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RESEARCH OF CO_2 EMISSIONS IN THE REPUBLIC OF MOLDOVA AND IN SOIL UNDER DIFFERENT FIELD CROPS

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Abstract

The research object of this study is the agricultural soils of the Republic of Moldova. From an economic point of view, they are attributed to the field of phytotechnics and soil resources in the agricultural economic sector. Greenhouse gas emissions (GHGE) from agriculture have three major sources of origin: enteric fermentation, manure management (both in the livestock sector) and agricultural soils (in the sector of plant and soil resources). The 2010 year was determined as the reference year for projections of CO_2 emissions/seizures from agricultural soils in the Republic of Moldova. For modelling future emissions, the results of national inventory of GHG emissions for 1990-2012 were used as a basis. The projections of CO_2 emissions from groundwater were developed for 2015, 2020, 2025 and 2030 after some scenarios (IPCC, 2016). With respect to green fertilizers (autumn vetch as an intermediate crop), the following basic parameters were taken into account: average green weight - 80%; average nitrogen content in the green mass - 0.8%; average productivity - 20 t/ha; 1.4 (or, in other words, 1 tonne of green lemon meal equivalent to 1.4 tonnes of manure). It is planned to sow autumn meadows as an intermediate crop used as a green fertilizer, and crop rotation will be as follows: autumn wheat or autumn barley - vetch as intermediate crop - corn or sunflower. The introduction of intermediate crops as a green fertilizer will be carried out in parallel with the implementation of the farming conservative system ("No-Till" and "Mini-Till"). Changing the use of agricultural land and soil management practices can greatly influence the organic carbon reserves in the soil. Carbon of organic origin and nitrogen are closely related to the organic matter (humus) content of the soil. Carbon leakage through the oxidation process due to land use changes and soil management practices are accompanied by the co-mineralization (biochemical decomposition) of the humus nitrogen. In the case of soil carbon losses, mineralized nitrogen is considered as an additional source of nitrogen available to convert to direct GHG emissions.

Key words: *crop rotation, greenhouse gas emissions, soil carbon leakage, Republic of Moldova.*

INTRODUCTION

The carbon cycle has a decisive role in the global changes in the environment with which the rest of the cycles are closely linked, as well as the climate-dependent climate change.

The carbon cycle in terrestrial systems is determined by the balance between the carbon dioxide stored in the vegetal carbon and the amount of CO_2 emitted mainly through the respiration process of the soils. Soil respiration is the most important source of CO_2 and other greenhouse gases. This can be illustrated by the fact that only 10% of total CO_2 emissions are responsible for industrial CO_2 emissions, while the rest of the bio-systems, with the predominance of soils, is 90% (Заварзин, 1993).

Organic matter, stored in humus and dead biomass in the planet's soils, contains three times as much carbon as all terrestrial vegetation (Sundquist, 1993). Each year soil releases 4-5% of its carbon in the atmosphere by transforming organic matter into CO_2 and other compounds due to biochemical mineralization processes.

Soil utilization and exploitation in agriculture contributes to accelerating processes of decomposition of accumulated organic matter and consequently to carbon loss. This process has a universal character and occurs at increased rhythms, especially in the early years after land reclamation. The soils of Canada after 100 years of exploitation lost 25% of the original carbon (Jauzen et al., 1998).

This phenomenon is characteristic for other countries as well as for the Republic of Moldova. Research carried out by various authors has shown that chernozems of Moldova 100 years after recovery have lost as much as 25% of the CO_2 - accumulated carbon dioxide (Крупеников, 1967, 1989; Загорча, 1990) as well as Canada's soils. It is obvious that human activity related to the exploitation of fertility contributes to a large extent to the wider opening of the most important carbon deposits on the terrestrial surface, represented by the organic matter of the soils. Changes that take place in the carbon circuit under the influence of human activity have many aspects, including the greenhouse effect.

The United Nations Framework Convention on Climate Change only takes into account climatic changes that are directly or indirectly conditioned by human activity through global changes in the atmosphere. From this point of view, the appreciation of CO_2 emissions in agricultural land is of particular importance due to the enormous amount of carbon stored in the humus of the soils that undergo the essential transformation under the anthropic factor.

To achieve this goal, it is important to make a clear target of total CO_2 emissions from soils resulting from soil respiration and emissions that contribute to climate change by increasing the CO_2 content in the atmosphere. Here, it must be taken into account that the soils cover is an open thermodynamic unit, the balance of which is determined by the amount of accumulated indoor energy, the trophic links in the soils and the biogenetic circuit. The dominant factor determining the functioning of this system is the carbon flux.

In steady state, the amount of carbon released from the soil through ”output” CO_2 emissions is equal to the amount of carbon (stored) "input" carbon. In cases where the "entry" becomes steadily less than the "exit", the soil balance deterioration occurs resulting in its degradation and fertility decrease. The amount of carbon captured (deposited) in the soil ”input” depends on the mass of organic matter produced by photosynthesis, and the amount of carbon lost "output" is determined by the intensity of respiration of the soil biota.

The dynamics of input and CO_2 emissions in soils changes according to external factors such as temperature, humidity, biogenic ratio, environmental response, etc. External factors change your microbiological activity level, but initially the value of this process is actually a function of the amount of carbon entering the soil.

Soils of natural phytocoenoses are characterized by a high bioenergetic level and are still in a steady state due to equal amounts of organic matter consumed and entrained. Therefore, CO_2 emissions from soils occupied by natural phytocoenoses are compensated for by carbon stored in the soil as a result of biochemical processes of humming of dead vegetation.

This is very important for the correct assessment of the changes in human activity in the balance established in the untapped natural soils and the consequences related to the greenhouse phenomenon.

Multiple researches carried out abroad and in the Republic of Moldova found that the exploit-tation and exploitation of soils in agriculture necessarily lead to the gradual decrease of the microbiological activity of the soils and consequently to the reduction of the CO_2 emissions from the agricultural lands (Бабьева et al., 1989; Лебедев, 1988; Cornfield, 1961; Herrmann, 1993; Witkamp, 1966; Мехтиев, 1961, 1963; Маринеску, 1992).

Based on this postulate, in fairly frequent cases, wrong conclusions are made regarding the contribution of agricultural land to the greenhouse effect. The error lies in the fact that the demining of CO_2 emissions from soils harvested in relation to those covered with natural vegetal carpet is interpreted directly, without taking into account the second part of the carbon circuit - the quantity returned to the soil “input”.

Due to the fact that the “input” of carbon into the soil with vegetal residues is affected from a qualitative and quantitative point of view in a much larger proportion of the land, a negative carbon balance is established.

Namely, the value of the CO_2 balance in arable soils considered their contribution to the increase in the atmosphere of this gas and its contribution to the phenomenon called greenhouse effect.

MATERIALS AND METHODS

Until now, no valid method has been developed to determine greenhouse-gas emissions from arable land that could be applied on large areas. Research carried out in the Republic of Moldova and other countries determined that the CO_2 emissions in the soils used are 2.0-2.5 times lower than those covered with natural vegetation.

Hence, agricultural land, unlike land with natural vegetation, is characterized by a negative carbon footprint, which is why it can be seen as a source of CO_2 with the contribution to greenhouse effect and climate change.

Measuring CO_2 emissions from agricultural soils that lead to anthropogenic interference in the atmosphere is of particular importance for predicting climate change in view of the enormous amount of carbon stored in the organic matter of the soils.

From a methodological point of view, this is very difficult because the carbon circuit in agrofitocenoses is influenced by multiple natural and anthropogenic factors, often very variable in space and time.

In the country and abroad literature, a large amount of data on soil respiration has accumulated according to the most diverse natural and anthropogenic factors, but there is virtually no research that would highlight carbon emissions that remain uncompensated.

Here we have to mention that a universal method in this sense usable for all possible cases cannot be elaborated because the factors that influence the carbon circuit are multiples and quite frequently have a regional or even local character.

On a major scale the problem is reduced to solving two main tasks. The first is to give a satisfactory assessment of soil carbon losses over a certain period of time, and the second is to determine the amount of carbon returned to the soil within the same time limits.

The end result of the processes that influence the carbon circuit is reflected in the changes in soil humus content over time and also gives the answer to the question of greenhouse gas emissions. It is also worth mentioning that changes in humus in the ground where carbon is deposited are slow, that the changes produced can be measured significantly with a long period of time (5-10 years). An additional problem in this respect is the natural variation of the organic substance in the soil cover, which often exceeds the changes found in periodically harvested samples.

The extensive use of the method based on direct assessments of carbon content change in soils for the purpose of measuring greenhouse gas emissions is limited by two key factors. The results obtained are valid only for areas with uniform soil cover. Large areas (the arable land area of a country) would require an enormous number of such measurements, which is impossible for economic reasons even for well-developed countries.

The method is similarly appreciated by Canadian researchers, although this country has a network of 15 000 polygons that carries out carbon monitoring in soils (Jauzen et al., 1998).

The possibility of using the nitrogen exported from the soil to the agricultural plants for the appreciation of the humus consumed was based on the academic I.V. Tiurin (Тюрин, 1965), then the idea was concretized by A.M. Lâcov (Лыков, 1979). Consideration has been given to the close link between CO_2 emissions and the amount of nitrogen released from soils as a result of the biochemical decomposition of organic matter. The content of carbon and nitrogen in humus is stable, with slight variations within the pedogeographic areas. In the soils of Moldova, the ratio of carbon and nitrogen in humus is equal to 10.7, ranging from 10.1 to 11.3 (Крупеников, 1967; Крупеников et al., 1984). This ratio is characteristic of the upper soil layer and slightly decreases to greater depths.

The elaborated methodology follows the purpose of assessing the greenhouse gas emissions from agrofitocenoses taking into account the agricultural lands of the Republic of Moldova. Data from the universal and local scientific literature, including recent information (Rusu et al., 2005; Унгурян et al., 1997; Боинчан, 1999), were used in the development.

The field works were carried out according to the methodology of pedological field research.Laboratory analyzes were performed according to classic methods and GOST.

The carbon balance is determined for the area occupied by each crop.

$$B \pm = (V - C) * S \qquad (1)$$

B - carbon balance;

V - carbon entering the soil by humification of vegetable residues and organic fertilizers;

C - carbon released from the soil through CO_2 emissions as a result of humus mineralization;

S - the area occupied by the crop, ha.

The amount of carbon entering the soil (V) is determined according to the equation:

$$V = V1 + V2 \qquad (2)$$

V1 - carbon entering the soil with vegetal remains;
V2 - carbon entering the soil with organic fertilizers.
The amount of carbon entering the soil with vegetal debris (V1) is equal to the result obtained from the multiplication of the basic crop with the accumulation and humification coefficients of the vegetable residues divided by the coefficient of 1.724 for the transition from humus to carbon. For this purpose, the data in the annex is used.
The amount of carbon entering the soil with the applied organic fertilizers (V2) is equal to the result obtained from the multiplication of the dose with the respective humification coefficient (appendix) and divided by the coefficient 1.724 for humus to carbon.
The sum of the results (V1 + V2) considered your carbon bound (entrained) by the soil into humus (V).
The amount of carbon released from the soil is estimated by the equation:

$$C = [Er - (Em+Eo+ Ev+ Es)]\cdot r_1 \cdot r_2 \cdot 10.7 \qquad (3)$$

Er - the amount of nitrogen exported with the crop production (main and secondary) is determined by multiplying the main crop of the crop by that coefficient in the Annex;
Em - the amount of nitrogen exported from the chemical fertilizer account. It shall be determined taking into account the amount of fertilizer applied, the nitrogen content of the fertilizer and the nitrogen content of the fertilizer (Annex);
Eo - the amount of nitrogen exported from organic fertilizers. Determine in the same way as nitrogen from chemical fertilizers, using the appropriate information in the Annex;
Ev - the amount of nitrogen used in plant debris. It is determined, taking into account the calculated mass of vegetable residues, the nitrogen content of the vegetal debris and the coefficient of its use (Annex);
Es - the amount of symbiotic nitrogen exported from the soil. Depending on the harvest, the nitrogen fixation coefficient and its use for harvesting shall be determined in accordance with the Annex;
r_1 - the coefficient expressing the dependence of humus mineralization on the soil granulometric composition (appendix);
r_2 - the coefficient expressing the dependence of the cultivation of humus mineralization (appendix);
10.7 - the nitrogen passage in carbon.

RESULTS AND DISCUSSIONS

The imbalance in agrofitocenoses between soil mineralization processes and those responsible for the synthesis of humus is well demonstrated by the data presented in the fundamental work "The Basics of Soil Science", the author of which is V.A. Covda (Ковда, 1973). In natural steppe phytocoenoses annual phytomasium production accumulates 10 t/ha of carbon, of which 1.04 t/ha is stored in soil humus as a result of humification processes. In agrofitocenoses, the amount of carbon in the crop production reaches only 2 t/ha, of which 0.16 t ha is stored in humus. The author believes that under specific conditions these data may vary widely, but the difference between natural and agricultural phytocoenoses regarding the ratio between loss and accumulation of carbon in the soil is preserved. The annual amount of carbon stored in the humus "input" in natural phytocoenoses is 6.5 times higher than agrofitocenoses.
In soil, along with the processes of organic matter mineralization and CO_2 release, the synthesis processes take place with its storage in humus. Changes in carbon content over time (difference between initial and final concentrations) is the balance of the carbon content for that time period.
The balanced balance (without change) is evidence of a lack of greenhouse gas emissions as well as a positive balance showing that the soil has accumulated more carbon than it lost through CO_2 emissions.
The negative (carbon footprint) in the measured soil considered the contribution of the soil to greenhouse emissions.
In Tables 1 and 2, prospects for nitrogen, organic and green chemical fertilizers (sidereal crops) are submitted to 2030.
In the case of SLB, the prospecting was carried out on the basis of the information available in the New Land Recovery and Soil Fertilization

Program (Part II: Increasing Soil Fertility). For MS, the prospecting was based on the Soil Fertility Conservation and Enhancement Program for 2011-2020, the National Development Strategy “Moldova 2020” and the National Strategy for Agricultural and Rural Development for the years 2014-2020. With reference to SMA, the recommendations of good practices on sustainable development of the agricultural sector as well as the draft version of Moldova's low-emission development strategy were taken into account until 2020 (Cerbari et al., 2010; 2012).

Table 1. Prospects regarding the application of natural nitrogen and organic chemical fertilizers in the Republic of Moldova in the period 1990-2030, thousands tons N

Name	1990	1995	2000	2005	2010	2011	2012	2015	2020	2025	2030
	SLB (baseline scenario)										
Chemical fertilizers, nitrated, FSN	92.10	10.51	10.24	16.10	20.63	24.99	34.05	55.00	59.40	90.00	99.90
Natural organic fertilizers, FON	54.54	9.96	0.47	0.25	0.10	0.18	0.13	0.28	0.84	2.52	4.20
	SM (scenario with measures)										
Chemical nitrate fertilizers, FSN	92.10	10.51	10.24	16.10	20.63	24.99	34.05	45.00	49.50	77.50	86.00
Natural organic fertilizers, FON	54.54	9.96	0.47	0.25	0.10	0.18	0.13	0.49	1.68	5.04	10.08
	SMA (scenario with additional measures)										
Chemical nitrate fertilizers, FSN	92.10	10.51	10.24	16.10	20.63	24.99	34.05	37.50	42.50	70.00	80.00
Natural organic fertilizers, FON	54.54	9.96	0.47	0.25	0.10	0.18	0.13	0.56	2.52	6.72	11.76

Table 2. Prospecting for Green Fertilizer Applications in the Republic of Moldova 1990-2030, thousands tons N

Name	1990	1995	2000	2005	2010	2011	2012	2015	2020	2025	2030
	SLB (baseline scenario)										
Areas where green fertilizers will be applied - autumn vetch, thousands of ha	0	0	0	0	0	0	0	0	25	50	75
Ground green vetch embedded in the soil, thousands of tons	0	0	0	0	0	0	0	0	500	1000	1500
Green fertilizers transferred to equivalent organic fertilizers, thousands of tons	0	0	0	0	0	0	0	0	700	1400	2100
Green fertilizers – F SIDERAL thousands of tons N	0	0	0	0	0	0	0	0	3.92	7.84	11.76
	SM (scenario with measures)										
Areas where green fertilizers will be applied - autumn vetch, thousands of ha	0	0	0	0	0	0	0	25	50	75	100
Ground green vetch embedded in the soil, thousands of tons	0	0	0	0	0	0	0	500	1000	1500	2000
Green fertilizers transferred to equivalent organic fertilizers, thousands of tons	0	0	0	0	0	0	0	700	1400	2100	2800
Green fertilizers – F SIDERAL thousands of tons N	0	0	0	0	0	0	0	3.92	7.84	11.76	15.68
	SMA (scenario with additional measures)										
Areas where green fertilizers will be applied - autumn vetch, thousands of ha	0	0	0	0	0	0	0	50	75	100	150
Ground green vetch embedded in the soil, thousands of tons	0	0	0	0	0	0	0	1000	1500	2000	3000
Green fertilizers transferred to equivalent organic fertilizers, thousands of tons	0	0	0	0	0	0	0	1400	2100	2800	4200
Green fertilizers – F SIDERAL thousands of tons N	0	0	0	0	0	0	0	7.84	11.76	15.68	23.52

With respect to green fertilizers (autumn vetch as an intermediate crop), the following basic parameters were taken into account: average green weight - 80%; average nitrogen content in the green mass - 0.8%; average productivity - 20 t/ha; 1.4 (or, in other words, 1 ton of green lemon meal equivalent to 1.4 tons of manure).

It is planned to sow autumn meadows as an intermediate crop used as a green fertilizer, and crop rotation will be as follows: autumn wheat or autumn barley - vetch as intermediate crop - corn or sunflower.

The introduction of intermediate crops as a green fertilizer will be carried out in parallel with the implementation of the farming conservative system ("No-Till" and "Mini-Till").

Table 3 presents the prospecting on the areas where the agricultural conservative systems will be applied in the Republic until the year 2030 in Moldova (Cerbari et al., 2010; 2012; IPCC, 2006).

We plan to perform the following tasks: sowing in April of the basic crop (corn or sunflower); determination of changes in the characteristics of the arable layer as a result of the incorporation into the soil of two vines (June); appreciation of crop harvest of basic crops; the appreciation of changes in soil characteristics after harvesting the first basic crop; calculating the carbon balance in the soil after the first basic crop.

In case of extension of the project during the next years, the research polygon will ensure the planned crop rotation: bushy vines → maize → autumn wheat → autumn barley → sunflower.

Under these systems all plant residues from the basic crop are to remain in the field for mulching (Cerbari, 2010). The area of implementation of the agricultural conservative system is expected to be twice as high as the area of the intermediate crops, as they only resemble the grain crops of autumn (wheat and barley) and in the second year after the incorporation of the broom into soil as green fertilizers, these areas will again be used in the farming conservative system, already under the crops of sunflower and corn.

Table 3. Prospects for the application of nitrogen fertilizers in the Republic of Moldova in the period 1990-2030, thousands tons N

Name	1990	1995	2000	2005	2010	2011	2012	2015	2020	2025	2030
	SLB (baseline scenario)										
Areas where agricultural conservative systems will be applied, thousands ha, including:	0	0	0	0	0	0	0	0	50	100	200
wheat autumn	0	0	0	0	0	0	0	0	20	40	70
autumn barley	0	0	0	0	0	0	0	0	5	10	30
maize	0	0	0	0	0	0	0	0	20	40	70
sunflower	0	0	0	0	0	0	0	0	5	10	30
	SM (scenario with measures)										
Areas where agricultural conservative systems will be applied, thousands ha, including:	0	0	0	0	0	0	0	50	100	200	300
wheat autumn	0	0	0	0	0	0	0	20	40	70	90
autumn barley	0	0	0	0	0	0	0	5	10	30	60
maize	0	0	0	0	0	0	0	20	40	70	90
sunflower	0	0	0	0	0	0	0	5	10	30	60
	SMA (scenario with additional measures)										
Areas where agricultural conservative systems will be applied, thousands ha, including:	0	0	0	0	0	0	0	100	200	300	400
wheat autumn	0	0	0	0	0	0	0	40	70	90	120
autumn barley	0	0	0	0	0	0	0	10	30	60	80
Maize	0	0	0	0	0	0	0	40	70	90	120
Sunflower	0	0	0	0	0	0	0	10	30	60	80

In the case of SLB, the prospecting was carried out on the basis of the information available in the Program for Land Reclamation and Soil Fertility Enhancement (Part II: Increasing Soil Fertility), in the "Moldovan Village" National Program (2005-2015), in the National Strategy for Sustainable Development of the Agro-Industrial Complex of the Republic of Moldova (2008-2015). For MS, the prospecting was based on the Soil Fertility Conservation and Enhancement Program for 2011-2020, the National Development Strategy Moldova 2020 and the National Strategy for Agricultural and Rural Development for the years 2014-2020. With reference to SMA, the recommendations of good practices on sustainable development of the agricultural sector as well as the draft version of Moldova's low-emission development strategy were taken into account until 2020.

In spite of all these shortcomings, this method is recognized by most researchers as a benchmark method for checking other less sophisticated methods.

In the Republic of Moldova, 3 rounds of agrochemical cartoons were carried out, covering virtually all arable land with a period of 5 years. However, the data obtained cannot be used to determine carbon balance in soils, and is in many cases contradictory (Andrieș, 1999). The main cause is that the samples were not collected from fixed points and the variability of carbon in the arable layer in many cases exceeded its changes over time.

Therefore, the method of assessing the carbon balance and CO_2 emissions of agricultural land by periodic measurements of soil content cannot provide the desired results at country level. For this purpose, it can be used to verify data obtained by other methods with priorities and shortcomings of another order.

A network of long-lasting field experiences has been established in the Republic of Moldova for the development of advanced cultivation technologies for field crops, which studies the evolution of soil fertility according to various fertilization systems. Experiences are 35-55 years old and cover all the country's pedoclimatic zones. The data on carbon evolution in the main soils can be used for the purpose indicated above.

Another way to measure CO_2 emissions from greenhouse soil would be by measuring carbon dioxide exchange between the vegetation mat and the atmosphere using detectors placed on special stationary towers, or by using mobile means such as aviation. In this case the carbon dioxide shift is determined within the field surface area with one crop or another. The measurements are carried out continuously for several months. The method has been tested in Canada and has been found to be expensive and difficult to use for large areas of land. Another shortcoming mentioned by the authors is related to the impossibility of interpreting the data obtained for a longer period of time.

In recent years, attempts have been made to solve the problem of greenhouse gas emissions from soils by applying various mathematical models using computers. The data obtained in this way are qualified as very approximate and must be compared with direct estimates of the carbon circuit parameters. The advantage of mathematical models is that they can be applied on large surfaces and thus meet the greenhouse gas emission assessment requirements.

Satisfactory results have been obtained by applying the “Century model” model in Canada which has allowed the humic evolution of soils to develop over the course of 100 years (Jauzen et al., 1998). Improving mathematical models along with the quality of the initial data introduced into computers makes it possible to use them more widely in assessing the carbon footprint and greenhouse-gas emissions of agricultural land.

Taking into account the stable ratio of carbon to nitrogen in soil organic matter, and with the export of nitrogen from the soil to the vegetal production (primary and secondary crops) it is possible to calculate the amount of carbon released from the soil simultaneously with the nitrogen, the carbon released from the soil CO_2 emissions.

When making calculations, consider that part of the nitrogen used by the plants may have a different origin than humus. Of those from the total nitrogen exhaust, the nitrogen bound by the leguminous crops, that is used by plants from industrial and organic fertilizers, vegetable debris is reduced. An insignificant amount of nitrogen enters the soil with atmospheric precipitations (7 kg/ha), by nesting (5 kg/ha). The nitrogen coming from these sources corresponds to losses by denitrification and leaching and is not taken into account.

For assessing carbon balance and assessing CO_2 emissions from greenhouse soil, the amount of CO_2 input and land in the soil must be determined with the non-alien plant material and organic fertilizers applied. Other carbon inputs into the soil, such as seed carbon and carbon-bound blue algae, are not considered to be insignificant.

The amount of carbon entering the soil is determined taking into account the humification coefficients of vegetable residues and organic fertilizers, as well as the carbon content in the humus formed.

The difference between ground and inbound carbon (the balance sheet) considered the greenhouse gas emissions in the case of dominating the mineralization processes over the humification.

The principles outlined have been used by several authors to determine the balance of humus in agricultural soils and to develop measures to preserve and increase fertility (Ţurcan et al., 1994; Лыков, 1979; Дьяконова et al., 1984; Дьяконова, 1990; Лозановская *et al*., 1987; Попов et al., 1987). The achievement of satisfactory results is conditioned by the specification of the parameters of the indices used at local and regional level in relation to their variation according to the pedoclimatic factors.

The application of the methodology allows to assess the greenhouse gas emissions of agricultural land with reduced time and financial means. Emissions can be determined for one year and for longer periods of time. With the help of the methodology, the monitoring of CO_2 emissions in soils can be organized, the prognosis of the evolution of this phenomenon and the elaboration of the control measures.

The shortcomings to be taken into account the variability of the coefficients are related to the use for the evaluation of emission (humification of plant residues coefficients for use of nitrogen in fertilizers, fixation of atmospheric nitrogen). These indices need to be specified at the pedagogic and agricultural level.

Given the approximation of the results obtained by applying the calculation method, they should be compared with the data obtained in the long-term experiments by direct estimation of the parameters of the carbon circuit in the agrofitocenoses.

It should be noted that for the conditions of the Republic of Moldova the methodology developed can provide satisfactory results.

CONCLUSIONS

Soils with natural vegetal carpet (natural phytocoenoses) cannot contribute essentially to the greenhouse effect due to a balanced carbon balance.

Soil valorisation leads to deterioration of carbon balance and the dominance of decomposition processes with organic matter compared to humification following the alienation of plant production on the field and the intensification of biological processes. The phenomenon is experiencing increased rhythms especially during the first years of fertility exploitation.

The imbalance that is set in the carbon balance in the soils, along with other consequences, causes the carbon dioxide to rise in the atmosphere.

Measurement of CO_2 emissions contributing to the greenhouse effect can only be achieved through the balance sheet approach taking into account all carbon inputs and outputs of the soil.

Total CO_2 emissions from soils from the breathing process cannot be considered as greenhouse emissions because a considerable part of the carbon lost by respiration returns to the soil with vegetal residues being mobilized by photosynthesis.

Increasing CO_2 emissions from soils exploited in agriculture to natural phytocoenoses can be qualified as anthropogenic contributing factor to the greenhouse effect.

So, the remediation of the quality and the increase of the production capacity of the studied soil is possible only by increasing the flow of organic matter into the arable layer. The use of the vetch as a green fertilizer is an effective way of achieving this genre.

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