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CONTRIBUTIONS TO THE DEVELOPMENT OF THE FIELD CROPS YIELD IN TEISANI AREA HOUSEHOLDS, PRAHOVA COUNTY

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Abstract

The aim of the paper was to analyze the technological performance of the field crops on luvisoils in Teisani area, Prahova County, where corn and potato are cultivated for personal consumption and beet for animal nutrition. The cultivation of wheat and fodder plants has been an exception. Studies conducted have firstly referred to the introduction of crops in rotation system, through cooperation and exchange between households and within their own household for those with larger surfaces. To compare the productivity of crops, the yield energy value has been used as a measure unit, which facilitates the comparison. The yields was reduced up to the lower limit of crop potential because of monocultures and the lack of appropriate technologies, even for small farming machinery.
The results showed that using improved technologies, in 2013 and 2014, the yields were significantly superior, the highest ones, for potatoes and alfalfa, the last one as jumper field. Introducing alfalfa in the crop rotation system has led to the potato yield doubling, but also of those of wheat, corn and beet. Using manure and organic material available and degradable in the form of compost made in their own household, to which are added small amounts of nitrogen and phosphorus, there were obtained average yields by 40% higher than the average of the experience and by 139%, i.e. 2.4 times higher than the unfertilized variant, very much used in the area. Therefore, it was demonstrated, that there are huge resources to produce agricultural products and primary food in the Teisani rural area. Small peasant households should be encouraged and financially supported to participate to food production both for their own consumption, but also for the market.

Key words*: *agricultural crops, fertilization, management, peasant household

INTRODUCTION

In the Teisani area, the experiment was organized on luvisoils type soils. Total agricultural surface used in the experiment was 2,253 ha [8], of which the arable land represented 478 ha. The cultivated surface with various crops was: wheat = 31 ha, corn = 188 ha, potato = 50 ha, alfalfa = 66 ha, and beet = 20 ha.
The remaining agricultural land was cultivated with vegetables, fruit trees, pastures, shrubs, other crops etc.
The following yields of the main crops were obtained: wheat = 1.5-1.6 t/ha, potato = 4.2 t/ha, beet = 5 t/ha, corn = 1.4 t/ha, and alfalfa = 15 t/ha.
Our study took into consideration the possibility of agricultural technologies optimization and the development of a management that is going to bring a significant yield increase on this type of soil and, therefore, the small farming agriculture will have a higher contribution to the rural areas development [2].
Given the plots pronounced splitting into small lots, it was also taken into account the possibility of collaboration between households, in order to form some suitable provide crop rotations for the research purpose.
The surveys conducted among householders have led to the finding that the locals have mostly used monoculture in all crops, at this moment the soil being at its physical and biological resistance limit, luvosoils having, by definition, a medium to low fertility [6] [3].
Our working hypothesis proposed itself to think, to experiment and to implement a crop rotation system which is going to led to yields higher than double as now into the area.

MATERIALS AND METHODS

Taking into account the negative effects of monocultures [4], we focused on a crop rotation system consisting of five economically important crops, namely: 1. winter wheat; 2. corn; 3. beet; 4. potato; 5. alfalfa – jumping field. It is replaced by deep plowing at every 4 years.

Cultures haven't been arranged in the field according to the experimental technique requirements, but treatments have been made on different plots and to different owners.

Each of these five crops from the presented crop rotation has received six fertilization variants, which were established according to the researches previously conducted in this regard [1][5][7]: V1 – control, unfertilized; V2 – 20 t/ha own compost; V3 – 20 t/ha own organic matter; V4 – 100 kg/ha NPK (32 + 32 + 32); V5 –20 t/ha compost + 100 kg/ha NP (18 + 18); V6 – 20 t/ha organic matter + 100 kg/ha NP (18 + 18).

Alfalfa also received the same treatment, for comparison.

Soil tillage, seeding, maintenance and harvesting works were the usual ones in the area, they not being the subject of our study.

Comparative studies and statistical calculation were carried out on the energetic equivalent of each crop, otherwise the comparison between them it wouldn't have been possible.

The transforming coefficients in energetic equivalent for each crop are the following ones: wheat = 375,000 kcal/ha; corn = 396,000 kcal/ha; beet = 206,000 kcal/ha; potato = 800,000 kcal/ha; and alfalfa = 345,000 kcal/ha.

The statistical calculations were performed by bifactorial analysis of variance, regressions and correlations analysis.

RESULTS AND DISCUSSIONS

Climatic conditions of the two years (2013 and 2014) were similar, so that the energy production were close to an average of 370,150 kcal/ha = 370.15 x 10^3 kcal/ha, i.e. ≈ 4 % deviations for each year (Table 1).

Table 1. Unifactorial analysis of the average energy produced by the agricultural crops from Teisani in each of the study years (original)

Years	Average (kcal/ha x 10^3)	Average ratio (%)	Difference (kcal/ha x 10^3)	Signifi-cance
2013	384.17	103.79	14.02	
2014	356.14	96.21	-14.01	
General average: 370.15 x 10^3 kcal/ha				

The variations were insignificant and placed within the confidence interval on the risk of 95% (also see Fig. 1).

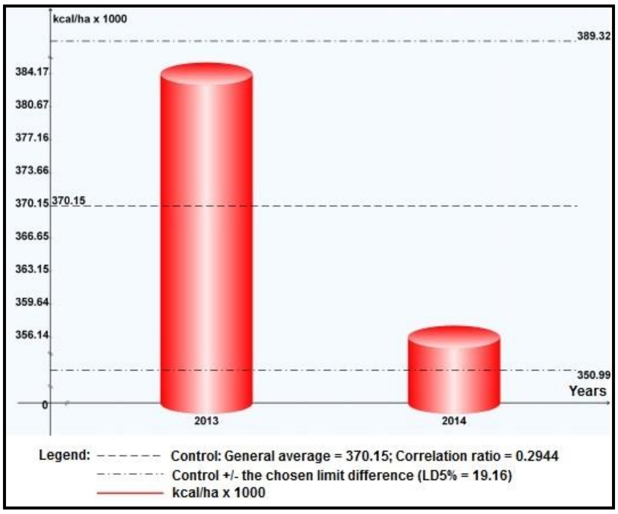

Fig. 1. Graphical representation of the average energy evolution produced by the agricultural crops from Teisani in the years 2013 and 2014 (original)

Fertilization factor, however, was decisive for observing the crops characteristics, their response being different (Table 2).

Table 2. Unifactorial analysis of the fertilization role in the energy production processes in the agricultural crops from Teisani, in average for the study years (original)

Fertili-zation	Average (kcal/ha x 10^3)	Average ratio (%)	Difference (kcal/ha x 10^3)	Signifi-cance
V1	216.17	58.40	-153/98	o o o
V2	419.75	113.40	49.60	*
V3	305.77	82.61	-64.38	o o
V4	424.68	114.73	54.52	*
V5	518.12	139.97	147.97	* * *
V6	336.45	90.89	-33.70	
General average: 370.15 x 10^3 kcal/ha				

Compared to the general average, the unfertilized version detaches itself very significantly negative. The best option for the average of all crops was V5 – 20 t/ha compost + NP (18 + 18), followed by V2 – 20 t/ha compost applied single, in autumn.

The results are presented in Fig. 2, where one can found a correlation ratio of 0.75 and a correlation coefficient of $r = \sqrt{r^2} = \sqrt{0.75} = 0.87$.

The mentioned production function is also a very significant one.

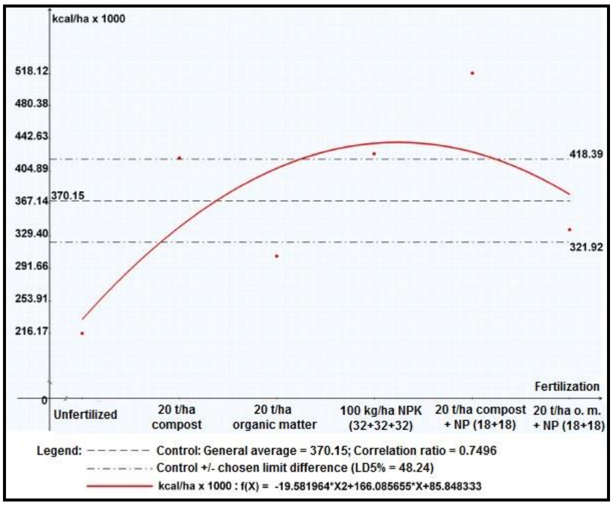

Fig. 2. Graphical representation of the fertilization influence on the energy produced by the agricultural crops, in average for 2013 and 2014 (original)

The monofactorial analysis of the most efficient culture in the area is shown in Table 3 and Fig. 3, from which it resulted that the most effective crop in the region and in average is the alfalfa, with 744.81 x 10^3 kcal/ha, followed by potato, with 689.84 x 10^3 kcal/ha. In descending order were the crops of beet, corn and wheat.

Table 3. Unifactorial analysis of the role of each culture from the crop rotation system in producing energy – Teisani, average for the study years (original)

Crops	Average (kcal/ha x 10^3)	Average ratio (%)	Difference (kcal/ha x 10^3)	Signifi-cance
Wheat	119.97	32.41	-250.18	o o o
Corn	125.43	33.89	-244.72	o o o
Beet	170.73	46.12	-199.42	o o o
Potato	689.84	186.37	319.69	* * *
Alfalfa	744.81	201.21	374.65	* * *
General average: 370.15 x 10^3 kcal/ha				

On average for the both years, the bifactorial analysis between the crop rotation system and the level of fertilization is shown in Fig. 4.

From Fig.4., there were noticed the following aspects:

(i)Especially for alfalfa and potato, the fertilization version with 20 t/ha compost + NP (18+18) obtained the highest yields and significantly positive, the next ones being the simple one with 20 t/ha compost and the one only with chemical fertilizers (NPK).

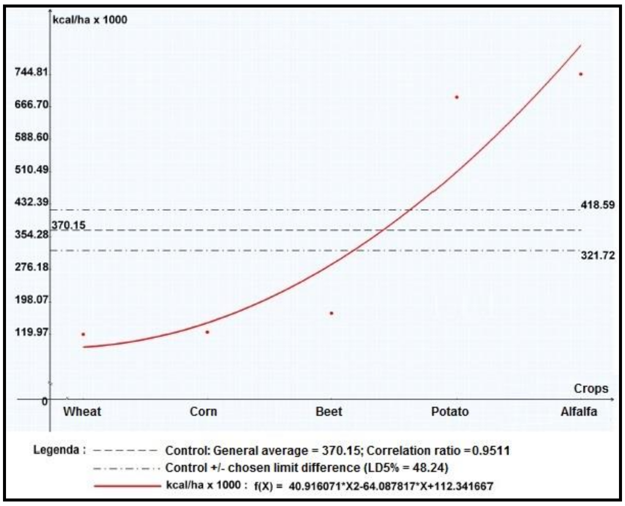

Fig. 3. Graphical representation of the crop rotation influence on the energy produced by the agricultural crops, in average for 2013 and 2014 (original)

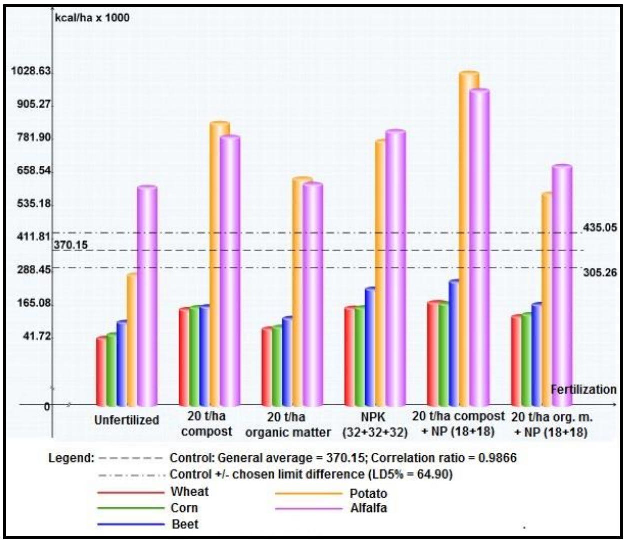

Fig. 4. Graphical representation of the fertilization and crop rotation influence on the energy produced by the agricultural crops, in average for 2013 and 2014 (original)

(ii)Wheat, corn and beet crops had a weaker reaction to fertilization, so that their yields were situated closer to the control variant.

(iii)Therefore, the local resources (straws, scraps, waste) of which compost could be achieved, are a very convenient and cheap alternative, available to every producer. It could even lead to a 3 times increase for the potato yield and a 2-3 times for the alfalfa yield.

CONCLUSIONS

Bringing back the small producers from the hill and mountain regions to the commercial agricultural circuit is a goal of the European policy and an unfulfillment of the local rural policies. Yield level (but also the technology level) is an extremely low one and, frequently, it not even covers their consumption needs.

In the research area (Teisani) it was implemented a dispersed experience regarding the possibility of introducing a collective crop rotation system (more landowners) and of using some local resources and industrial manufactured inputs for increasing the harvests up to the region's climatic potential.

It has been working for two years, 2013 and 2014, using a crop rotation system with jumper field, namely wheat – corn – beet – potato – alfalfa, but also six graduations of fertilization.

The two years were similar from climatic point of view and they have achieved, in average, yields' energetic levels insignificant differentiated compared to the experience average. It is however visible a very significant increase of harvest's energy at 20 t compost/ ha + 100 kg/ha NP (18 + 18) and slightly significant for the versions 20 t compost/ ha and NPK (32+32+32). The non-composted organic matter, in any of the variants, hasn't brought the expected increases.

Most valuable crops in terms of energy are alfalfa and potato, followed by wheat and corn, beets being the last of them.

The presented concept doesn't serve only to the yield level growth with 2-5 times, but also to a most welcomed ecological system. All organic wastes can be permanently brought to the household' fermentation pit, supporting the hygienisation of the entire household.

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