers and 18.9% of the herders reported that conflicts can be resolved in courts or police station. This show that, the social, economic and political tensions created as a result of numerous escalations of violent conflicts between herders and crop farmers have put a question mark on the suitability or relevance of the state alone to manage and resolve such conflicts. Therefore, there is need of involving traditional leaders.

Table 4. Resolutions According to the Respondents

Variable	***Crop farmers(n=64)**		***Herders (n= 32)**	
	Frequency	Percentage (%)	Frequency	(%)
-Grazing reserve to be reactivated	13	20.3	32	100.0
-Conflicting parties to be sensitize on peace by community leaders	41	60.1	15	46.9
-Factors of conflicts must be properly managed by institutions involved in the conflict resolutions	50	78.1	29	90.1
-Herdsmen must keep to agreed routes and farmers to avoid encroaching the routes	32	50.0	32	100.
-Law on the grazing reserve should be amended and improve upon	21	32.8	31	96.9
-Government and non-governmental agency should available seeds for establishment of forage in grazing reserves	43	67.2	30	93.8
-Traditional and local leaders should be well involved in finding lasting solutions to conflict.	64	100.0	32	100.0

Source: Field Survey, 2016 * Multiple responses exist

CONCLUSIONS

Struggle for common resources has degenerated into violent conflicts in Girei Local government area of Adamawa State between Fulani herders and crop farmers. These conflicts have become more intense, widespread and destructive. There is food insecurity due to destruction of farms and stored food. Some survivors have permanently lost all they laboured for in their lives. Since most of the Fulani herdsmen do not own or possess land, they therefore depend on free range. However, additional farms acquired and encroachments of traditional cattle routes and grazing reserves as a result of increased in population have drastically reduced the grazing space for the livestock to access pasture areas and water points. As a result one can argue that the aggregate of such instance have negative impact on the agricultural activity which is the main economic activity of area, and by an extension the rest of the state.

The following recommendations are suggested for proper conflict resolutions between the Fulani herdsmen and farmers:
(i)Re-demarcation of grazing reserves for herders.
(ii)There is need for sensitization of crop farmer-herders in the areas of awareness on the need of co-existence.
(iii)Government should be firm and fair in its resolution and implementation of decisions.
(iv)Traditional and local leaders should be well involved in finding solutions to

herdsmen-farmer conflict. The committees proposed above must have representatives of the local leadership.

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HIGH VALUE AGRICULTURE IN THE REPUBLIC OF MOLDOVA, COMPARATIVE ANALYSIS AND FEASIBILITY OF INVESTMENTS

Andrei ZBANCĂ, Sergiu PANUȚA, Virgiliu MOREI, Grigore BALTAG

The State Agricultural University of Moldova, 44 Mircesti, 2049, Chisinau, Republic of Moldova, Phone: +373 22 432 432, Fax: +373 22 312 276, E-mail: andzbanca@yahoo.com

Corresponding author: andzbanca@yahoo.com

Abstract

The objective of Moldova's integration into the international economic system requires a qualitative change of the current situation in the food sector. The globalization of the world economy and the technical – scientific progress provides new opportunities for increasing efficiency and upgrading production technologies for agricultural production. In Moldova this task can be achieved by targeting entrepreneurs towards crop diversification and export of agricultural products with high added value, for which there are profitable and modern markets. Currently, entrepreneurs focus on development of high-value agricultural sector, which provides the greatest profits and, due to this fact, could become an important source of increasing income in the rural sector. The aim of the research is a comparative analysis of cultivation of high value crops, and the result is to create an informational support that enables local entrepreneurs to select the correct crops based on the economic indicators and financial resources to invest argued. Information and research results were made under the Agricultural Competitiveness and Enterprise Development Project (ACED). The authors have developed annual financial models for each crop and perennial plantations were developed additional investment budgets. High value production (particularly fruit and vegetables) offers the highest profits and it has great to increase farmers' incomes. For small and medium farms practicing commercial agriculture (HVA) is the solution for developing efficient and sustainable business in market economy.

Key words**:** *agribusiness, production costs, profitability, sales income, budget*

INTRODUCTION

Transformation of Moldovan food sector in a modern, efficient and competitive one requires important investments and appropriate support of authorities especially through agrarian policies. The development of local horticultural sector is a practical way of modernization and diversification of agriculture and at the same time a potential source of incomes in rural areas. Local farmers have no access to complex information (economy, technology, and marketing) of high value agrarian sector and meet problems while selecting correctly crops for cultivation.

The aim of the research is to develop budgets and comparative economic analysis that includes the most important high value agrarian crops allowing local and international entrepreneurs to select correctly the crops based on economic indicators and to invest reasonably financial resources.

Currently the agrarian entrepreneurs are oriented to develop high value agriculture (HVA) that is locally represented by the horticultural products (fruits, vegetables, grapes, essential oil crops and products derived therefrom).

The outcomes of research are actual for all stakeholders that are covering the high value agrarian sector where currently a great interest is observed for its development from the side of entrepreneurs and external donors (sponsors).

MATERIALS AND METHODS

As sources for research were used data of agrarian sector especially of high value agriculture as well as specialized literature. Other sources are field surveys and information from agricultural producers. The comparative advantages of growing of high value crops was analysed through economic argumentation of incomes and costs for 45 crops.

Information and research results were

conducted within the Project Agricultural Competitiveness and Enterprise Development (ACED). The author developed annual financial model for each crop (technological sheet) and for the perennial plantings investment budgets were developed (the period from planting to fructification). The results of these tests served as a basis for the comparative analysis of advantages of growing high value crops and for making recommendations for farmers.

RESULTS AND DISCUSSIONS

Agriculture of the Republic of Moldova stays the main sector of national economy with a share of 11.7% in GDP structure, 50% of volume of exports and employees around 30% of the working population of the country.

Table 1. Estimation of necessary investments and term of recovery for growing high value crops in the Republic of Moldova (calculated per 1 ha)

No	Specification	Term of recovery for investments, years	Average yield per hectare, t/ha	Necessary investment, Euro/ha	Available subsidies, Euro/ha
1	Apples - MM 106	10.6	25.0	6,128	465
2	Apples - M 26	7.7	41.2	8,274	698
3	Apples - M 9	7.3	60.3	19,999	4,498
4	Plums	11.0	20.0	5,411	349
5	Peaches	9.0	20.0	5,014	349
6	Nectarines	8.0	15.0	5,148	349
7	Pears	9.5	21.4	6,208	465
8	Pears Abbé Fétel	9.7	53.3	30,276	4,493
9	Apricots	8.1	14.6	5,745	349
10	Cherries Mahaleb	7.1	8.0	4,296	349
11	Cherries Maxima 14	6.0	12.0	5,746	660
12	Cherries Gisela 6	6.7	16.3	14,542	4,279
13	Cherries	6.9	12.0	4,734	349
14	Nut	11.1	2.2	7,281	465
15	Almond	7.9	1.6	6,849	465
16	Currant trellis	2.5	6.0	5,627	3,102
17	Currant bush	2.2	5.2	4,013	3,102
18	Raspberry	3.4	7.0	7,057	3,163
19	Blackberries	2.4	16.7	7,181	3,163
20	Strawberry	4.0	17.8	14,521	3,163
21	Remontant strawberry	3.1	23.7	14,521	3,163
22	Wine grapes	29.1	12.9	9,365	930
23	Table grapes	10.8	14.4	10,144	1,163
24	Greenhouse cucumbers	4.8	104.6	156,837	62,326
25	Greenhouse tomatoes	4.2	153.8	156.837	62,326
26	Greenhouse peppers	4.1	76.9	156,837	62,326
27	Outdoor tomatoes, seedling	0.1	70.0	1,116	372
28	Outdoor tomatoes seeds	0.2	60.0	1,116	372
29	Outdoor cucumbers	0.1	40.0	930	312
30	Outdoor peppers	0.1	45.0	1,116	372
31	Eggplant	0.1	60.0	1,116	372
32	Early potatoes	0.3	22.0	1,116	372
33	Late season potatoes	0.3	38.0	1,116	372
34	Onion	0.2	50.0	1,256	502
35	Garlic	0.1	12.0	1,256	502
36	Late season cabbage	0.3	80.0	1,116	372
37	Cauliflower	0.2	25.0	1,116	372
38	Broccoli	0.2	22.0	1,116	372
39	Carrot	0.1	45.0	1,256	502
40	Beet	0.3	50.0	1,116	372
41	Courgette	0.5	50.0	930	372
42	Watermelon	0.5	40.0	1,116	372
43	Melon	0.4	30.0	1,116	372
44	Salad	0.2	20.0	1,116	372
45	Celery	0.1	20.0	1,116	372

Source: Author's calculations based on investment budgets (period from planting to fructification) [1, 2].

Fruit and vegetables sector consists of two subsectors: fresh products and processed products. The sector of processed products includes four major product groups: canned, dried, frozen products and juices. Production of fresh fruits and vegetables for market provides the highest value to farmers, thus being the most profitable, where high quality of product is assured throughout the value chain. Production of fruits and vegetables for processing industry offers farmers lower incomes and requirements towards products' quality are lower thus requiring lower production costs.

Below are the results of economic calculations related to the amount of investments, subsidies and terms of recovery for high value agricultural plantations (Table 1).

Table 2. Estimation of economic results of the operational activity of growing high-value crops in the Republic of Moldova (calculated per 1 hectare)

No	Specification	Sales incomes, Euro/ha	Sales costs, Euro/ha	Gross profit, Euro/ha	Economic profitability, %	Economic calculations per 1 kg of production, Euro/kg		
						Average sales price	Unit cost	Gross profit (commercial excess)
1	2	3	4	5	6	7	8	9
1	Apples - MM 106	3,512	2, 287.3	1,224	53.5%	0.140	0.091	0.049
2	Apples - M 26	6,244	3,395.3	2,848	83.9%	0.152	0.082	0.069
3	Apples - M 9	10,408	5,674.2	4,734	83.4%	0.173	0.094	0.078
4	Plums	2,940	1,919.2	1,020	53.2%	0.147	0,096	0,051
5	Peaches	3,349	1,817.6	1,531	84.2%	0.167	0.091	0.077
6	Nectarines	4,256	1,811.6	2,444	134.9%	0.284	0,121	0,163
7	Pears	4,286	1,987.6	2,298	115.6%	0.200	0.093	0.107
8	Pears Abbé Fétel	10,933	5,471.6	5,461	99.8%	0.205	0.103	0.102
9	Apricots	4,612	1,987.1	2,625	132.1%	0.316	0.136	0.180
10	Cherries Mahaleb	5,507	1,960.1	3,547	181.0%	0.688	0.245	0.443
11	Cherries Maxima 14	7,926	2,913.8	5,012	172.0%	0.660	0.243	0.418
12	Cherries Gisela 6	10,733	4,570.9	6,162	134.8%	0.660	0.281	0.379
13	Cherries	6,718	1,932.6	4,786	247.6%	0.560	0.161	0.399
14	Nut	5,116	1,816.9	3,299	181.6%	2.326	0.454	1.871
15	Almond	5,233	1,827.6	3,405	186.3%	3.256	0.512	2.744
16	Currant trellis	8,037	3,020.4	5,017	166.1%	1.340	0.503	0.836
17	Currant bush	6,966	2,667.2	4,298	161.2%	1.340	0.513	0.827
18	Raspberry	6,837	4,029.1	2,808	69.7%	0.977	0.576	0.401
19	Blackberries	14,264	4,259.2	10,004	234.9%	0.856	0.256	0.600
20	Strawberries	12,403	6,606.6	5,797	87.7%	0.698	0.372	0.326
21	Remontant strawberries	18,522	7,830.6	10,691	136.5%	0.781	0.330	0.451
22	Wine grapes	2,230	1,880.7	349	18.6%	0.173	0.146	0.027
23	Table grapes	3,897	2,357.1	1,540	65.3%	0.270	0.163	0.107
24	Greenhouse cucumbers	46,469	26,902.8	19,566	72.7%	0.444	0.257	0.187
25	Greenhouse tomatoes	48,234	25,583.6	22,651	88.5%	0.314	0.166	0.147
26	Greenhous peppers	48,301	25,036.3	23,264	92.9%	0.628	0.325	0.302
27	Outdoor tomatoes, seedling	10,874	5,546.5	5,328	96.1%	0.155	0.079	0.076
28	Outdoor tomatoes seeds	6,460	3,042.7	3,417	112.3%	0.108	0.051	0.057
29	Outdoor cucumbers	9,581	3,265.3	6,316	193.4%	0.240	0.082	0.158
30	Outdoor peppers	11,143	5,217.9	5,925	113.6%	0.248	0.116	0.132
31	Eggplant	12,093	4,462.1	7,631	171.0%	0.202	0.074	0.127
32	Early potatoes	5,526	3,175.5	2,350	74.0%	0.251	0.144	0.107
33	Late season potatoes	6,221	3,801.1	2,420	63.7%	0.164	0.100	0.064
34	Onion	6,977	3,354.3	3,622	108.0%	0.140	0.067	0.072
35	Garlic	9,070	3,816.8	5,253	137.6%	0.756	0.318	0.438
36	Late season cabbage	5,767	3,489.5	2,278	65.3%	0.072	0.044	0.028
37	Cauliflower	7,151	3,928.0	3,223	82.1%	0.286	0.157	0.129
38	Broccoli	7,930	3,546.5	4,384	123,6%	0.360	0.161	0.199
39	Carrots	8,623	3,105.9	5,517	177.6%	0.192	0.069	0.123
40	Beet	5,442	2,864.1	2,578	90.0%	0.109	0.057	0.052
41	Courgette	3,140	1,922.9	1,217	63.3%	0.063	0.038	0.024
42	Watermelon	3,256	1,841.9	1,414	76.8%	0.081	0.046	0.035
43	Melon	4,070	2,018.5	2,051	101.6%	0.136	0.067	0.068
44	Salad	9,209	4,487.3	4,722	105.2%	0.460	0.224	0.236
45	Celery	10,698	4,887.2	5,810	118.9%	0.535	0.244	0.291

Source: Author's calculations based on cultivation budgets for the fructification period [1, 2].

Based on the presented information in the previous table entrepreneurs/farmers can take qualitative decisions regarding the sector which they want to invest. At the same time the owner need to analyse the dynamic evolution of the consumers and mainly: if it

would rise, stay at the same level or will decrease. Just after these complex analysis decisions on implementation for production sectors that offers fewer risks and have a range of advantages compared to other agricultural sectors need to be taken.

Based on researches conducted at budgeting incomes and costs for 45 high value agrarian costs, it was possible to systematize data and to provide their complex analysis (Table 2).

Table 3. Costs budgeting and its components at growing high-value crops in the Republic of Moldova (calculated per 1 hectare)

No.	Specification	Sales costs, Euro/ha					
		Total	Inlcuding				
			means for production	machinery services	manual operations	Other costs and fees (including amortization)	unexpected expenses
1	Apples - MM 106	2,287.3	783.1	229.9	687.6	378.7	207.9
2	Apples - M 26	3,395.3	858.4	303.8	1,036.9	887.6	308.7
3	Apples - M 9	5,674.2	942.2	367.7	1,635.0	2,213.6	515.8
4	Plums	1,919.2	523.7	167.7	692.1	361.3	174.5
5	Peaches	1,817.6	413.1	174.8	626.1	438.4	165.2
6	Nectarines	1,811.6	429.8	163.1	542.5	511.5	164.7
7	Pears	1,987.6	430.9	163.8	703.3	509.0	180.7
8	Pears Abbé Fétel	5,471.6	590.0	322.6	1,715.6	2,346.0	497.4
9	Apricots	1,987.1	259.0	126.0	687.6	733.8	180.6
10	Cherries Mahaleb	1,960.1	235.2	110.5	871.7	564.5	178.2
11	Cherries Maxima 14	2,913.8	310.5	170.0	1,196.9	971.5	264.9
12	Cherries Gisela 6	4,570.9	427.7	213.9	1,627.9	1,885.9	415.5
13	Cherries	1,932.6	208.4	119.9	1,196.9	231.7	175.7
14	Nut	1,816.9	313.8	108.3	689.7	540.0	165.2
15	Almond	1,827.6	313.8	107.3	649.3	591.1	166.1
16	Currant trellis	3,020.4	400.0	507.2	817.3	1,021.3	274.6
17	Currant bush	2,667.2	436.6	505.3	698.8	784.1	242.5
18	Raspberry	4,029.1	486.8	526.2	932.9	1,716.8	366.3
19	Blackberries	4,259.2	500.9	221.2	1,481.2	1,668.8	387.2
20	Strawberries	6,606.6	452.8	292.2	1,147.1	4,113.8	600.6
21	Remontant strawberries	7,830.6	614.9	318.9	1,649.4	4,535.6	711.9
22	Wine grapes	1,880.7	441.1	140.3	702.4	425.9	171.0
23	Table grapes	2,357.1	570.0	157.6	864.3	550.9	214.3
24	Greenhouse cucumbers	26,902.8	6,953.0	857.7	4,196.3	12,450.1	2,445.7
25	Greenhouse tomatoes	25,583.6	8,176.4	1,108.7	3,662.9	10,309.8	2,325.8
26	Greenhouse peppers	25,036.3	6,119.8	709.0	3,182.0	12,749.5	2,276.0
27	Outdoor tomatoes, seedlings	5,546.5	3,142.2	501.6	1,027.7	370.8	504.2
28	Outdoor tomatoes, seeds	3,042.7	1,363.0	396.3	834.2	172.6	276.6
29	Outdoor cucumbers	3,265.3	1,141.4	329.3	879.1	618.6	296.8
30	Outdoor peppers	5,217.9	3,148.4	423.3	999.3	172.6	474.4
31	Eggplant	4,462.1	2,417.3	429.7	1,036.8	172.6	405.6
32	Early potatoes	3,175.5	1,930.5	271.7	469.9	214.8	288.7
33	Late season potatoes	3,801.1	2,303.7	359.9	602.4	189.5	345.6
34	Onion	3,354.3	1,315.2	354.6	954.6	425.0	304.9
35	Garlic	3,816.8	1,926.3	252.8	795.5	495.2	347.0
36	Late season cabbage	3,489.5	1,801.4	465.1	683.7	222.0	317.2
37	Cauliflower	3,928.0	2,302.6	397.7	618.4	252.2	357.1
38	Broccoli	3,546.5	1,978.2	375.8	502.5	367.6	322.4
39	Carrots	3,105.9	956.3	326.0	929.6	611.5	282.4
40	Beet	2,864.1	1,054.7	343.0	863.3	342.7	260.4
41	Courgette	1,922.9	587.8	306.6	616.3	237.5	174.8
42	Watermelon	1,841.9	707.0	299.8	421.8	245.9	167.4
43	Melon	2,018.5	846.6	268.0	547.8	172.6	183.5
44	Salad	4,487.3	1,994.2	403.1	1,226.9	455.2	407.9
45	Celery	4,887.2	2,752.6	396.0	722.0	572.2	444.3

Source: Author's calculations based on cultivation budgets for the fructification period [1, 2].

Based on the achieved results and comparative economic analysis of practice of HVA we can conclude that in conditions of market economy small and medium farms (cultivated area within 1 ha to 50 ha) need to concentrate on implementation of intensive

agriculture applying advanced technologies mainly based on high-value agriculture and narrow specialization.

At the same time economic results of operational activities differ considerably for high-value crops through obtained value of sales revenues and gross profit depending on the intensity level. The comparative analysis of budget data economic argument of activities in vegetable sector demonstrates a true regularity: with justified increasing of the production costs (intensity level), economic efficiency and results of operational activity enhance.

As a result of calculations realized at budgeting incomes and costs for high-value crops, it was possible to systemize data regarding related costs and their components for crops (Table 3).

In Moldova the trade balance of fruits and vegetables in general has a positive balance. This is due to the fact that the country records positive results for fruits sale, but for vegetable sales our country has a significant negative balance for the whole period. The main reason is the fact that local farmers cannot ensure production and sale of fresh vegetables during the year and huge imports of these products are needed.

Dominance of agriculture in Moldova's economy is confirmed by the highest share of food exports. This high share is supported by the processing industry that makes the majority of food exports and contributes with 7-8% to the GDP and employees around 5% of labour force.

Processing industry of fruit and vegetables is a traditional industry in Moldova oriented mainly to export that at the moment has a total capacity of around 200 thousand tons and is focusing its efforts to diversification of markets and products.

Now the processing industry of fruits and vegetables includes 8 large enterprises that process 70-80% of the total volume of production and around 90 small and medium enterprises that contribute with 20-30%. Currently food industry uses its processing capacities just for around 45-50% from the total and it continuously decreases that proves inefficiency of this sector though: diversification of the range of products and markets, enhancing the quality and production conformity, price guarantees for the fruits and vegetables purchased in advance, slow modernization of technology and processing process, etc.

In the conditions of market economy Moldova has considerable reserves regarding the increasing production volumes of fruits and vegetables to ensure local needs and volume of export because there is a guaranteed demand and prerequisites for continuous growth for the local and international markets.

Conditions of market economy impose agricultural producers to orient their activity through businesses that fall and meet the following aspects: quality and productivity, implementation of modern and intensive technologies, development of product's value chain, combine high-value agriculture (commercial agriculture) with subsistence farming (extensive farming), develop marketing infrastructure, associating the interests of homogeneous production professional organizations and cooperation for promoting and access to new profitable markets, etc. Moldovan agriculture will revitalize and develop just in the case agricultural producers will comply and practice sustainable agriculture for all the sectors, including the horticultural sector.

CONCLUSIONS

Researches and investigations carried out in the sector of high-value agriculture allowed us to conclude the following:

-Production of high-value products (especially fruits and vegetables) offers the highest profits and thus represents an important potential for increasing farmers' incomes. For small and medium farms practicing commercial farming (of high-value) is the only solution for efficient and sustainable development in market conditions;

-It is necessary to implement advanced technologies and to enhance the intensity level for crops cultivation – main direction to ensure competitiveness of local fruits and vegetables on regional and strategic markets;

It is necessary to use intensive technologies

for production of berries and vegetables (outdoor and greenhouses) that will ensure diversification of high-value products and more efficient use of production factors during the year (especially of labour force);
-Is absolutely necessary to identify and promote methods of farmers' association for irrigation of crops, especially for fruits and vegetables;
-Cooperation of farmers for homogenisation of technologies and quality oriented to create industrial quantities and their sale at reasonable prices.

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