AGRICULTURAL PRACTICES TO IMPROVE SOIL QUALITY FROM THE PERSPECTIVE OF REDUCING GREENHOUSE GAS EMISSIONS

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Abstract
The paper provides an overview of the agricultural economy. Prioritizing an action behavior in terms of vulnerabilities favors the orientation of agriculture through more environmentally friendly methods. The emphasis is on the possibility of facilitating the implementation and promotion of a responsible production model with the environment. During the research we tried to highlight issues that, in our opinion, are important for the development of the agricultural sector as part of the economy. An important role is played by the implementation of the best practices in the correct management of the land and the promotion of the organic production models can significantly contribute to the increase of the carbon absorption in the soil and, at the same time, to the indication of the possible improvements of their performance. The purpose of the following research is to collect data and information on the most efficient management models that will create the premises for the production of production models that will respond in the future to climate change challenges, especially from the perspective of reducing greenhouse gases, in depending on soil quality.

Keywords
Soil, environmental, agricultural, carbon emissions, management

JEL Q00, Q24, Q10, Q52, Q53

Introduction

One of the main objectives in the field of agriculture and rural development is to maintain a low level of greenhouse gas emissions generated by the agricultural sector. The role of research in the field and studies have shown an important factor in the fact that a reduction of the carbon footprint per ton of food produced from organic farming compared to conventional agriculture, in principle, due to the abandonment of the use of chemical fertilizers and pesticides.

Research and development is important for all academic fields and industries. From this perspective, agriculture as a field is not an exception, having a special relevance starting from tradition. The study points out that, in scientific research, interdependence should be analyzed with other areas that have the role of improving the quality of research through innovation, so that agricultural sector research is complemented by various forms of academic knowledge that have proven to be vital, such as would be the quality soil. Approaching innovations in terms of methodologies applied in other sciences such as management, mathematics, even correlating soil degradation processes, determining the main pollutants, monitoring and controlling the soil, monitoring the soil quality status are relevant for agriculture. First, the dissemination of information from various fields can make information more efficient. The proper classification of these information resources may entail prioritizing the use of new information on detailed topics, such as performance in land / soil use, that is, which production would lead to higher long-term profit.

Low carbon agriculture sector analysis

The achievement of the objectives set in this research project requires the definition, construction and application of a specific research methodology focused on the evaluation of the costs and the economic-financial impact of the sequestration of 4% / year of the carbon dioxide at the farm level. The use of specific econometric instruments and methods is envisaged, highlighting the possibility of defining economic models for decarbonising agricultural production. From a methodological point of view, both descriptive analysis will be applied to highlight the factual situation of sequestration of a certain percentage of carbon dioxide at the farm level, as well as the interactive method to identify the possible trends, evolutions and perspectives in applying these measures. It will also adapt, calibrate and run in the subsidiary, some models already validated in the literature, which may complement the research.

The researches that will be carried out within this theme will focus on the description of factors through which to exploit the decarbonisation potential of agriculture and to promote an environmentally responsible agricultural model. At the same time, it is envisaged to improve the studies regarding the interactions determined by promoting the carbon dioxide storage at the farm level and the environmental requirements at the farm level, while analyzing the soil quality.

Agriculture and environmental issues

For Romania, the main sources of greenhouse gases are nitrous oxide ($N2O$) based on soil nitrification and management of natural fertilizers, the resulting methane ($CH4$) from enteric fermentation of herbivores, mainly cattle, and carbon dioxide ($CO2$) from from the energy / fuel used by buildings and machines. 50% of agricultural emissions are nitrogen oxide, followed by 45% methane, while only 5% of emissions are based on carbon dioxide.

Carbon sequestration contributes to the overall goal of lowering greenhouse gas concentrations in the atmosphere. The incorporation of the vegetal mass in the soil on the agricultural lands where green crops are established, contributes to carbon sequestration. But the result of this objective will be quantified by monitoring the surfaces on which green crops were established, as well as by quantifying the amount of plant biomass resulting from afforestation. Lack of knowledge in the field, due to problems with the advisory system for farmers in agriculture, but also the pursuit of an immediate profit, are some causes that have led to often inadequate agricultural practices, with negative influence on the environment. Studies have shown that agriculture generates almost 15% of the country's greenhouse gas emissions (at the level of 2012).

The process of land abandonment has accelerated in Romania in the past years, resulting in the loss of biodiversity. Uncultivated land has increased by 50% since 2005, and, at 952,000 ha, constitutes 7% of the total agricultural area of the country (2010). The abandonment of

agricultural land has far-reaching effects on ecosystem services, such as increased carbon storage, lower soil erosion, better water quality, and loss of traditional cultural landscapes.
The figure no. 1 below shows the greenhouse gas emissions from EU28 in 2017, broken down by main source sectors. Energy accounts for 80.7% of greenhouse gas emissions in the EU28 in 2017, and transport accounts for about one third. Greenhouse gas emissions from agriculture contribute 8.72%, industrial processes and product use by 7.82%, and waste management by 2.75%.
In the agricultural field a main objective of the development of the rural area is to maintain a low level of greenhouse gas emissions generated by the agricultural sector depending on the local characteristics.

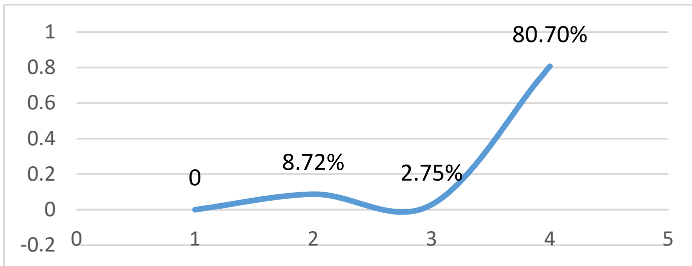

Fig. no. 1 Greenhouse gas emissions in the EU by sector in 2017
Source: CEE 2017

The researches that will be carried out within this theme will focus on the description of factors through which to exploit the decarbonisation potential of agriculture and to promote an environmentally responsible agricultural model. At the same time, it is envisaged to improve the studies regarding the interactions determined by promoting the carbon dioxide storage at the farm level and the environmental requirements at the farm level, while analyzing the soil quality.
Consideration of soil properties, climate and crop management are vital characteristics from the perspective of emissions. The following scenarios are aimed at the interaction between crop growth, soil carbon, nitrogen needs and climate.
Most agricultural soils contain too little natural nitrogen available to meet the crop requirement during the growing period. As a result, it is necessary to supplement the nitrogen naturally contained in the soil each year. Applying the right amount of nitrogen at the right time is the basic requirement of good fertilizer management.
Each agricultural producer must understand the need for accurate assessment and periodic monitoring of plant nutrient requirements based on realistic forecasts, depending on: local technological conditions, tradition, sun, climate, expected production yield.
Nitrogen needs vary considerably in different crops, and within the same crop, with the level of harvest possible to be achieved in a certain conjuncture of pedoclimatic and technological factors.
The production capacity of a crop, determined genetically, can be reached only under ideal conditions, when through the factors mentioned above optimal conditions for plant growth and development are achieved.
The land management for carbon sequestration is highlighted by soil carbon inventory, especially by the form in which it is kept, the capacity, the persistence and bulk density, the textural class of the soil.
Changes in crop management practices management practices that affect soil organic dynamics C are crop selection, high biomass crop rotation, crop residue management, nutrients and water management, use of organic fertilizers and management of organic soils and degraded land (Hutchinson et al., 2007; Petersen et al., 2013; Smith et al., 2012).

The research revealed a difference in soil carbon when the C factors had the effect of applying a management method based on the interdependence between production and crop rotation, soil quality, carbon uptake, climate. At the same time, soil carbon changes are caused by land use changes.
The management applied through the modification of some practices of crop management have first and foremost an impact on the organic texture of the soil through the rotation and selection of crops, which can produce biomass by managing crop residues.
The climate characterized by successions of drought years followed by rainy years leads to, during the drought years, the accumulation of nitrates in the unsaturated area between the root layer and the groundwater aquifer, nitrates which are then transferred to the free water in the rainy years (piston effect). In this way, the annual losses of nitrates, even if they are small in the dry years, can lead, by accumulation, to great pollution of the groundwater aquifer in the years with excess precipitation.
It is considered as a good agricultural practice to adapt the fertilization and the timing of its fertilization to the type of agricultural crop and to the characteristics of the soil. The assessment of the nutrient requirement is made according to the nutrient reserve of the soil, the local climatic conditions, as well as the quantity and quality of the predicted production.

Results

The land management for carbon sequestration is highlighted by soil carbon inventory, especially by the form in which it is kept, the capacity, the persistence and bulk density, the textural class of the soil. In certain areas, especially on soils with thin limestone substrate, there is an imminent danger of groundwater pollution. Depending on the local specificity, this danger should always be taken into account when applying organic fertilizers in such high risk areas. The calculation method regarding the contribution of nitrogen from organic sources is important for the assessment of greenhouse gas emissions from agricultural activities. Organic nitrogen can be used by crops only after its passage into an inorganic form through mineralization or gradual decomposition of organic matter from the soil, first in ammoniacal nitrogen and then in nitric nitrogen.
Investments in the modernization of agricultural holdings aimed at maintaining a low level of greenhouse gas concentrations in the atmosphere should, in particular, take into account the control of greenhouse gas emissions in zootechnical production (methane and nitrogen oxide).
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.
Due to its peculiarities of geochemical behavior, it is difficult to manage both in monoculture and in isolation.
Also, it is difficult to determine with sufficient precision the amount of nitrogen required for a certain crop during the active vegetation period, respectively to calculate the dose of nitrogen fertilizer to be applied for fertilization. It is considered as a good agricultural practice to adapt the fertilization and the timing of its fertilization to the type of agricultural crop and to the characteristics of the soil. The assessment of the nutrient requirement is made according to the nutrient reserve of the soil, the local climatic conditions, as well as the quantity and quality of the predicted production.
The ability of the soil to provide the nutrients needed for the plants varies depending on the type of soil, respectively its level of fertility.
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, etc.).

The conservation and improvement of the fertility of a soil and the creation of adequate conditions of mineral nutrition is ensured by a rational fertilization, in a system of crop rotation. A rational fertilization practice involves the acquisition and acquisition of technical-scientific information that will allow a relevant answer. Any nitrogenous fertilizer in organic form is mineralized as a result of the activity of bacteria present in the soil, ultimately resulting in nitric and ammoniacal nitrogen. The main evolution factor for mineral forms of nitrogen is the ratio between carbon and nitrogen in fertilizer (C / N).

Carbon sequestration contributes to the overall goal of lowering greenhouse gas concentrations in the atmosphere. The use of crops with a high capacity to fix nitrogen in the soil, contributes to achieving the objectives of maintaining a low level of greenhouse gas concentrations in the atmosphere.

The agricultural producers have the possibility to buy the fertilizers necessary for the fertilization of the crops at any time of the year, as needed. Deposits must have a capacity to ensure storage for a period greater than one month than the prohibition interval for applying organic fertilizers to the field defined by the period when the average air temperature is below 5^{o}C. Loss of nitrogen in the form of gases in the atmosphere (Ng).

These losses can occur through different mechanisms, especially by denitrification and volatilization of ammonia on the surface of alkaline soils.

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 extraradicular and liquid ones were due both to the possibility of controlled application of according to the phases of vegetation, culture, agrofond 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.

The conversion of nitrogen fertilizers into the soil, through the passage of nitrogen from one chemical form to another, can lead, in most cases, to losses of assimilable mineral nitrogen and to changes in soil reaction, which can reduce the efficiency of these fertilizers.

Table no. 1 Specification of crops

Nr.crt.	Specification of crops	N	P_2O_5	K_2O
1	Autumn wheat straw 1: 1.3	26.5	13.7	16.4
2.	grain rye straw 1: 1	27.5	10.8	22.3
3.	grain oat straw 1: 1.5	28.5	11	31.2
4.	Corn grains: strain 1: 1.6	27.5	12.5	16.5
5.	Sugar beet roots: Leaves and parcels 1: 1	4.9	2.0	6.0
6.	Pea berry berries: 1: 1.5 edges	61.0	16.6	28.0
7.	Soybean beans: 1: 1.5 rods	70.0	22.5	34.0
8.	natural grass grass fan	24.0	5.6	18.0
9.	Natural grassland grass	6.5	1.4	4.5
10.	Hemp stems	10	8.5	17.5

Source: Insse 2017

The table above shows that the soil with the richest culture in N is the one with soy, while other relatively more frequent crops are located in the middle area with 1/3 of N, so that for each one the method will be applied of the appropriate nutrient, as in estimating the level of

the planned crops, the climatic characteristics of the place must also be taken into account, since they are decisive in the dynamics of the fertilizing elements in the soil and especially in the mineralization of the organic matter and in the movement of nutrients in the soil, soil profile, below the rooting area.
The hypothesis of carbon storage in the soil could be an option to mitigate climate change for agriculture, by managing the land and changing its use. In this study, we will consider the possibility of adapting the methods used to estimate carbon changes in the soil. For large-scale assessment, the schedule CO_2 emissions from the soil should be taken into account.

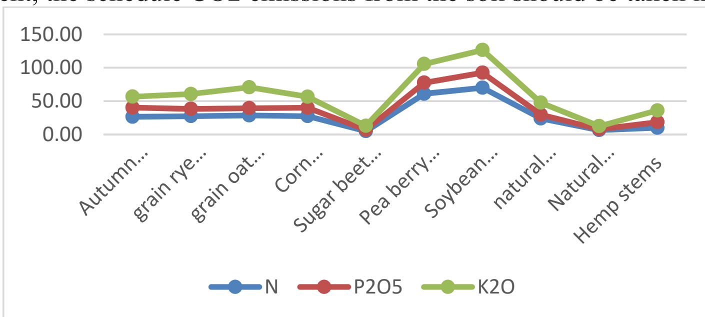

Fig. no. 2 Specifications of crops
Source: Developed by the authors

The soil is a non-renewable resource that requires constant monitoring to prevent its degradation and to promote efficient management. The soil may degrade depending on many items. Of strategic importance is the type of fertilizer, the age and the technique of applying fertilizers with N, with the amount of nitric nitrogen resulting from mineralization of the organic matter from the soil and other organic residues incorporated into the soil as well as with the amount of nitrogen entering the soil on other ways.
Solid fertilizers can produce pollution only in the case of heavy rains that occur immediately after application.

$$DN = Nc - (Ns + Na + Nb + Nr) + (Ni + Ng + Nl) \quad (1)$$

where:
DN is the nitrogen dose from fertilizer (organic + mineral) for the expected harvest, in kg / ha;
Nc is the nitrogen requirement for the expected harvest, in kg / ha;
Ns is the nitrogen available from the soil during the vegetation period, in kg / ha;
Na is nitrogen from irrigation water and from the atmosphere (powders, precipitation), in kg / ha;
Nb is nitrogen from biological fixation, in kg / ha;

There is no nitrogen from the mineralization of the plant residues of the previous crops, in kg / ha

- Ni is nitrogen lost by immobilization by soil microorganisms, in kg / ha;
- Ng is nitrogen lost through volatilization, including denitrification, in kg / ha;
- Nl is nitrogen lost through surface runoff and leaching, in kg / ha.

The prohibition periods for applying fertilizers on the ground are defined by the time interval when the average air temperature drops below 5^0C. This interval corresponds to the period when the requirements of the agricultural crop relative to the nutrients are reduced or when the risk of percolation / leakage to the surface is high.
When using nitrogen fertilizers in a predominantly organic form, it must be borne in mind that nitrogen, before being absorbed by plants, must undergo mineral form through a series

of transformations they undergo in the soil. Therefore, these fertilizers are applied with sufficient time before the time of maximum absorption by the crops.
When applying chemical fertilizers it is necessary to take into account the crop specific requirements it is recommended to be applied according to the ratio between nutrients.
For example: those where P_2O_5 predominates are more suitable for pre-sown grain cereals, those with a nitrogen ratio are suitable for technical crops, etc. Soil properties influence the use of fertilizers: larger quantities of fertilizers can be administered on heavy soils than on light ones; fertilizers with alkaline physiological reaction will be applied on acid soils, and fertilizers with acid physiological reaction will be applied on alkaline soils.
The periods when applying organic fertilizers should be determined according to different conditions as early as possible, during the crop growth period, to maximize crop nutrient uptake and minimize the risk of pollution.
On the heavily degraded meadows, only one crop is obtained during the year, and in the case of other meadows two or three harvests, but with the highest weight at the first harvest.
The application of organic fertilizers on permanent pastures (pastures and meadows) is subject to the condition of not exceeding the dose of 170 Kg N ha-1 year-1 and not being applied during the prohibition periods.
For the establishment of the fertilization plan, the export of the elements for each plot according to its mode of operation is considered.
Member States may require the mention of calcium, magnesium, sodium and sulfur content fertilizers with secondary nutrients and, if the conditions provided for in Article 17 are met, from the fertilizers with main nutrients placed on their markets, shall be expressed as follows:
(a) in the form of oxide (CaO, MgO, Na2 O, SO3) or
(b) in elemental form (Ca, Mg, Na, S) or
(c) in both forms.
For the conversion of calcium oxide, magnesium oxide, sodium oxide and sulfuric anhydride content into calcium, magnesium, sodium and sulfur content, the following factors are used:
(a) calcium (Ca) = calcium oxide (CaO) × 0.715;
(b) magnesium (Mg) = magnesium oxide (MgO) × 0.603;
(c) sodium (Na) = sodium oxide (Na 2 O) × 0.742;
(d) sulfur (S) = sulfuric anhydride (SO3) × 0.400.
The value withheld for the declaration is the value rounded to the nearest decimal place both when the content is expressed as oxides and if it is expressed in elementary form.
acid soils with pH <6.5;

- neutral soils with pH = 6.5 - 7.5;
- alkaline soils with pH> 7.5.

Many studies have evaluated cropland, grassland and marshland, while Schmidt (2008) evaluated the transition from natural land to agricultural land. For example some studies the fact that a change factors from permanent cover to an annual harvest, plus simultaneous factors for the changes of the crop management involves the achievement of a balance between the soil carbon and its kinematic function of the use and degradation of the soil. Not infrequently the concern is to follow the cyclicality of the crops used depending on the texture of the soil. But a technical formula cannot be validated precisely because depending on the periods of maintenance of the soil with fertilizers these techniques have to be controlled according to external factors.
Consideration of soil properties, climate and crop management are vital characteristics from the perspective of emissions. The following scenarios are aimed at the interaction between crop growth, soil carbon, nitrogen needs and climate.
Most agricultural soils contain too little natural nitrogen available to meet the crop requirement during the growing period. As a result, it is necessary to supplement the nitrogen

naturally contained in the soil each year. Applying the right amount of nitrogen at the right time is the basic requirement of good fertilizer management.

Conclusions

The role of research in the field and studies have shown an important factor in the fact that a reduction of the carbon footprint per ton of food produced from organic farming compared to conventional agriculture, in principle, due to the abandonment of the use of chemical fertilizers and pesticides. One of the main objectives in the field of agriculture is to maintain a low level of greenhouse gas emissions generated by the agricultural sector. Farmers must continually improve the techniques adapted to the new challenges of keeping the soil covered, to use techniques for managing the environment of the land to help maintain the carbon in the soil. Research has revealed that soil carbon changes are caused by land use changes. In conclusion, we can say that, conservation and improvement of the state of natural resources and habitats by encouraging the use of innovative, environmentally friendly agricultural production methods that come to protect the environment, biodiversity conservation and the improvement of water, soil and natural landscape quality are vital. In the field of rural development, agricultural economy, economic environment, we need a clean environment that is based on the rational use of natural resources, increasing competitiveness by identifying the best practices in the field. Prioritizing an action behavior in terms of vulnerabilities favors the orientation of agriculture through more environmentally responsible methods. In part, the need for innovation in agriculture will contribute to the understanding of the economic-financial impact of the storage of a percentage of carbon dioxide at the farm level and to the definition of the demands imposed by achieving a functional and highly competitive market economy. The role of the research is also the possibility of developing environmentally responsible agricultural production models that will significantly contribute to the decarbonisation of agriculture.

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