Considerations regarding improving the ecological and environmental performance of agriculture

POPESCU Lavinia, PhD

Bucharest University of Economic Studies, Bucharest, Romania
popesculavinia14@stud.ase.ro

SAFTA Adela Sorinela, PhD

Bucharest University of Economic Studies, Bucharest, Romania
saftoadela19@stud.ase.ro

Abstract. *The agri-environment economy provides a significant database for environmental policy decisions. The prioritization of an actionable behavior regarding the agri-environment vulnerabilities, favors the orientation of the agriculture through more environmentally responsible methods, represents a current trend, with a broad support within the Common Agricultural Policy (CAP). The promotion of an agricultural model capable of ensuring its own sustainability implies the existence of a set of common values and rules in which to buy as many producers as possible, with a common objective, respectively to reduce greenhouse emissions and to promote an ecological responsibility of the production model. Agriculture can significantly contribute to achieving the objectives of reducing the negative effects of climate change, not only from the perspective of ensuring the conservation of carbon reservoirs, which are still present in the soil, or by expanding their size and favoring the formation of humus, but in particular by reducing the consumption of energy needed in agricultural production and the supply of biomass needed for renewable energy production., much greener. The transition to a low carbon economy, more environmentally responsible, in the national agricultural sector can contribute, both to the significant increase of food security, but also to the optimization of the agricultural production structures, which will thus conform more easy to environmental requirements. It becomes primarily the role of implementation in agriculture of feasible standards more environmentally friendly, and environmentally friendly in this context, the research in the field and the continuous training acquiring new values. An important role is played by the implementation of best practice methods in the proper management of the land and the promotion of organic production models can significantly contribute to increasing the carbon absorption in the soil and, at the same time, to indicate possible improvements in their performance.*

Keywords: agri-environment, environmental, agricultural, carbon emissions, methods.

Introduction

The rural society, at the level of the whole country, is currently undergoing a transition process, a direct result of the socio-economic changes produced by the transition to the market economy. 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. It is a priority for farmers to keep the soil covered, to use techniques for managing the environment of the land, for example, local agricultural production helps to maintain carbon in the soil.

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 the agricultural sector's research is complemented by various forms of

academic knowledge that have proved to be vital, such as 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.

Literature review

PICBE | 698

Greenhouse gas emissions tend to emit forecasts and targets for EU

The change of agricultural paradigms, and the orientation of agriculture towards more environmentally responsible practices, is a current trend, with broad support within the Common Agricultural Policy (CAP). Adequate land management and the promotion of organic production models can significantly contribute to increasing carbon uptake in the soil and also indicate possible improvements in their performance. As argued by (Yadav & Wang, 2017), agricultural land is a major source of atmospheric greenhouse gas (GHG) emissions and contributes majorly to global climate change, in the context of 20% of total GHGs. is issued from agricultural land.

Although some significant progress has been made in promoting environmentally responsible agriculture, and conditions have been created for the transition to an efficient agrarian economy from the point of view of the use of available resources, the issue of greenhouse gas emissions from numerous agriculture has arisen academic debates. The need to reduce carbon emissions and develop their level of absorption at the farm level acts, as noted in some specialized studies (Ramírez et al., 2019; Aznar-Sánchez et al., 2019) as an incentive in promoting the use of biomass as a raw material in the production of different categories of organic products, for the decarbonisation of agricultural production as a whole and the consolidation of carbon reservoirs.

Low carbon agriculture sector analysis

Evaluation of carbon storage and land use strategies in functional and competitive market economies. Agriculture generates 14% of Romania's total GHG emissions in 2010, while the regional average, as well as the EU-15 and EU-27, was 10% Managing forests to combat climate change Protecting restoring and promoting the sustainable use of terrestrial ecosystems, sustainable forest management, combating desertification, stopping and repairing soil degradation and stopping biodiversity loss Romanian farmers rely heavily on organic fertilizers, most of them coming from individual farms. Inadequate management of animal waste, especially in subsistence agriculture, together with the rare wastewater treatment facilities in rural areas contributes to this environmental impact.

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.

Table 1. Impact indicators

Indicators	2012	2020	2030
The level of emissions from agriculture	18299 Gg CO ₂	29882*	20.000GgCO ₂ .
The weight of the functional surface from the viable surface and the economically viable margin for irrigation	50%.	70%	90% of the total viable infrastructure

Source: “Elaboration of the elements of the report on the forecast progress, report under Article 3.2 of Decision 280/2004 / EC”, MMAP

In the context of climate change, there is a need for a new activity in the agricultural field, which means using natural resources and good practice models to provide observation systems, information management understanding, modeling and analysis of environmental phenomenon for evaluation, exploitation and management natural resources (water soil, climate).

Table 2. Greenhouse gas emissions in the EU by sector in 2017

No	Factor of greenhouse gas emissions	Per continent
1.	Industrial processes	7,82%
2.	Agriculture	8.72%
3.	Waste management	2.75%
4.	Energy accounts	80.70%

Source: CE

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.

Figure 1 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%.

Figure 1. Greenhouse gas emissions in the EU by sector in 2017

Source: CEE

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 impact of climate change from the perspective of reducing greenhouse gas emissions.

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.

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. To estimate all greenhouse gas exchanges, 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 CO₂ emissions from the soil should be taken into account.

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 ground water pollution. Depending on the local specificity, this danger should always be taken into account when applying organic fertilizers in such high risk areas.

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 calculation method regarding the contribution of nitrogen from organic sources is important for the assessment of greenhouse gas emissions from agricultural activities.

The nitrogen in the soil is found, almost entirely, in the organic matter, and only a small fraction of it is in an immediately assimilable form for plants.

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. Typically, soil organic matter is made up of fractions that differ by the value of the C / N ratio (carbon: nitrogen).

When estimating the level of the planned (planned) crops, the climatic characteristics of the place (in particular the thermal regime and the precipitation, including their annual distribution) must be taken into consideration, considering that they are decisive in the dynamics of the fertilizing elements in the soil and in particular in mineralization of organic matter and in the movement of nutrients in the soil profile, under the rooting zone.

It is undeniable that nitrate losses from the soil are more intense in the seasons with more abundant rainfall, when, as a rule, the soil is deprived of vegetation. Under the specific conditions of our country, after the annual crops, more or less quantities of mineral nitrogen from the previous fertilization remain (about 50% of the applied nitrogen remains unconsumed by the crops) and from the mineralization of the organic matter from the soil. Mineralization is more intense in autumn, when favorable conditions of temperature and humidity are encountered and when there is also an increased risk of nitrate water pollution. In counteracting this phenomenon, crop rotation plays an essential role. It is recommended to rotate with the main crop a crop with rapid growth, capable of harnessing the residual nitrogen and that in spring can be used as green fertilizer for spring-summer culture. The main evolution factor towards mineral forms of nitrogen is the ratio between carbon and nitrogen in fertilizer (C / N). It may be more or less high and conditions the rate of mineralization. The transition from the organic to the mineral (ammoniacal or nitric) form depends on the value of the C / N ratio. It is difficult to estimate with minimum rigor what quantities of nitrogen or other nutrients from the previous crops can be taken into account in calculating fertilizer doses.

Table 3. The level of nutrients according to crops

Nr.crt	Specification of crops	N	P ₂ O ₅	K ₂ O
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

Table 3 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.

PICBE | 702

Figure 2. Specification of crops

Legend: Nitrogen (N), Phosphorus (P2O5), Potassium (K2O)

Source: INSSE

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 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. Typically, soil organic matter is made up of fractions that differ by the value of the C / N ratio (carbon: nitrogen). The fraction, with the value of the C / N ratio of order 8-11, called humus, is a stable fraction, which has reached equilibrium and therefore decomposes more slowly; other fractions with higher values of this ratio are decomposed faster than humus by soil microorganisms, whose activity is more or less intense,

depending on the temperature and humidity conditions. For soil conditions in Romania it represents between 1 and 2% of total nitrogen, both in soils.

Nitrate losses in the form of nitrates, with surface run off and percolation water, are the main diffuse pollutant of the aquatic environment, arising from agricultural activities.

The nitrogen in the soil is found, almost entirely, in the organic matter, and only a small fraction of it is in an immediately assimilable form for plants. 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.

The prohibition periods for applying fertilizers on the ground are defined by the time interval when the average air temperature drops below 5°C. 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 P₂O₅ 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.

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_2O) $\times$ 0.742;

(d) sulfur (S) = sulfuric anhydride (SO_3) $\times$ 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 $\text{pH} < 6.5$;

- neutral soils with $\text{pH} = 6.5 - 7.5$;
- alkaline soils with $\text{pH} > 7.5$.

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.

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 cyclical 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.

Methodology

The achievement of the objectives set in this research 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 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.

Results and discussions

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. Adapting to climate change is not just a challenge and a condition that, in the long term, new methods will be developed, planning new agricultural techniques more environmentally friendly to be applied by farmers in increasing numbers. 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.

Conclusion

Whether agriculture can contribute to reducing greenhouse gas emissions remains a question. That is why scientific research has shown that by achieving a successful management, adaptable solutions can be identified in practice on areas of interest, depending on the quality of the soil from the geographical environment. It is known that research and innovation activities and consultancy services can help farmers to adopt production systems that best meet local characteristics.

Regarding land use changes and land management, research has revealed that there are uncertainties in the levels of carbon stock changes due to variations in local conditions and lack of reliable land data (Borjesson and Tufvesson, 2011). It is also a constant concern and concern of the research regarding the fact that at present, there is nothing common in the standard procedure for the accounting of carbon in soil (Arzoumanidis et al., 2014; Brand et al., 2013; Petersen et al., 2013).

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.

References

- Andrei, T., Stancu, S., Iacob, A. I., & Tusa, E. (2008). *Introduction to econometrics using EViews*. Bucharest: Editura Economica.
- Communication from the Commission Europe 2020 A strategy for smart, Sustainable and inclusive growth, Brussels, 3.3.2010 COM (2010) 2020 Available at: http://europa.eu/press_room/pdf/
- Directive 96 / 61 / EC, dated September 24, 1996 concerning the integrated prevention and control of pollution. Available at www.eur-lex.europa.eu.
- Comănescu, M., 2010: Increasing environmental responsibility, *Journal of Theoretical and Applied Economics*, Volume XVII (2010), No. 5 (546), 39-52.
- Duțu, M. (2008). *Urban planning law*, Ed. Univers Law, Bucharest
- EViews, User Guide, Version 7.0 QMS Quantitative Micro Software, Irvine, California, pp.140-141, 2010.
- LUCARELLI Sonia and Ian MANNERS (2006): *Values and Principles in EU*, Routledge 2 Park Square, Milton Park, Abingdon, Oxon;

Romania's National Strategy for Sustainable Development 2013-2020-2030 Available; www.anpm.ro (EC) Regulation no. 614/2007, dated May 23 2007 concerning the Financial Instrument for the Environment. Available at: www.eur-lex.europa.eu;

SCHEUER, Stefan (2005): EU Environmental Policy Handbook. A Critical Analysis of EU Environmental Legislation. Making it accessible to environmentalists and decision makers, Brussels: European Environmental Bureau;

. Wallace, Helen, William WALLACE & Mark Pollack (2005) Policymaking in the European Union, Publisher European Institute of Romania, Bucharest;

http://mmediu.ro/new/?PAGE_ID=81; Report on the implementation of environmental policies – Romania-EU, Brussels, 2017 European Commission Flash Eurobarometer 426 2015. "SMEs, resource efficiency and green markets)

https://data.europa.eu/euodp/en/data/dataset/S2088_426_ENG European Commission, 2015. Tax reforms in EU Member States – in 2015, 008 institutional document 008 dated September 2015, p. 68.

www.insse.ro

<http://ec.europa.eu/eurostat/data/database>

Adevale, C., Reganold, J. P., Higgins, S., Evans, R. D., & Carpenter-Boggs, L. (2019). Agricultural carbon footprint is farm specific: Case study of two organic farms. *Journal of Cleaner Production*, 229, 795-805.

Andrei, J. V., Dusmanescu, D., & Mieila, M. (2015). The influences of the cultural models on agricultural production structures in Romania and some EU-28 countries-a perspective. *Economics of Agriculture*, 62(297-2016-3679), 293-307.

Aznar-Sánchez, J. A., Piquer-Rodríguez, M., Velasco-Muñoz, J. F., & Manzano-Agugliaro, F. (2019). Worldwide research trends on sustainable land use in agriculture. *Land Use Policy*, 87, 104069.

CES.(2008). Avizul Ccomitetului Economic și Social European privind relația dintre schimbările climatice și agricultură în Europa, NAT/384 Schimbările climatice și agricultura în Europa Comitetul Economic și Social European, Bruxelles, 9 iulie 2008.

Huang, J., Chen, Y., Pan, J., Liu, W., Yang, G., Xiao, X., ... & Zhou, L. (2019). Carbon footprint of different agricultural systems in China estimated by different evaluation metrics. *Journal of Cleaner Production*, 225, 939-948.

Ramírez, P. B., Calderón, F. J., Fonte, S. J., & Bonilla, C. A. (2019). Environmental controls and long-term changes on carbon stocks under agricultural lands. *Soil and Tillage Research*, 186, 310-321.

Westhoek, H., Van Zeijts, H., Witmer, M., Van den Berg, M., Overmars, K., Van der Esch, S., & Van der Bilt, W. (2014). Greening the CAP. An analysis of the effects of the European Commission's proposals for the Common Agricultural Policy, 2020.

Yadav, D., & Wang, J. (2017). Modelling carbon dioxide emissions from agricultural soils in Canada. *Environmental Pollution*, 230, 1040-1049.

Zhang, N., Zhang, G., & Li, Y. (2017). Does major agriculture production zone have higher carbon efficiency and abatement cost under climate change mitigation. *Ecological Indicators*.

Agovino, M., Casaccia, M., Ciommi, M., Ferrara, M., & Marchesano, K. (2019). Agriculture, climate change and sustainability: The case of EU-28. *Ecological Indicators*, 105, 525-543.