SUPPORTING THE DEVELOPMENT OF THE AGRICULTURAL SECTOR. CONSIDERATIONS REGARDING IMPROVING THE ECOLOGICAL AND ENVIRONMENTAL PERFORMANCE OF AGRICULTURE

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Abstract

The paper focused on reconsidering the role of applying strategies in soil treatment in agricultural production. Particular emphasis is placed on the interdependence between fertilizers applied to permanent pastures and agricultural plantations to improve soil quality. The main result of the research is to identify the correct management of nitrates in improving soil quality, as a means of sequestration of C at ground level by collecting data on nitrate efficiency and, consequently, carbon sequestration will contribute to the overall goal of significantly increasing carbon sequestration in the ground. During the research we tried to highlight aspects that, in our opinion, are important for the development of the agricultural sector, improving agricultural management by applying good practices responsible for the environment in terms of improving soil quality and preserving the biosphere and ecosystem.

Keywords: *soil, environmental, carbon emissions*
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Introduction

The role of research and the studies in the field have revealed an important factor: a reduction of the carbon footprint per ton of food produced from organic farming compared to conventional agriculture, due to the abandonment of the use of chemical fertilizers and pesticides. We put emphasis on the possibility of facilitating the promotion and implementation of a responsible production model with the environment. In the research we tried to put spotlight on the issues that we consider relevant for the development of the agricultural sector as part of the economic development. Research and evolution is important for every field and industry.

The analysis points out that, in the scientific research, interdependence should be examined with other areas that have a part in upgrading the quality of analysis through remodelling, in which a way so that agricultural sector research is accompanied by various forms of academic knowledge that has a very important purpose, such as would be the quality soil. Approaching remodelling in terms of methodologies applied in other sciences such as physics, chemistry, engineering can help in the field of studying correlating soil degradation processes, determining the main pollutants, monitoring and controlling the soil and the quality status are very important for agriculture. In the domain of rural development, agricultural economy, economic environment, we must keep the environment a safe place and keep it clean, especially having a rational use of natural resources, increasing competitiveness by identifying the best practices in the field.

1. Literature review

Adapting to the effects of climate change is a high priority for the agricultural sector - where gradual climate change is occurring with significant effects on the agricultural sector. Agricultural practices will have to take into account the changing risk of floods, the intensity and frequency of droughts and the increased risk of soil erosion and desertification. Promoting measures to protect ecosystems and prevent their deterioration will also help increase the productivity and sustainability of agriculture. This involves, among other things, the rehabilitation and sustainable management of irrigation services, the reuse of water in irrigation and the development of land management plans, especially for the areas most vulnerable to soil loss and degradation. Climate change mitigation measures are defined as actions to limit or control greenhouse gas (GHG) emissions. By managing the sources of such emissions, these measures help to limit the total accumulation of GHGs in the atmosphere. Reduction actions inevitably have a global dimension, as local emission reduction measures inherently reduce total global emissions and have an impact on the climate in proportion to their contribution to the global target [3]. Agriculture occupies an important place in carbon emissions as shown in the figure [1].

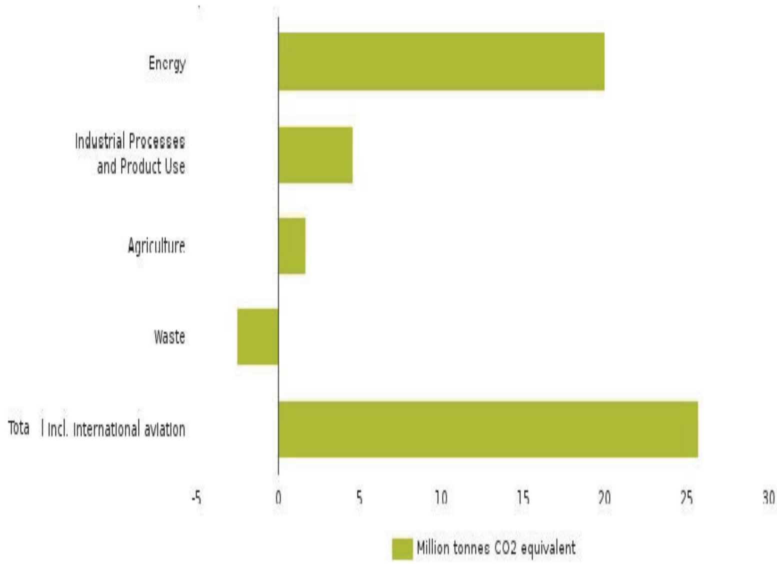

Figure 1. Change in EU's greenhouse gas emissions by sector
Source: EEA EU

2. The EU political context

In accordance with Art. 93 of Regulation (EU) no. 1,306 / 2013 of the European Parliament and of the Council regarding the financing, management and monitoring of the agricultural policy.

The rules on cross-compliance include legal management requirements (SMR) and good agricultural land conditions (GAEC), including the obligation to maintain permanent

grassland at national level, defined on the basis of the framework set out in Annex II to that Regulation, for the following areas:
- environment, climate change and good agricultural conditions of the lands;
- public health, animal health and plant health;
- animal welfare.

2.1. Soil and the importance of treating soil as a means of sequestering carbon emissions

It is good to know that fertilizers used in maximum doses do not lead to higher production increases. Each plant has a greater or lesser requirement for a particular substance. That is why it is vital to know the properties of the soil, soil analyzes not only lead to production increases, but also determine the decrease of production costs. Following the agrochemical analysis we will know exactly what we have in the soil as a "starting point" and depending on the expected production the type and amount of fertilizers required is applied.

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The main objective in the field of agriculture is to maintain a low level of greenhouse gas emissions from the agricultural sector. Table [1].

Thus a surplus of either nitrogen or phosphorus leads to environmental pollution, such as eutrophication of surface water. As a result, it is desirable to reduce the overuse of mineral fertilizers. Improper management of fertilizers (natural or chemical) can lead to serious environmental problems (eutrophication - a phenomenon that severely affects the balance of aquatic ecosystems) and health.

It is important to maintain traditional agricultural practices - grazing - due to the abundance of pastures with "high natural value", characteristic of Romania.

Without maintaining these pastures and grasslands, many of the habitats and wild species of international importance would be lost. Climate change is expected to increase the pressure on these pastures through floods and soil instability in the coming years, so possible scenarios for retaining and conserving these resources is a priority in the agricultural sector. Support will be important for these pastures to cope with climate change. This may include incentives to improve land management.

From the point of view of development, rural areas have a significant gap with urban areas and are characterized by: persistent structural deficiencies (large number of people employed in agriculture, aging population, a large number of subsistence farms, etc.); low added value of agri-food products; low labor yields and productivity, especially in semi-subsistence agriculture; weak entrepreneurial spirit for the development of economic activities, reduced access to credit; a dysfunctional land market; a modest export orientation; insufficient investment in research and development; access to services and infrastructure far behind urban areas; the continuous increase of regional disparities; a high share of the population at risk of poverty and social exclusion; an inefficient public administration; a number of risks to humans and the environment exacerbated by climate change.

Table 1. Impact Indicators

Energy sector	Million tonnes CO2 equivalent	Percentage
Total incl. international aviation	25.7	0.6
Waste	-2.5	-1.8
Agriculture	1.7	0.4
Industrial Processes and Product Use	4.6	1.2
Energy	20	0.6

Source: EEA

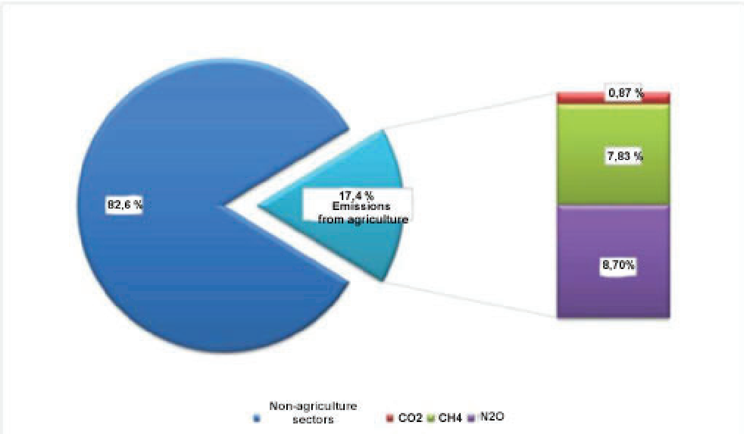

Figure 2. Emissions GES from agriculture
Source: MADR - ROM E-3

The concrete analysis of agricultural practices is not a novelty as scientific research but this analysis aims to present some possible technical solutions to determine the development of farmers, stimulating the application of technologically advanced practices to improve soil quality through customized fertilization according to needs crop growth and the history of applied fertilizers, and an increase in the use of permanent pastures to reduce GDS, the evolution in the EU being shown in the table [2].
Local companies in the agricultural sector have registered substantial increases for 2019 and expect it to be an upward trend in the agricultural business environment. According to estimates, the 10 most important players in agriculture achieved, in 2018, a total turnover of 6.8 billion lei, concentrating 16% of the total turnover in this sector.
Of the business generated in the agricultural sector, plant production in Romania has increased, in the last five years, by 26%, reaching 13.9 billion euros last year, thus ranking 6th in the European Union (EU), with almost 6% of the total. All these elements bring into question how much of the benefit of this increase is in fact the size of the effects generated by agricultural practices applied to soils by fertilizers and fertilizers, an aspect that only through monitoring we can predict.

Table 2. Evolution of the permanent grassland ratio

MS	annual ratio 2016			reference ratio for years 2015-2020		
	total farmland declared (ha)	permanent grassland area declared (ha)	annual ratio %	total farmland declared (ha)	permanent grassland area declared (ha)	reference ratio %
BE	1,314,400	448,987	34.2	1,315,486	443,224	33.7
BG	3,715,306	430,730	11.6	3,679,813	429,132	11.7
CZ	3,052,450	568,829	18.6	3,060,035	562,796	18.4
DK	2,406,971	187,406	7.8	2,432,797	188,410	7.7
DE	15,837,869	4,225,999	26.7	15,910,715	4,275,141	26.9
EE	780,945	191,413	24.5	808,521	226,379	28.0
IE	4,492,546	4,146,476	92.3	4,529,921	4,126,327	91.1
EL	3,474,055	1,113,762	32.1	3,351,290	1,148,530	34.3
ES	19,282,905	5,188,284	26.9	17,924,941	4,738,728	26.4
FR	26,443,752	8,308,807	31.4	26,084,955	8,138,942	31.2
HR	943,389	128,516	13.6	877,953	112,044	12.8
IT[1]	8,388,012	1,352,638	16.1	8,388,012	1,318,111	15.7
CY	133,987	2,622	2.0	132,259	2,994	2.3
LV	1,402,663	320,117	22.8	1,396,574	310,985	22.3
LT	2,683,626	695,077	25.9	2,680,109	577,221	21.5
LU	116,009	61,497	53.0	118,283	60,716	51.3
HU	4,657,441	576,847	12.4	4,649,119	583,495	12.6
NL	1,703,370	690,270	40.5	1,733,770	704,152	40.6
AT	2,060,208	904,038	43.9	1,963,729	852,273	43.4
PL	11,893,373	1,849,142	15.5	11,813,509	1,694,509	14.3
PT	2,370,452	893,592	37.7	2,314,906	884,013	38.2
RO	7,513,858	1,675,808	22.3	7,277,405	1,741,649	23.9
SL[1]	412,748	234,513	56.8	412,748	231,666	56.1
SK	1,697,140	390,167	23.0	1,717,269	400,310	23.3
FI	2,042,392	134,006	6.6	2,076,488	132,482	6.4
SE	2,522,147	424,332	16.8	2,613,443	374,188	14.3
UK[2]	13,807,482	8,547,962	61.9	13,939,630	9,037,730	64.8
Total EU	145,149,497	43,691,838	30.1	143,203,679	43,296,146	30.2

Source: ECA, based on the European Commission's data

The data of the National Institute of Statistics (INS), reveals the fact that Romania occupies, in 2018, the first place in corn among EU Member States both in terms of cultivated area and production, of 18.7 million tons.
According to the analysis presented, in 2018, the business of local companies in the field of agriculture reached the value of 43 billion lei, increasing by 14.7% compared to the results of 2014.
Cross-compliance rules are mandatory for farmers requesting direct payments, transitional national aid, beneficiaries of support measures for afforestation and forestry, agri-environment and climate payments, support for conversion to organic farming methods, support for maintaining organic farming practices , payments for areas facing natural or other specific constraints, payments for forestry commitments, support for the wine sector and other support schemes from European funds or the national budget for, in accordance with the regulations in force
Romania faces enormous challenges in reaching its economic and social potential, in the agri-food and forestry sector, as well as in rural areas. GDP per capita is less than 50% of the EU average and significantly lower in rural areas.

2.2. Soil improvement practices with fertilizers

Due to the specific behavior of nitrogen in the soil, fertilization with this nutrient and also the cultivation techniques that influence its dynamics in the soil should be conducted in a way that minimizes losses with percolating water, thus reducing the risk nitrate contamination of groundwater and surface water.
The risk of pollution is mainly related to nitrogen oxidation compounds. When not applied as nitric acid salts, nitrates and nitrites result from the biological oxidation of the relatively immobile cationic form NH4 + to a more mobile anionic form NO3-, i.e. the transition of nitrogen compounds from reduced forms of nitrogen to oxidized forms, a process known in literature under the name of nitrification process.
Define nitrification as the part where ammonia nitrogen (NH4 +) is converted by the bacterium nitrosomonas into nitrites (NO2 -), which are then converted to nitrates (NO3 -) by the bacterium nitrobacter.
• fertilizers on the nitrosomonas bacterium by keeping it inactive, keeping nitrogen in a stable form of (NH4 +) for as long as possible, this form being less exposed to losses by leaching and de-nitrification.
This form of nitrogen remains available in the soil for plant growth, reducing losses through leaching and release of hazardous gases. Nitrates in the form of nitrates (NO3 -):
When broken down by water in the soil it is very mobile and can be lost by leaching.
In conditions of high humidity through the de-nitrification process it is lost in the atmosphere in the form of dangerous greenhouse gases.
Ammoniacal nitrogen (NH4 +):

- It is continuously taken up by the roots.
- It is retained by humus and clay particles keeping in the soil. Ammoniacal nitrogen (+) positively charged (-) negatively charged (-) negatively charged Bacteria nitrosomonas Bacteria nitrobacter NH4 N02 N03 N-Lock Nitrites Nitrates Soil (-) negatively charged Ammoniacal nitrogen STABILIZED NITROGEN Nitrogen stabilized Positive plant available (+) The benefits of nitrogen stabilization with azot are favorable to both culture and the environment.
- Benefits to the crop

• Nitrogen applied to the crop remains available to the plants for a long time.

• Increases production potential (7% increase in production).

• Improves plant health. Environmental benefits

• Decreased leaching.

• Reducing the amount of nitrates in groundwater.

• Reduces the release of harmful greenhouse gases into the atmosphere. This process is mediated by specialized chemotrophic microorganisms of the genera Nitrosomonas and Nitrobacter. The use of extraradicular fertilizers as a fertilization process in modern agriculture is also a possible method of developing organic farming due to the very small amounts of active substance applied. In the development of these fertilizers it is noticed the introduction in the NPK type matrix of small quantities of substances with phytoregulatory role, such as synthetic chemicals with phytoregulatory role.

The ability of the soil to provide the nutrients needed for the plants varies depending on the type of soil, The fertility level of a soil can be degraded if the cultivation technologies are incorrect or, on the contrary, it can be increased if cultivated in a way that improves its chemical, physical and biological properties.

A soil with good natural fertility and productivity can be depreciated by being poor in one or more nutrients or by degradation of some properties or can be totally destroyed by erosion phenomena; a soil with low natural fertility can become productive by correcting the limiting factors that prevent the normal growth and development of the plants (acidity, excess or nutrient deficiency).

Nitrogen is par excellence a plant-specific nutrient and is therefore found in different amounts in natural organic fertilizers, especially in the form of protein from animal manure. Rapid development of fertilization methods and technologies using fertilizers extra radicular and liquid ones were due both to the possibility of controlled application of according to the phases of vegetation, culture, agro fond and nutritional deficiencies as well increase cost efficiency indicators fertilization - economic results. Due to its peculiarities of geochemical behavior, it is difficult to manage both in monoculture and in isolation.

In accordance with the needs and legislation for the protection of water quality, fertilization must be carried out in a controlled manner, so as to ensure, as far as possible, the optimal use by cultivated plants of nutrients already in the soil and those from mineral fertilizers and applied organic.

It is considered as a good agricultural practice to adapt the fertilization and the moment of its performance to the type of agricultural culture and to the soil properties. The assessment of the necessary nutrients is made according to the nutrient reserve of the soil, the local climatic conditions, as well as the quantity and quality of the forecasted production.

Rational fertilization with mineral and organic fertilizers must be in accordance with the following principles:

- ❖ In order for a crop to produce at a quantitative and qualitative level corresponding to its potential, in favorable environmental conditions, it must have available, throughout the vegetation period, a series of mineral nutrients (nitrogen, phosphorus, potassium, calcium, magnesium , sulfur, iron, manganese, copper, zinc, boron and molybdenum), in appropriate quantities and proportions;
- ❖ The mechanisms of involvement and participation of nutrients in physiological processes in plants are the same, regardless of their origin (from natural sources or mineral fertilizers);

- The quantitative requirements of mineral nutrients vary with the nature of the crop, the soil reserve, the expected harvest and the climatic conditions;
- Soil is the main source of water and nutrients for plants.

According to the existing technical data, the effectiveness of liquid complex fertilizers is 15-20% higher compared to other conventional fertilizers, and the non-uniformity of administration on the soil surface is not higher than 4-5%, at the same time with a better assimilation of nutrients. to plants.
For economic reasons, the interest of farmers is channeled to obtain plant production as close as possible to the production capacity of the plants they grow, which involves the use of intensive cultivation techniques, including fertilization.
In view of the economic aspects presented above, as well as the restrictions imposed by the environmental protection, the quantities of nitrogen applied must be dimensioned in such a way as to ensure the completion of the existing mineral nitrogen stock in the soil to the level necessary to obtain profitable productions of surface and groundwater against nitrate contamination.Dynamic culture-climate-soil models are mathematical models that describe the interactions between crop growth, soil dynamics C and N, and environmental processes. These models can be viewed as a system of process-oriented equations that describe soil carbon, SOC change and GHG emissions (Smith et al., 2008, 2012).
Dynamic models consider agriculture from a system perspective and simulate crop production, residue decomposition, gas emission monitoring (eg CH4, N2O) and water dynamics, soil C and N, all being interdependent (Goglio et al., 2013; Grant et al., 2015; Lehuger et al., 2007, 2009).
The accuracy of the method applied, for example, a factor for a change from permanent cover to grassland (Styles and Jones, 2007), or displacement of the last crop (e.g. maize) would cause additional land to be cultivated to maintain production matching.
Soil quality is determined by soil material, erosive effects, climate and vegetation. The calcium carbonate content is strongly correlated with the quality influenced by the distribution of clay in soils, topography and raw material. In addition, soil conservation, conservation and restoration could be considered "win-win" processes. Soil is non-renewable as a resource therefore constant monitoring is vital in order to prevent degradation.

2.3. Practical methods of applying fertilizers on sloping land

On such lands there is an increased risk of nitrogen loss through surface runoff, which depends on a number of factors such as: soil slope, soil characteristics (especially water permeability), cultivation system, anti-erosion arrangements and especially the amount of precipitation.
The risk is maximum when the fertilizers are applied superficially and when a period of heavy rainfall follows.
On such lands fertilization should be done only by incorporating fertilizers into the soil and taking into account weather forecasts (no fertilizers are applied, especially liquid manure, when heavy rainfall is forecast).
On arable lands with slopes between 2 and 8%, it is recommended to maintain the percentage of autumn crops and / or cover crops at over 20% of the arable area of the farm included in this category of slope.
On arable lands with slopes between 8-15% it is recommended to increase the percentage of autumn crops and / or cover crops to at least 25% of the arable area of the farm.

On lands with slopes greater than 15%, it is mandatory to maintain the share of autumn crops and / or cover crops at over 30% of the arable area of the farm included in this category of slope. Immediately after application to these soils, organic fertilizers are incorporated into the soil (no later than 24 hours).
Crop sowing, like all other agricultural operations on sloping land, should only be carried out on contour lines.
In addition, soil conservation, conservation and restoration could be considered "win-win" processes. Soil is non-renewable as a resource therefore constant monitoring is vital in order to prevent degradation.
Is the natural question being asked can organic farming solve this problem and can it help to reduce greenhouse gas emissions? Yes, scientific research has shown that, in addition to a number of positive factors, organic farming is more efficient and better for the climate than conventional agriculture.
Development of a realistic production strategy for the production farm with a high degree of scientific foundation, taking into account the evolution of the environment important environmental factors in achieving a successful management.
It is well known that research and innovation activities and consulting services can help farmers to adopt production systems that best meet local characteristics. Risk management tools will in turn be crucial in limiting the negative effects of natural disasters on agricultural production. Innovation is not limited to a technical or technological dimension. This refers more and more to the strategy, marketing organization design management. Farmers do not necessarily apply new technologies, their innovations appear as a result of different ways of thinking combining knowledge in an innovative way.
This process starts from sharing the collective knowledge of farmers' collective experience regarding natural resources, ecological processes regarding product quality and the exchange of information as open sources. Scientific research could explain why and how some agroecological practices are effective.

Conclusions

Research has shown that soil carbon changes can be caused by changes in land use, with the type of production influencing soil performance. In conclusion, we can say that the conservation and improvement of natural resources and habitats by encouraging the use of innovative, environmentally friendly agricultural production methods that protect the environment, conserve biodiversity and improve water, soil and natural landscape quality is vital. Scientific research could explain why and how some agroecological practices are effective. Is the natural question being asked can organic farming solve this problem and can it help to reduce greenhouse gas emissions? Yes, scientific research has shown that, in addition to a number of positive factors, organic farming is more efficient and better for the climate than conventional agriculture. If we put a price on saving unspent money as money earned, today it is not relevant how much we will earn today but it is important what we earn tomorrow using agricultural techniques to protect biodiversity.

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