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FARM AGRO-ENVIRONMENTAL DIAGNOSIS, A NECESSITY?

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Abstract

Global warming currently implies two major problems for mankind: the need for a drastic diminution of greenhouse gas emissions on one hand, and the need to adapt to the climate change effects on the other hand. The CRESC Strategy emphasized the agricultural sector contribution to the greenhouse gas production by more than 15% of total greenhouse gases produced in our country, although in the last 25 years the greenhouse gases were down by half. In order to measure the impact of farming activities upon the environment, as well as the effects that the climate changes have upon agriculture and the sustainable development of the European rural area, sets of agro-environmental indicators were established; these indicators were tested in Romania's case as well, with regard to the relevance for policy assessment, the response capacity, analytical base, data accessibility and measurability, interpretation facility and cost effectiveness. Following these studies, the conclusion was that only part of these indicators can be calculated, the remaining indicators being estimated by mathematic modelling, due to the great diversity of physical-geographic conditions and agricultural systems, which depend on a wide range of specific local characteristics. In the last 20 years countries like France, for instance, designed methods to measure the agro-environmental indicators at farm level. Farmers' awareness and involvement is essential in the environment protection activity and the contribution that this activity can bring in the fight against climate change. The purpose of the paper is to test the DIALECT method on the Romanian farms, by a double approach, i.e. global and thematic, by the environmental components. The diagnosis has the capacity to measure the environment "value added", expressed by a better nitrogen and manure management, the way in which the conversion to organic farming takes place, which is the effect of the change in crop rotation, the way in which certain operations better optimize the use of own natural resources (soil, weather, biodiversity, etc.) and put a limit to the pressure on resources (water, energy, etc.), while other operations have a negative impact upon the local ecosystems.

Key words**:** *agro-environmental indicators, climate change, diagnosis, DIALECT method, global warming*

INTRODUCTION

As a result of human activities, the high GHG concentrations in the atmosphere (carbon dioxide, methane and nitrogen oxide in the first place) intensify the natural "greenhouse effect", resulting in the increase of the Earth's temperature. Only in the last 40 years (1970-2010) the carbon dioxide concentrations (CO2) increased by 70%.

Although divergent opinions exist among scientists, the global warming phenomenon remains a reality and it is very important to understand and explain the impact of the increasing values of certain weather parameters upon the physical-geographical systems of our planet [3]. Other researchers [7], on the basis of certain paleo-climate studies and indicators (on the ice caps, on the sediments resulting from glacier melting, etc.) revealed that in the last 20 years out of the 600 investigated years, the indicators reveal the accelerated climate warming. The specialty studies revealed that the climate changes are differently felt depending on the latitude [5]. In this respect, it is worth mentioning that at temperate latitudes, the temperature increase is under 0.4^{o} C, compared to Greenland, Siberia and the Arctic Peninsula, where the temperature increase reached 3^{o} C. [8]

The global warming phenomenon, which can adversely impact the sustainable development of human society in general, and of agriculture in particular, threatening the population's food security and health, became a new science, which aroused the interest of both researchers and governments. These reached the conclusion that only by the joint efforts of the economic and political powers of each state in part, we ca initiate a collective action in order to reduce these effects.

Temperature increase has significantly impacted several physical and biological systems (water, habitats, health), which are becoming increasingly fragile.

The climate change in Romania is considered into a European context; taking into consideration the regional conditions, temperature increase will be stronger in summer time, while in the north-eastern part of Europe, the strongest temperature increase is expected during the winter.

Global warming currently implies two main problems for mankind, namely:

-on one hand, the ***need for a drastic diminution of greenhouse gas emissions*** in order to stabilize the concentration of these gases in the atmosphere – thus hindering the anthropic influence upon the climate system and making it possible for the natural ecosystems to get adapted in a natural way - and,

-on the other hand, the ***need to get adapted to the climate change*** effects, while having in view that these effects are already visible and unavoidable due to the climate system inertia, regardless of the result of actions targeting the diminution of emissions.

Even since the 1970s, the intensification of production methods contributed to pollution increase. Consequently, limiting the impact upon the environment acquired an increased importance in the agronomic research, and became a topic of great interest for researchers. These scientific concerns led to the proposal of methods and methodologies for the evaluation of agriculture impact upon the environment, such as [2]. Some of these methods utilize sets of indicators for measuring the extent to which the proposed objectives are reached.

MATERIALS AND METHODS

From the point of view of the sustainable development of agriculture and rural areas, as well as of countering the effects of climate change, in our country different studies, methods and strategies were designed or are under the investigation, testing or implementation stage, among which the most recent is the Strategy CRESC [6].

The strategy started from the sectoral identification of the GHG emission sources and from the quantitative estimation of these gas emissions produced by our country at present (Table 1)

Table 1. GHG emissions in Romania

GHG sources and categories of absorption basins	Total GHG emissions in 2011 (CO_2 equiv.)	% of total GHG emissions (without LULUCF)
Energy (transports inclusively)	86,320.46	69.98%
Out of which transports	14,577.72	11.82%
Industrial processes (solvents utilization included)	12,591.53	10.21%
Agriculture	18,941.46	15.36%
Forestry	-23,353.01	-
Other destinations of land (without forests)	-1,951.93	-
Wastes	5,366.48	4.35%
Total CO_2 equivalent with LULUCF	98,040.60	-
Total CO_2 equivalent without LULUCF	123,345.54	100%

Source: MMAP, 2015, CRESC Strategy, V2, p.25
Note: LULUCF= Land use land use change and forestry

According to CRESC Strategy, "at EU level, Romania had the greatest generalized decrease of GHG emissions in agriculture, by 53% in the period 1990 – 2011, while the GHG emissions in agriculture in EU-28 decreased by only 25% in the same period. The diminution of emissions in agriculture in EU-28 is mainly due to the diminution of livestock herds, to the improvements of good agricultural practices, to the lower utilization of nitrogen fertilizers, as well as to a better manure management".

The Romanian agriculture is not intensive from the point of view of emissions, although it represents one of the factors that contribute to the general GHG emissions. The relatively great contribution of agriculture is the result of energy use in this sector. "For Romania, the main sources of greenhouse gas emissions are the nitrogen protoxide (N_2O) based on soil nitrification and manure management, methane (CH_4) resulting from the enteric fermentation of herbivores, mainly cattle, and carbon dioxide (CO_2) coming from the energy/fuels used by buildings and equipment. 50% of emissions in agriculture are represented by the nitrogen protoxide, followed by 45% methane, while only 5% of emissions are based on carbon dioxide" [6]

From the analysis of relevant environmental objectives for ***Agriculture*** it resulted that these directly respond to and are included at least in one of the strategic objectives:

Table 2. Relevant environmental objectives of agriculture in CRESC Strategy

Description of relevant environmental objectives (REO)	Diminution of GHG emissions	Adaptation to climate change
REO 1 Improving the air quality by the diminution of air pollutant emissions, of GHG emissions inclusively	YES	YES
REO 2 Sustainable management of water resources, in the climate change context	YES	YES
REO 3 Improvement and maintenance of soil quality and sustainable land use	YES	YES
REO 6 Protection and improvement of living conditions	YES	YES
REO 7 Sustainable waste management		YES
REO 8 Protection/ maintenance of areas with high value landscapes and of objectives with cultural value		YES
REO 9 Increasing the information of people on the climate change effects and necessary adaptation measures		YES

Source: MMAP, 2015, CRESC Strategy

The European Environment Agency (EEA, 1999) developed the Method DPSIR (Driving Force – Pressures - State – Impact - Response), which represents an analytical framework to describe and understand the linkages between the economic and environmental activities, under the form of a set of 35 indicators integrating the environmental aspects in the agricultural, forestry and water management policies in the rural area.

The Institute for Soil Science and Agrochemistry Research proposed a research project TOGI [7] whose main objective is the adaptation and application of the DPSIR Community methodology at local and regional level.

The evaluation criteria of agro-environmental indicators refer to the relevance for policy evaluation, response capacity, analytical base, data accessibility and measurability, interpretation facility and cost effectiveness (Table 3).

Table 3. DPSIR Method applied to agriculture and the equivalent TOGI indicators

Driving forces	
Input use	Mineral fertilizer consumption
	Pesticide consumption
	Water utilization
	Energy utilization
Land use	Land use change
	Crop/livestock structure
	Farm management activities
Tendencies	Intensification/extensification
	Specialization/diversification
	Marginalization
Pressures and benefits	
Pollution	Gross nutrient balance
	CO_2 emissions in atmosphere
	CH_4 and N_2O emissions
	Soil contamination with pesticides
	Manure utilization
Resource loss	Water absorption
	Soil erosion
	Land cover change
	Genetic diversity
Environment conservation and improvement	Area with high natural value
	Alternative energy production
Specific site status	
Biodiversity	Dynamics of poultry population on farms
Natural resources	Soil quality
	Nitrates/pesticides in waters
	Ground water level
Landscape	Landscape situation
Global impact of national agriculture upon the environment	
Habitats and biodiversity	Impact upon biodiversity and habitats
Natural resources	GHG quota allocated to agriculture
	Nitrate contamination quota allocated to agriculture
	Water utilization quota for agriculture
Landscape diversity	Impact upon landscape
Responses	
Public policy	Area benefiting from agri-environment support
	Regional levels of good agricultural practices
	Regional levels of environmental targets
	Area with natural protection
Market signals	Prices for organic production and market share
	Organic farm incomes
Technology and skills	Training level of holders
Attitudes	Organic farming area

Source: ICPA, Project Cex MENER 615/2005, stage 1

The following conclusions can be drawn from the project results:

The development of agro-environmental indicators is facing difficulties in reality:

• The environmental problems are often too complex to be represented by individual parameters (such as landscape diversity),

• Romania's territory is quite diverse in terms of farm structures (crop, livestock types, etc.), soil characteristics, topographic and climate conditions, farm size and agricultural productivity,

•The relations between agriculture and environment are complex, so that a simplified description is not necessarily useful; the impact of many agricultural processes depends on a wide range of specific local characteristics,

•The lack or insufficiency of data sets prevents/constrains the implementation of the most appropriate concepts/methodologies of indicators, for instance the irrigable area must be used with approximation for water use assessment,

• The required data for state/impact indicators are often unavailable. Furthermore, several indicators from these fields should be based on modelled or approximated data,

•The causal links are not sufficiently understood so as to be represented through indicators.

In spite of these problems, the agro-environmental indicators remain key instruments for environmental reporting in agriculture (and in other fields as well). The limited resources for data collection make it necessary to select a limited set of indicators that can be maintained on long term as part of an agro-environmental information system."[4]

Environment analysis at farm level through a diagnosis of interactions between the farming activity and the environment, in other words, a diagnosis of the negative and positive effects of the farm activity upon the environment is quite opportune and complementary in the context of the difficulty to calculate certain agro-environmental indicators at local, regional or national level.

Involving the farmers directly in making agro-environmental diagnoses in their own farms, this make them aware of the need to reduce the greenhouse gas emissions and adapt to the climate change effects.

At the same time, at present, the environment is an important component that the agricultural policies take into consideration for conservation and financial support, as well as for the implementation of actions, such as: establishment of criteria for the selection and implementation of agro-environmental measures on the farms, providing CAP subsidies, establishment of high environmental value, recognition of high natural value agricultural systems or of those with environmental constraints, conversion to organic farming, etc.

The DIALECT method completes the weaknesses of the previous method by including the agro-environmental evaluation at farm level.

This method was developed by the research center "SOLAGRO" from Toulouse, France, in the period 1995-2015 and it is successfully applied on more than 2000 farms from France, from other different countries of the European Union and even from other regions of the world with temperate climate.[11] In the 20 years since the creation of the first version, improved versions were designed, in line with the research works in the field of agro-environment and climate change, while making available a performant interface, totally or partially transposed into the languages of the EU member states and adapted to the new online informatic technologies, so as to be used by any interested person in this field.

This analysis tool establishes the current situation of the environment and reveals the agro-ecological systems, identifies the risky practices and can suggest improvement modalities to farmers. The diagnosis has the capacity to measure the environment "value added", expressed by a better nitrogen and manure management, by the conversion modality to organic farming, the effect of a change in crop rotation, the modality in which certain operations better optimize the use of own natural resources (soil, weather, biodiversity, etc.) and limit the pressure upon resources (water, energy, etc.), while other have a negative impact upon the local ecosystems.

The environment evaluation method at farm level is based on a double approach:

A global approach, which makes an analysis of farm operation, including two themes:

-farm diversity and

-rational utilization of inputs.

A thematic approach, measuring the impact of farm activity upon different environment components: water, soil, air, biodiversity, resource use, etc.

A specific part of the diagnosis was dedicated to the farm *energy analysis*. Energy is a necessary condition throughout the production process.

The DIALECT tool responds to 3 evaluation levels:

1-Selection of criteria and indicators

2-Scoring scale

3- Share of criteria and indicators.

Table 4. DIALECT method structure, approaches, criteria and indicators

Farm agro-environmental diagnosis	
Tool structure: a double approach	
Global	**Thematic**
System analysis and its practices	**Agricultural activity impact upon different environment sectors**
"System" diversity : 70 points	Water: 9 indicators
-Crop production diversity: 3 indicators	
-Autonomy of animal production and organic matters: 3 indicators	Soil: 5 indicators
-Natural infrastructures: 2 indicators	Biodiversity: 4 indicators
Indicator management: 30 points	Resource utilization: 5 indicators
-Nitrogen, Phosphorous, Water, Phyto, Energy: 10 indicators	
-Pressure indicators: 4 indicators	
-Result indicators: 4 indicators	
-Method indicators: 2 indicators	
Score from 1 to 100 points	**Score 1 to 20 for each theme**

Source: SOLAGRO, 2006. Manuel d'utilisation Dialecte – Version 2. 54 p.

1-Selection of criteria and indicators: The risks of impact upon the environment are evaluated on the basis of agro-environmental indicators. Each theme contains several criteria, which include indicators grouped into subcriteria. The diagnosis is based on the analysis of 8 criteria and 20 indicators. Each indicator is defined by a calculation modality using quantitative or qualitative variables.

2-Scoring scale: For certain indicators, it is necessary to define an evaluation scale that includes a *minimum value* and a *maximum value* and the evaluation modality within this scale (linear or non-linear).

3-Share of criteria and indicators: Regrouping the indicators needs the design of a points coding, so that these can be combined within a criterion or theme (Table 4).

The instruments used by the DIALECT method are the following:

- *a survey questionnaire*, which makes it possible to collect information, mainly quantitative information (crop rotation, livestock herds, evolution of crops and livestock herds, products, etc.), as well as many qualitative information for the description of the environment on the territory of a given farm;
- *a web platform* for data inputting, which makes it possible to automatically calculate the indicators and express the results in pdf format;
- *a utilization manual* of the Dialect site [11].
- *a database* is available on the Internet for all the diagnoses made by different experts, researchers or students from different universities in this field. This enables the following: comparing the obtained results with those obtained from other similar farms or groups of farms from different countries of the European Union and ensures the development of agro-environmental benchmarks for a given type of farm and/or agricultural area.

RESULTS AND DISCUSSIONS

The diagnosed crop production farm is located in the county Ialomita, and it was established in the year 2000. In 2011, this was taken over by the young farmer from his parents, who obtained the certification and created an Agricultural Individual Enterprise.

The agricultural land is found on the Danube bank, along the Borcea branch. "The soils were formed on the alluvia deposited by the river during the repeated floods, their genesis and evolution being influenced by the flooding regime, by the depth of ground water and the relief units, etc. The climate is of excessive continental type, with hot summers and cold winters. The yearly average temperature is 11.5 C^0. The yearly average rainfall is 550.5 mm, while in the period April –October it reaches 288.1 mm. The prevailing wind is the Crivăt, which brings about drastic decrease in temperatures over the winter. Being located on the eastern migration route of birds, the territory, also including the commune Făcăieni, is visited in the transit period, being a feeding and resting area for rare and very rare water and terrestrial bird species". [10]

"The red-necked goose is the most endangered goose species in the world, the population of this species being under decline, from a number of 60,444 birds in the period 1998-2001 to 38,500 birds estimated in the period 2003-2005. Among the main reasons for this decline, we can mention the deterioration of feeding habitats in the wintering areas."[9]

There is also an area of 5-6 hectares on the territory of this farm totalizing 98 hectares, where the red-necked geese (Branta Ruficollis) feed and spend the winter.

The young farmer accessed the Measure 112, which was implemented in the period 2011-2014 and he applies the Agro-environmental Measure, package 7, which he is currently using.

He committed himself to establish at least one winter grain crop or rapeseed crop each year, after September 15. The establishment of winter crops must be completed before October 15, so as not to disturb the flocks of geese, which choose their habitat on the farm land. At the same time, the maize crops are sown until May 15, and the harvesting does not take place earlier than September 15.

Respecting these rules (and many others, according to the agro-environmental requirements), the crop structure in the year 2014 was the following: 34 ha with wheat, 37 ha with rapeseed and 27 ha with maize, the largest part of arable areas being operating under land lease system.

The wheat crop is located on 5 parcels, the rapeseed crop on 2 parcels and the maize is cultivated on 10 parcels.

In the year 2014, the average yields per hectare were 6 tons/ha for wheat, 3 tons/ha rapeseed and 10 tons/ha for maize. According to the obligations assumed in package 7, the farmer left almost 3 tons of maize in different feeding locations for the red-necked geese.

The farm has the entire range of agricultural machinery; it applies conventional technology, with the application of fertilizers and pesticides outside the resting and wintering periods of these migratory aquatic birds.

The herbicide application is minimal, mechanical works for weed control and the "false seeding" method being used.

The direct and indirect energy consumption, expressed in "liters oil equivalent" summed up 392 leqp /ha, accounting for 31% agricultural diesel oil, 50% of the applied fertilizers, 3% of the phyto-sanitary products and 17% of the different materials used (plastic packages, baling wire/string, etc.).

The produced energies (304 leqp/ha) resulted from the obtained harvests.

The ratio of output energy to input energy is very small, i.e. 0.78, while the energy efficiency coefficient specific to the system must range from minimum 5 to maximum 15, so as to be considered a sustainable, green and non-polluting system.

The CORPEN balance revealed a great application rate of chemical fertilizers (114 kg N/ha), compared to the necessary fertilizers for obtaining the respective harvests.

Thus, 102 kg N/ha and 24 kg P/ha remained unused, which can levigate by leaking into the ground waters and 623 kg N/year were volatized, i.e. 6 kg de N /UAA ha. (Figure 1)

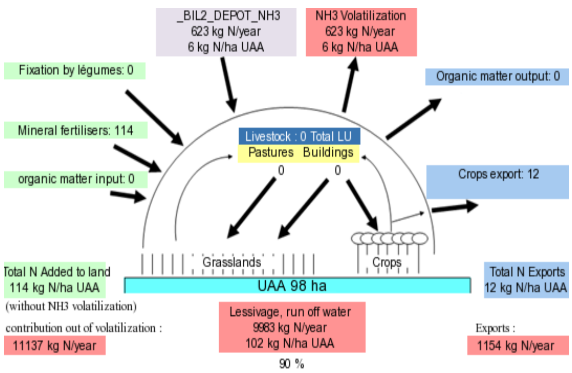

Fig. 1. Nitrogen annual flow on the farm (kg N / ha)
Source: Dialect appraisal, www.dialect.solagro.org, Toulouse, France, data introduced on-line by the author

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At farm level, the DIALECT program estimated that ***greenhouse gases*** resulted from the farm activities totaling 203 tons/year, i.e. 2 tons/ha, consisting of 112 tons/year CO_2 and 91 tons/year N_2O, under the form of direct or indirect emissions. (Table 5)

Table 5. Main sources of GHG emissions from the farm

Direct and indirect GHG	**tons CO_2 /year**	**kg CO_2 /UAA ha**	**%**
Direct GHG emissions from the farming activities, out of which:	120	1227	59
-Burning fuels and oils	*29.1*	*297*	*14*
-Direct N_2 O emissions from soil	*53.6*	*547*	*26*
-Indirect N_2 O emissions from soil	*37.5*	*383*	*19*
Indirect GHG emissions from the activities of third parties, out of which:	82.5	841	41
-purchased seeds	*0.1*	*1*	*0*
-manufacturing of chemical fertilizers	*61.7*	*630*	*30*
-manufacturing of pesticides	*3.2*	*33*	*2*
-manufacturing of plastic packages	*1.2*	*12*	*1*
-manufacturing of agricultural machinery and implements	*11.8*	*120*	*6*
-construction materials-buildings	*4.5*	*46*	*2*
TOTAL GHG emissions	**202.7**	**2068**	**100**

The sequestrated carbon stock totalized 7 tons/year, accounting for only 4% of total GHG emissions from the farm territory.

According to the DIALECT method, the diagnosis based on the global farm approach cumulated a score of 42 points out of 100 possible points (out of which 22 points are dedicated to the livestock production). From the total score, diversification/specialization in crop production cumulated 27/70 points while input management 15/30 points. The existence of natural infrastructures (green compensation areas and the average parcel size (5.8 ha) obtained a good score (17/18 points). The global situation of the farm is considered as "medium", both in general terms and in terms of diversification/specialization and input management. (Figure 2)

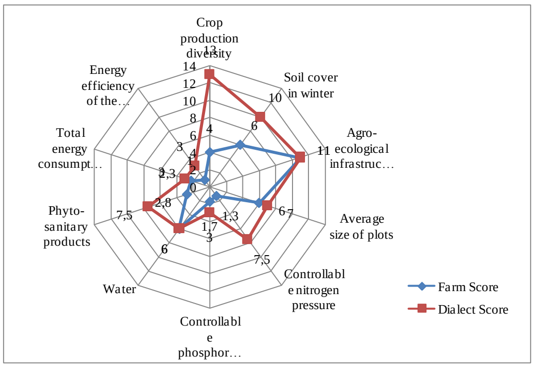

Fig. 2. Global situation of farm in relation to the optimum agro-environmental indicators

The thematic environment approaches, resulting from the Dialect Balance, qualified the farm as having a "good" impact upon water quality, with 14 points out of 20 possible points. (Table 6)

Table 6. Thematic environment approach – water quality and quantity

Thematic indicator: Water	**% of maximum value**	**Farm points**	**Maximum ceilings**
Nitrogen residues	18%	0.5	3.0
Phosphorous residues	57%	1.1	2.0
Phyto-sanitary residues	38%	1.1	3.0
Disposal of effluents from the livestock production sector	100%	3.0	3.0
Water utilization	100%	3.0	3.0
Soil cover in winter	61%	0.9	1.5
Size of parcels under different crops	85%	1.3	1.5
% of the length of protected water courses	100%	1.0	1.0
Water protection through natural elements	100%	2.0	2.0
Total	**xxx**	**14.0**	**20.0**

The thematic approach to the "soil" environment component revealed a "low" impact as regards the soil erosion control and natural soil fertility, with 5.8 out of 20 points (Table 7)

Table 7. Thematic approach to environment-soil (fertility, soil erosion control)

Thematic indicator: Soil	**% of the maximum value**	**Farm scores**	**Maximum ceilings**
Permanent grassland (% of UAA)	0%	0.0	10.0
Permanent pastures (% of UAA)	0%	0.0	8.0
Organic. fertiliz. area (% of UAA)	0%	0.0	4.0
Soil cover in winter (% of UAA)	72%	5.8	8.0
Planted area with no tillage (% of UAA)	0%	0.0	8.0
Total	**Xxx**	**5.8**	**20.0**

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Relatively low scores were obtained for the environment component "Biodiversity". Spontaneous flora biodiversity on the farm territory is very low due to pesticide application. A better score was obtained for the 5-6 protected hectares for the red-necked goose habitat, which is a recognized area of biological interest and a green compensation area.

Table 8. Thematic environment approach – plant and animal biodiversity

Thematic indicator: Plant and animal biodiversity	% of the maximum value	Farm scores	Maximum ceilings
Green compensation areas	100%	7.0	7.0
Productive pastures with low fertilization	0%	0.0	7.0
Recognized areas of biological interest	yes	4.0	4.0
Absence or low utilization of pesticides	no	0.0	5.0
Total	**xxx**	**11.0**	**20.0**

The consumption of resources is "medium", more significant surpluses being found in the indirect energy, i.e. a too great application of chemical fertilizers compared to crop consumption and the obtained harvests, under the conditions of a dry year without irrigation utilization.(Table 9)

Table 9. Thematic environment approach – consumption of resources

Thematic indicator: Consumption of resources	Consumption from the ceiling value	Farm scores	Maximum ceilings
Direct energy	11729/25000	2.1	4.0
Indirect energy	26714/25000	0.0	4.0
Phosphorous	2940/3400	0.5	4.0
Potash	0/4800	4.0	4.0
Water	0/50000	4.0	4.0
Total	**xxx**	**10.7**	**20.0**

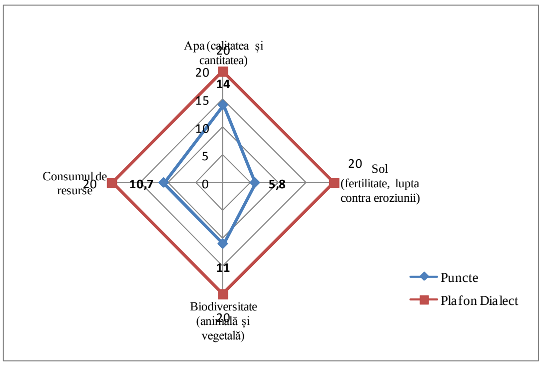

Fig. 3. Thematic approach to the farm impact upon the environment, through the optimum agro-environmental indicators

The graphical presentation of the thematic approach to the farm impact upon the environment, expressed through the optimum agro-environmental indicators, is quite suggestive. (Fig. 3)

CONCLUSIONS

At present, the global warming implies two main problems for mankind: the need for the drastic diminution of greenhouse gas emissions and the need to adapt to the climate change effects. Agriculture is one of the most affected sectors by the global warming, as it is dependent on the weather and climate conditions; at the same time, it is also a polluting agent with chemical fertilizers, pesticides, effluents from the livestock sector and a consumer of direct and indirect energy. In order to measure the impact of human activities upon the environment, as well as to evaluate the climate change effects upon the environment and the population, different sets of indicators were established. The agro-environmental indicators partially respond to the regional and national analysis needs, as the impact of many agricultural processes depends on a whole range of specific local characteristics (heterogeneous relief units, altitude, climate, agricultural production methods, from the most simple to the most sophisticated technologies, etc. The farm agro-environmental diagnosis method, created by the French experts and made available on a free of charge basis, for online utilization, represents a very easy to apply tool, even by farmers themselves. By their direct involvement in making agro-environmental diagnoses on their own farms, farmers become more aware of the need to drastically reduce the greenhouse gas emissions and of the need to get adapted to the climate change effects.

With the 42 accumulated points, the farm from the commune Făcăieni, diagnosed through the Dialect Method, is found among the 30% of the farms from the EU sample. The diagnosis results go back to the farmer, and the role of consultancy and researcher expert is only at the beginning.

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