STRATEGIES FOR USING NITRATES TO IMPROVE SOIL PERFORMANCE AND SOIL C SEQUESTRATION

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Abstract
The work focused on the ability to practice strategies for the correct use of nitrates to improve soil quality. 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 main result of the research is to identify the correct management of nitrates in improving soil quality, but also the use of crop rotation as a means of sequestering C at ground level, and last but not least, the aim of the next research is the risk management strategy in soil treatment through nitrate control, collecting data on the most efficient management models that will create the prerequisites for optimizing soil C sequestration by properly managing nitrates and using crop rotations based on soil quality, which will significantly contribute to improved performance and treatment strategies of soil applied in agricultural production and accordingly, it will provide information on reducing greenhouse gas emissions by using best agricultural practices in soil treatment. An important role is played by the implementation of best practices in the correct management of the land and the promotion of production models in order to increase the absorption of carbon in the soil. The aim of the following research is also to collect data that will create the conditions for the introduction of production models that will meet the challenges of climate change in the future, especially from the perspective of reducing greenhouse gases.

Keywords
Soil, environmental, agricultural, carbon emissions, management

JEL Classification
Q00, Q24, Q10, Q52, Q53

Introduction
Carbon sequestration contributes to the overall goal of lowering greenhouse gas concentrations in the atmosphere. 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. 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.

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. 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.

Literature review

Evaluation of carbon storage and land use strategies in functional and competitive market economies. 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. 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 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.

Materials and methods

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. 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. 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

Consideration of soil properties, climate and crop management are vital characteristics from the perspective of emissions. 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. 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. 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 climatic 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. 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.

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.

Strategic option

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 NH_4^+ to a more mobile anionic form NO_3^-, 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. 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;
- products derived from protein hydrolysates obtained by chemical, physical or enzymatic cleavage;
- extracts from algae or vegetable products;
- products derived from hydrolysates of vegetable origin, humic and / or fulvic acids and their soluble salts;

- metal chelates.

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.

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 main evolution factor for mineral forms of nitrogen is the ratio between carbon and nitrogen in fertilizer (C/N). 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.

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 ofaccording to the phases of vegetation, culture, agrofond and nutritional deficiencies as wellincrease cost efficiency indicators fertilization - economic results. 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 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.

The table no. 1 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.

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 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: Inpce

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.

Ni is the nitrogen lost by immobilization by soil microorganisms, in kg / ha, Ng is the nitrogen lost by volatilization, including denitrification, in kg / ha; Nl is the nitrogen lost by entrainment with surface runoff and by leaching, in kg / ha. Nitrogen released from the soil (Ns) Nitrogen from the soil is found, almost entirely, in organic matter, and only a small fraction of it is found in a form immediately assimilable to plants.

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 (Fig. no. 1)

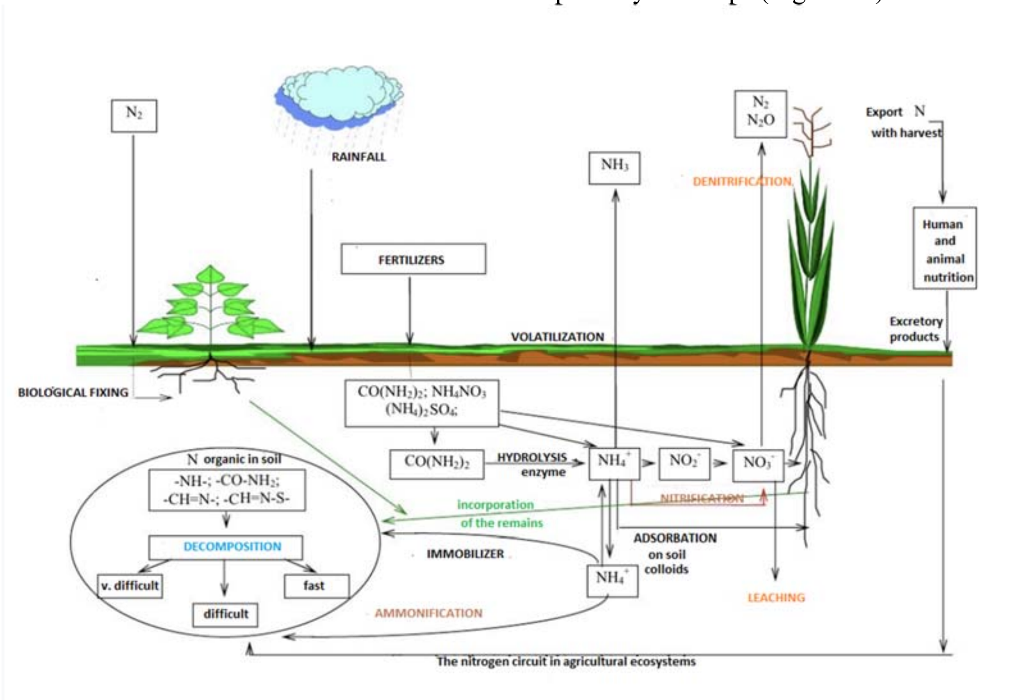

Fig. no. 1 The nitrogen circuit agricultural ecosystems

Source: INPCE

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.

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.

The EU political context

The pollution of the environment by improper application of fertilizers is considered to be in most cases determined by human negligence. In this context, several Member States have introduced national provisions limiting the cadmium content in phosphate fertilizers for reasons related to the protection of human health and the environment, by implementing Regulation (EC) 2003/2003 on chemical fertilizers Regulation (EU) 2019/1009 laying down the rules for making EU fertilizer products available on the market.

Results and Discussion

Carbon sequencing is that storage function at the soil level, which highlighted the importance of determining soil quality and interdependence with the climate ecosystem. Soil is defined as a strategic carbon reservoir, which contains more carbon than is found in the atmosphere and in the terrestrial vegetation. The accumulation of stabilized carbon in the soil requires a control in terms of storage. The quantity and type of residues produced by plants are also influenced by the addition of fertilizers, which are indispensable for sustaining the productivity of plants in agricultural systems. In addition, by their effect on the microbial activity, the carbon contributions of the plants, the climatic factors, such as the temperature solution.
In order to reduce the negative effects of climate change on agriculture, risk management tools need to be implemented to limit the negative effects of natural disasters on agricultural production. Accounting for a concept of stepping up processes in the agri-environment field in order to prefigure the application of greener models in agriculture, while reducing the level of GHG, is not to be neglected.
The quality of the soil is determined by the texture of the soil that must be maintained through the agricultural practices, in order to manage a possible degradation due to the climate or the vegetation. The calcium carbonate content is strongly correlated with the quality influenced

by the distribution of clay in soils, the geographical area as well as perhaps the most important of the material residues. Thus, it can be seen that the distribution of nitrogen in the soil is closely related to the organic carbon, vegetation and climate as well as the texture of the soil. Therefore, the use of land, the use of innovative agricultural practices based on a management designed on the basis of local data and adapted to agricultural production can be a factor in improving soil performance. In our opinion, the agricultural lands in general and especially those in Romania have considerable potential for carbon capture and storage. It is vital to have improved agricultural systems that efficiently utilize nutrient resources, increasing not only the amount of carbon in the soil, but also the biodiversity and resistance of agriculture even to climate change. As a rule, carbon stocks in agricultural soils can be increased by adapting certain agricultural activities. Research also shows that carbon absorbers are just as important as reducing emissions. Maintaining and further improving the natural absorbents represented by soils, agricultural land and coastal wetlands are essential.

Conclusions

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. 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 agricultural production models that will significantly contribute to the decarbonisation of agriculture.

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