

Agro-Environmental Indicators for Agricultural Holdings

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Abstract: *Settling a sustainable agriculture demands complex transformations and an obviously effort of introducing the elements of the environmental protection into practice of agricultural firms. The needs of information and evaluating the agriculture impact on the environment have outlined variously supervising indicators systems which evidence the interaction between the farming activities and natural resources, also their economic and ecological performances. At the agricultural holdings level, the agro-environmental indicators point to the aspects concerning the environmental farm management, decline in soil productivity, water pollution, air quality, fragmentation of wildlife habits etc. In the paper there are presented some characteristics of main agro-environmental indicators utilized in the EU states, stressing the importance of their adoption (in physical and value expression), into agricultural holdings practices in any European country, inclusive in Romania, in order to obtain a gain for the economy, people and not at least, for the environment.*

Agriculture is an economical sector which has a strong interaction with the entire environment. At the agricultural holdings level, adopting of some productions systems compatible with the natural systems has created the conditions for performing the production activities in a sustainable manner, so as it could contribute in a high measure to improvement the environmental resources of one country.

Within the actual Communitarian Agricultural Policy has shaped a new European agriculture model which from its entire specific concerns besides assuring the traditional functions of this sector, also, the environmental problems. At the same time with the review of CAP (EC no 1782/2003) the aspects referring to the environment protection, conservation and preventing pollution have became stringently and transformed in that elements which plays the role to orientate no only the agricultural holdings activity but the whole rural economy towards adopting the sustainable development vision.

The need of respecting the environment requests by the agricultural producers has materialized in creation of the general legislative frame which settles the communitarian agricultural practices, namely Good Agricultural and Environment Conditions (GAEC). This code shows what there the good agricultural and environmental practices are and presents the rules valid for all EU countries. According to GAEC the member states could define their own code depending on the local conditions or the specific of every country. The GAEC standards aim the agricultural producers to adopt the production techniques and strategies, also the good practices of resources management which mean both, an improvement of the environmental performances within the agricultural holdings, and for environment, a diminishing of pollution level. The legislative demands related to the environment focus on wild fauna, flower and natural habitat preservation, water protection against pollution with dangerous substances and also, with nitrates resulted from agricultural sources, being introduced sanctions in the case of non-compliance with the GAEC standards.

In the situation Romanian agricultural holdings, putting in the practice the Good Agricultural and Environment Conditions implies reconverting the conventional agricultural practices into that practices that are specific for an ecological agriculture, having beneficial consequences for the entire assembly economy- society- environment. Some of the action directions settled by GAEC from Romania are:

- fight against and prevent soil erosion: prohibit weeding crops (maize, sunflower, potatoes, sugar beet) on the arable lands that have an inclination more than 12 % or if slopes have still been cultivated, the GAEC indicates to cover the soils in the winter time with autumn cultures (wheat, barley) or with plants like clover, Lucerne; the soil could be covered by natural vegetation, not ploughed after harvesting;

- preserve the uncultivated arable land in good conditions for production (no weeds, no undesired vegetation) cultivating plants, natural regeneration of grass;

- maintain grassland upkeep at a minimum level to avoid spreading of the weeds and unwished plants which aren't good to feed animals (vegetation must be cut once a year or more times).

Like signature of the Kyoto Protocol (1997) which became compulsory since 2005, Romania has engaged to contribute on reducing the pollution level implementing some favorable environmental measures, inclusively in the agricultural sector. Presently, due to the practicing an inadequate management, the Romanian agriculture generates various kinds of pollutions: increasing the chemical substances concentration per hectare (chemical fertilizers, pesticides, insecticides, fungicides) like as result of using the traditional practices for soils fertilization and plants protection against diseases – that means from ecological point of view a great water and soil pollution -, destroying of some natural habitats of important species of plants, animals or birds through various works which point soil improvements but they are not rational applied, practicing of some great irrigation systems which contribute to the strong soil erosion, affecting the landscapes and a biodiversity because of abandoning of soil from economic reasons etc.

In this context, settling sustainable development in the agricultural sector demands the complex transformations and become very important the effort of compliance the need and the opportunity of introducing the elements of the environmental protection into practice of agricultural firms. These requests are not easy to realize, firstly because sometimes there are few and insufficient information registered on agriculture and environment situation, but mostly, it is not clear constituted an assembly of indicators which could measure the interaction between the agricultural activities and environment.

At the global level, the preoccupies to answer the needs of information and evaluating the agriculture impact on the environment, dated for over two decades, outlined numerous supervising indicators systems. These assure an evidence of interaction between the agricultural activities and environment (inputs and outputs) also, of ecological performances of the agricultural holdings, playing the role to determine the decisional factors of the all levels to take an interest in improving the sustainable development of the rural economy.

Being relatively numerous, the various assessment indicators systems have introduced voluntary in some farms of the European Union countries (Denmark, Germany, Belgian, Suisse, Great Britain, France, Holland, Luxemburg) or like current practice of the agriculture monitoring in other countries, like as Canada.

Some of the most usually agro-environment assessment systems are:

- GA, Green accounts (Denmark);
- EALF, Ethical account for livestock farms (Denmark);
- EMA, Environmental management for agriculture (UK);
- AEI, Agro-ecological indicators (France, Germany, Canada);
- AEL, Agricultural environment label (Netherlands) ;
- REPRO (Germany) ;
- FHL, Herd books system (Luxemburg, Belgium);
- STANK, Farm level nutrient (Sweden) etc.

Based on simple accounting principles, some of systems had into consideration kilos of active substances used (AEL). Other systems compare pesticide dosages used with standard recommended dosages (EALF, GA), but they do not make a difference between pesticides

according with their toxicity level or different modality of environmental impact. EMA, AEI and EYP systems give scores to risks associated with the particular pesticide used in the agricultural exploitations, those effects appearing in the degree of air and water pollution.

In spite the environmental indicators are simple for calculating, the illustrating environmental performances of the agricultural exploitations with environmental indicators is sometimes, difficult, because the necessary information are empirical, such as: all actual input in fields and stables, production and sales, N content inventory, fertilizer use, kg N/ha, standard crop N requirements etc.

However, there are many favorable aspects which recommend implementing an input-output accounting system:

- the main advantage of information offer by environmental indicators systems consist in possibility improvement ecological performances, in the same time with increase agricultural production. Adopting them, the exploitations became capable to impulse internal management transformations by introducing the environment aspects in agricultural activities preview;
- create the conditions for increasing efficiency of the energy used without supplementary expenses;
- stimulate reducing pesticides consumption and using some type of pesticides with low toxicity level;
- improve environmental performance and efficiency in input use, such as became possible the cost reduction;
- allow comparison between exploitations for increase the producers' interest in improving environmental performance, preserve soil quality, biodiversity, life's quality, which generally, there are features of sustainable development

Better known and having a large spread, the system Agro-Environmental Indicators (AEI) has an implementation on the national scale in Canada, since 1980 and due to the concrete obtained results could offer important guide marks for an economy being in the phase of identify the solutions, like as Romania's one. Also, it offers information about the strategies that have to be adopted so that the environmental performance of agricultural holdings, to increase.

The agro-environmental indicators used at the agricultural holdings level become real information means and measuring instruments of main pressures on agro ecosystems, risks, of the impact provoked by the agricultural activities on the environment, the consequences of the agricultural practices that producers used, meanwhile, suggesting the possible options which could influence the environmental performance of the agricultural sector.

Building the agro-environmental indicators system at the national level implies taking into consideration many aggregation levels of the indicators and results:

- agro-environmental indicators at the agricultural holdings level;
- agro-environmental indicators at the agricultural areas;
- agro-environmental indicators at the counties;
- agro-environmental indicators at the national level.

The agro-environmental indicators from the agricultural holdings level constitute the base level, meanwhile the most important for realizing the environmental sustainability of the agricultural activities. They measure the environmental risks generated by extensification or intensification of the crops or animals production, even in the place of their possible appearance and concern the main environmental components used by farms, those protection it is necessary: soil quality, water quality, air quality and biodiversity of species.

Monitoring the environmental management of the agricultural holdings could be made using some agro-environmental indicators (table 1):

Table 1
Agri-Environmental Indicators

Environmental factors category	Indicators	Information
Environmental farm management	Soil cover	Mineral fertilizers
	Nitrogen use efficiency (Residual soil nitrogen)	Manure storage and application
	Energy use efficiency ratio	Pesticides (herbicides, insecticides, fungicides) Energy input Energy output
Soil quality	Water erosion	Land use Cropping practices: Tillage practice
	Wind erosion	
	Tillage erosion	
	Soil organic carbon change	
	Soil salinization	
Water quality	Water contamination by nitrogen	
	Water contamination by phosphorus	
Atmospheric quality	Greenhouse Gases emissions	Main sources of GHG: nitrous oxide, methane, carbon dioxide
Agricultural biodiversity	Wildlife habitat on farmland	Wildlife damage Invasive alien species Soil biodiversity

Source: Barg St., Swanson D., Venema H.D., Valuing Changes in Agri-Environmental Indicators, IISD, 2005

The general approach of building some agro-environmental indicators expresses the input elements within the agricultural exploitations, whose efficiency utilisation will determine the quality and the volume of the natural resources. Subsequent, the impact on the environment could be measures with agro-environmental indicators calculated to the output like: extend of the vegetal crops and of the livestock, animals waste, the level pollution with sediments, overdosing with nutrients, the dangerous atmospheric emissions etc (fig 1).

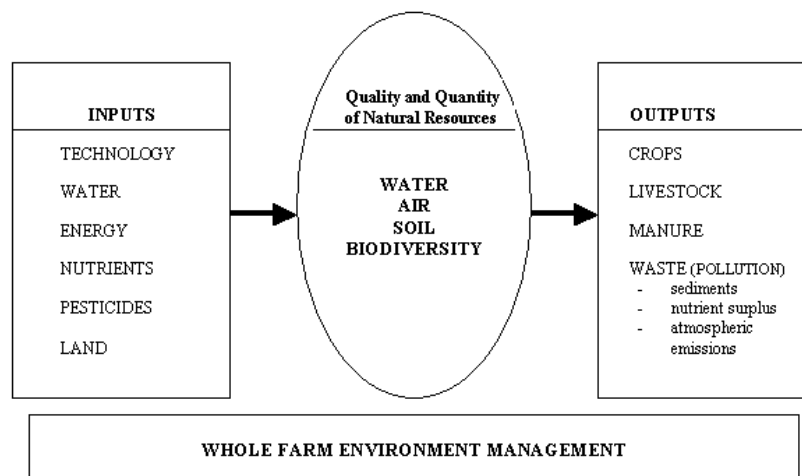


Figure 1. The role of the agro-environmental indicators

The demanded information for calculating the agro-environment indicators there are very numerous and they have to indicate various aspects of environmental impact provoked by the agricultural sector:

- possible effects resulted by the limiting cultivation of some important lands and the effect of agricultural practices on the environment. So, the manner in which the agricultural holdings soils are used could create the conditions for land erosion;

- assessment and knowing the cultivation practices, the impact on the environment varies depending by the types of practiced crops. In the case of row crops (corn, vegetables, potatoes, tobacco) the erosion risk is higher while the hay crops generate a lower risk of erosion;

- the modality in which the tillage practices are influenced. The most usual used practices, meanwhile having a beneficial effect on the environment are follow:

- conventional tillage practices - turning over the top 15-20 cm of soil, burying plant residues and exposing the soil, followed by secondary tillage to break up soil aggregates and produce a smooth, even seedbed;

- conservation tillage - breaks up the soil and kill weeds but do not turn the soil over;

- preparation for seeding using no-till - maintaining all plant residues on the surface;

- maintaining the area of summerfallow by tillage weed control - tillage be carried out periodically during the growing season;

- maintaining the area of summerfallow by a combination of chemical and tillage weed control or by chemical-only control;

- implications on environmental sustainability resulted from adopting some beneficial management practices that allow them to maintain or improve productivity while protecting the environment;

- method of fertilizer application. The possible method of fertilizer application could be: injected into soil or knifed-in (liquid or dry fertilizer), applied with seed, broadcast, banding etc;

- periodical using at least once every three years of soil tests for knowing the crops demands and the type of necessary fertilizer;

- assessment of the organic fertilizer used which have to be consummate in a lower quantity for reducing the risk of oversupplying nutrients and subsequent losses to the environment;

- the storage and application methods of the organic fertilizer which for a beneficial effect on the environment have to present a most reduce risk to spread of smells and flowing of nutrients;

- possibilities of reducing the pesticides and insecticides used;

- practice the alternative methods for controlling the pests;

- prevention animals access to surface water;

assessment of the energy efficiency used that could show the agricultural system performance grade. Depending by inputs efficiency and also, by outputs efficiency, the energetically performance of the agricultural system is influenced by the existing technical infrastructure in the agricultural holdings, the mechanize grade of the works, type of agricultural works practiced, introduction of some new production technologies, type of agricultural products obtained. It could appreciate by Outputs/Inputs rate under reserve of the possibility of influencing the energy use efficiency by one of the economic factors or climate changes;

- improvement the practices for could reduce the GHG emissions of the agricultural sources. The main sources which contribute to GHG emissions increase there are: raising the grade of fertilization with chemicals or organic nutrients, vegetal waists, collection and storage the organic waste or it direct degradation on the grassland, the ammonia volatilization, methane emissions

resulted by anaerobic decomposition of the organic waste, especially provided by the animals farms, carburant used for agricultural equipments functioning or for transportation the obtain products, carbon dioxide emissions provided from agricultural lands;

- warning on water quality changes, indicating the grade of risk of water contamination with nitrogen, phosphor, pesticides or pathogen agents;

- the capacity of natural habitats offer by agricultural holdings.

As we observe, the impact on the environment produce by the agricultural systems could be measured in physical expression using various indicators, the problem being to find some common expression forms of the environmental changes to the agricultural holding level, so those indicators could be added and aggregated on the superior interest levels – regions, counties, sector, and national economy.

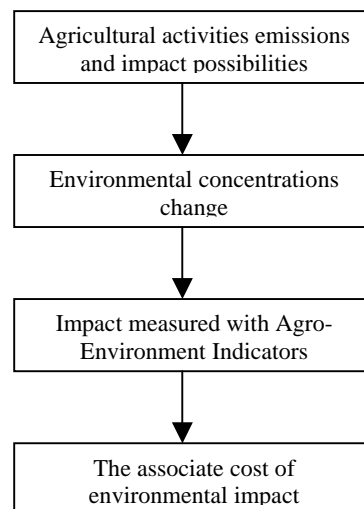


Fig 2. Value expression of the Agro-Environment Indicators.

Attaching a value expression to bio-physical impacts can help in policy analysis and reporting. Also, it could be identify the costs and benefice elements provided by agricultural holdings activity, comparisons at the diverse levels of agro-environment indicators changes and also, association of one economical value to various impact forms for could reach to a general indicator quantifying all agro-environmental interacts. Having a better capacity to generalize it allows a synthetically appreciation of contribution which agriculture sector brings to the environment and people health.

Literature

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