Environmental Impact of Conventional Agriculture

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Abstract

In the last decades conventional agriculture has caused the decrease in organic matter content in the soil and the accumulation of toxic compounds, thus affecting soil fertility and health. But the impact is not only felt on soil, one of the main causes of global warming is also intensive chemical fertilisation of agricultural crops. The intensification of conventional agriculture is considered the major factor that influenced the release from the soil into the atmosphere of "greenhouse gases" such as: nitrous oxide (N_20) and methane (CH_4) who are mainly produced by the spreading of animal fertilizers. This paper aims to determine the impact of conventional agriculture through a comparative study between the conventional defining elements of the intensive system and the eco-friendly alternatives in the extensive system, identifying in this way the possibilities to reduce pollution and to strengthen sustainable agriculture.

Key words: conventional agriculture, climate change, greenhouse gases, sustainability.
J.E.L. classification: Q15, Q01, O13

1. Introduction

Global warming and lack of food security are the most discussed subjects worldwide. The main factors that endanger are both soil degradation through intensive use of chemical fertilizers and climate change. In this situation, it is considered that feeding the world population under conditions of over popularization is a major global challenge. This challenge consists in guaranteeing food production and increasing agricultural productivity, but without harming the environment, thus requiring the implementation of sustainable agriculture. The impact of conventional agriculture on environmental resources: soil, water, air, flora and fauna cannot be neglected. The fastest and most intense changes following anthropogenic interventions in agriculture are felt at ground level, but there are direct and indirect consequences on all other environmental resources. The challenge, acceleration and intensification of soil degradation is determined by soil works that although they are used in order to obtain positive changes in physical processes, wanting to highlight the genetic potential of plants, excessive or wrong application leads only to negative effects. Soil works have effects on the physical, biological and chemical environment of the soil. The intensity of soil processing, quantity and method of incorporation of plant residues influence soil water content, temperature and contact between mineral and organic particles.

Another serious consequence that is manifested in conventional agriculture systems is the degradation of surface water quality and depth by accumulating excessive amounts above the permitted limits of chemical compounds. Thus, all possible measures must be taken to prevent such effects, which is one of the reasons for the use of conservative systems. In recent decades, the atmosphere has also deteriorated following an increase in CO_2 concentration in the atmosphere, as a result of intensive soil work accompanied by forest deforestation and burning of plant materials. The present research aims to identifying viable solutions like organic farming and improving

management systems at farm level in order to produce sufficient quantities to cover demand and also to use environmentally friendly ways in order to reduction of pollution and greenhouse gas emissions. In this context observation and comparation was used, we collected data from before entering the EU and after, with a brief presentation of the measures applied collectively among EU states to replace conventional agriculture with the ecological one. Furthermore, we compared conventional agriculture's effects with ecological agriculture.

2. Literature review

The problem of climate change was approached deeply by many, publications contain both observations of the process of change, its scale and pace (Grubb, 2014) as well as global environmental and socio-economic consequences (De Sherbinin, Schiller, & Pulsipher, 2007; EC, 2014; Nachmany, Fankhauser, Setzer, & Averchenkova, 2017). Nachmany et al. summarised the key trends in climate change leigislation, by providing a full report of world's 95 per cent global greenhouse gas emitters The issue of climate change is also widely described in the context of agriculture (Challinor et al., 2014; Prandecki, 2014; Wolkovich et al., 2012).Wolkovich, Cook, Allen at al. demonstrate by doing warming experiments that show changes in leafing and flowering timing, which can be observed on a higher scale in climate changes.

Recent findings show that conventional agriculture is one of the causes for climate change. The climate policy objectives have been presented in the long-term perspective. The objectives laid down for 2050 assume the reduction of basic greenhouse gases emission by 80-95% in relation to 2005 emission. Detailed plans are not yet known but taking into account the arrangements for the period 2021-2030, which assume the ambitious emission reduction of all economic sectors, it must be assumed that the European Union, regardless of the measures taken all over the world, will consistently and decisively strive for reducing greenhouse gases emission. For individual economic sectors, this means a need for new, innovative production solutions and a substantial organisational effort.

3. Research methodology

This paper includes quantitative research methods — Data analysis & Observation by analysing the current situation of conventional agriculture vs. ecological agriculture

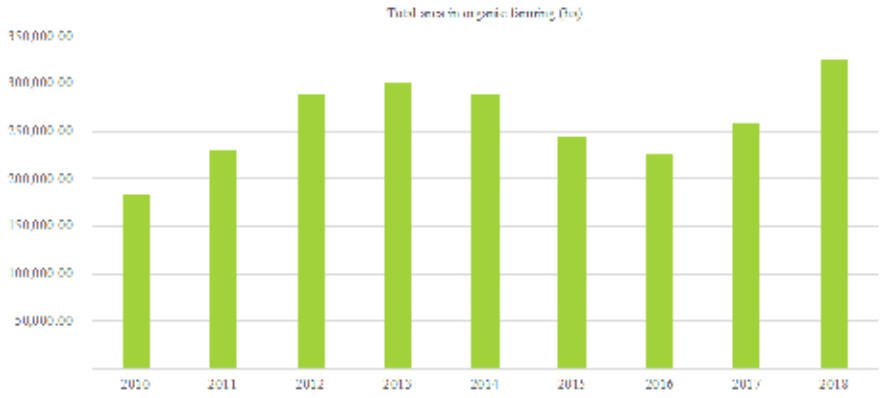
4. Results. The current situation of conventional agriculture vs ecological agricultural

Organic farming is becoming an increasingly important branch in Romania both in terms of demand and supply. Romania has favourable conditions for organic production in terms of natural conditions, soil and climate. Demand for certain products has increased considerably, for example dairy products and baby food. The incentives granted by the Romanian state in recent years, the reduced value added tax for food products, as well as the increase in the minimum wage, have helped Romanian consumers access more premium products.

Romania is a relatively small organic producer in terms of the percentage of land converted or subjected to conversion on organic land and in the percentage of organic sales in total retail sales. The lack of processing facilities forces Romanian organic producers to find export markets, so as to export a large volume of organic production.

In addition, the increase in consumer demand and a limited range of domestic organic products on the Romanian market trigger more imports in terms of both the product quality range and the selection of products.

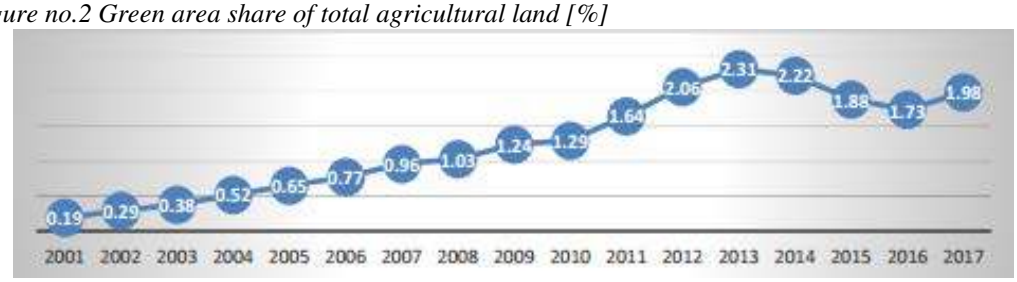
Figure no.1 Dynamics of ecological surfaces



Source : (MADR)

In Romania, during 2000-2017, the areas cultivated by production mode environmentally friendly have increased significantly. The smallest area cultivated in the ecological system was registered in 2000, this being 17,388 hectares and the largest area of was 301,148.08 hectares, value recorded in 2013. Figure 1 shows a continuous growth of ecological areas, which means that Romanians are increasingly interested in practicing organic farming. Compared with 2000, the area cultivated in ecological system increased 18 times in 2013. Since 2007, ecological areas recorded significant increases compared to previous years, the reason being the accession Romania to the European Union.

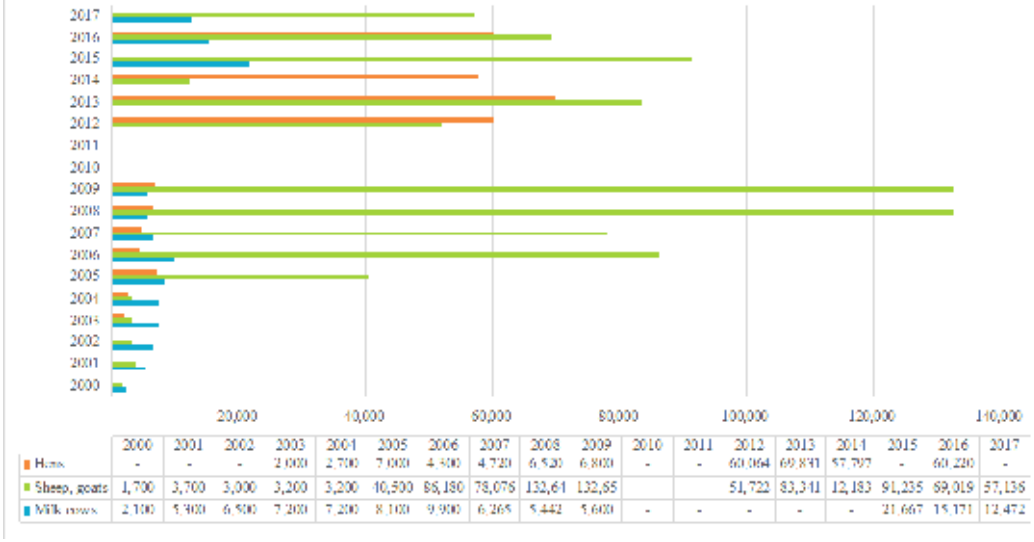
Figure no.2 Green area share of total agricultural land [%]



Source: (FiBL Statistics)

The data in the figure above show a significant difference between the area intended for organic farming and for conventional agriculture which at the level of year 2017 was 258,471 hectares under ecological regime, representing 1.98% of the area total agricultural of the country. Although the difference is large between the two types of agriculture, it is observed that the area used under the ecological regime was constantly increasing in the period 2000-2014, and since 2015 there is a slight decrease in the ecologically cultivated area, reaching below 2% of the total agricultural area. Growth index from year to year of the ecologically cultivated area averaged 1.3. Share of ecologically cultivated area in the total agricultural area of the country is on average 1.2%. The highest share was registered in 2013, when it reached value of 2.31% due to the increase in ecologically cultivated area (301.148.08 hectares, the largest area in 2000-2017)
but also, the decrease in agricultural area from that period.

Figure no.3 Evolution of ecologically reared livestock (thousands of head)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Hens	-	-	-	2 000	2 700	7 000	4 500	4 720	6 520	6 800	-	-	60 064	69 893	57 797	-	60 220	-
Sheep, goats	1,700	3,700	3,000	3,200	3,200	10,500	86,180	78,076	132,61	132,65			51,722	83,341	12,183	91,235	69,019	57,136
Milk cows	2 100	5 300	6 500	7 200	7 200	8 100	9 900	6 265	5 442	5 600	-	-	-	-	-	21 667	15 171	12 472

Source: (Eurostat)

Among the animals raised in the ecological system are: dairy cows in the number of 12,472 head in 2017; sheep and goats with 57,136 head (2017) and laying hens in the number of 60,220 heads in 2016. Sheep and caprine animals have seen a drastic decline from 2010 to the present day, having a maximum in 2009:132,650 heads.

In the case of ecologically reared animals, the highest growth during the period 2000-2017, registered the number of sheep and goats (which increased 78 times in 2010, compared to 2000), followed by dairy cows (12,472 heads in 2017 compared to 2,100 heads in 2000) and laying hens (with an increase of 30.4 in 2016 compared to the year 2003). Once Romania joined the EU, Romania had to adapt to the rules European Union on organic animal husbandry.

5. Food security

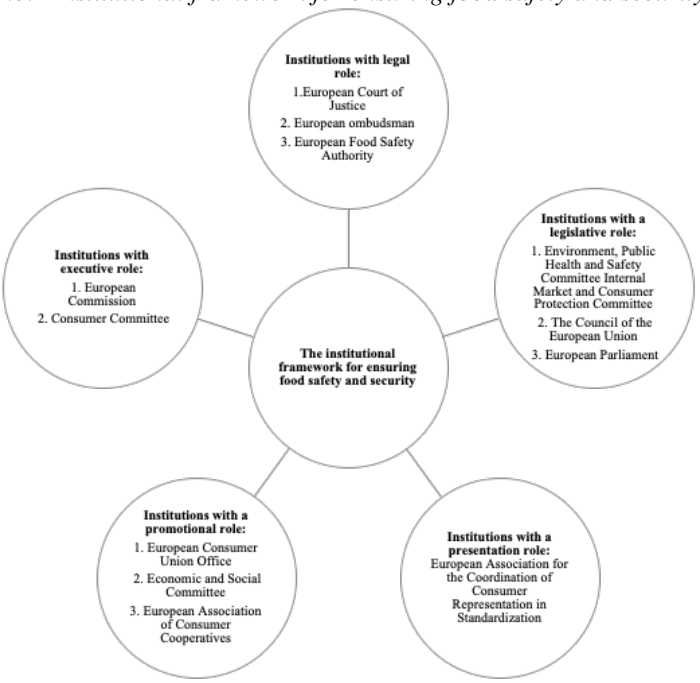
Guaranteeing food security is a vital interest for the world's population and a major requirement for the normal course of international life.

Food security must be achieved in a pyramid structure of national, regional and global measures. The concept of food security falls within the contemporary general concept of security in the sense that, under current conditions, security must be achieved at three levels: national, regional and global. In this respect, achieving food security as a component of economic security must lead to the achievement of three goals:

- ensuring adequate food production;
- modernizing the stability of the supply flow of agricultural products;
- ensuring access to the available agricultural resources of those in need of them, thus achieving the procurement of fundamental food necessary for human health.

Lack of food security can generate, internally, convulsions and social tensions, affecting the physical and mental health of the population and can create states of economic and political instability, and externally it can create various diplomatic, economic or economic pressures. political pressures that have the ultimate effect of deteriorating national security (Constantin Moştoflei, 2009, p15).

Figure no.4 Institutional framework for ensuring food safety and security



Source: Drawn by authors

Food security is often defined in terms of food availability, food access and food utilization (USAID 1995). A cite from USAID document from 1995: Global agriculture currently produces ample calories and nutrients to provide all the world's people healthy and productive lives […] However, food is not distributed equally to regions, countries, households and individuals.... Improved access to food through increased agricultural productivity and incomes-is essential to meet the food needs of the world's growing population.

Food safety is a parameter that concerns the consumer and all parts involved in the production, processing, transport and distribution of food are involved in its insurance. The basis of the preservation of food safety in the EU is professional training, civic education, consciousness and control of state institutions and non-governmental organizations, carried out to the highest standards.

6. Comparative study between ecological and conventional agriculture

Climate change in the current period is already an obvious reality faced by the world's population. Researchers and specialists, as well as concerned entities from related areas of interest seek optimal solutions to cope with these changes, in the sense of finding solutions to adapt to them, respectively solutions to mitigate the adverse effects produced. (MacRae R.J. et al 1989, p173-219)

In this context, explanations are also sought as to the causes that caused these climate change. Agriculture is the sector that 'benefits' from the effects of environmental changes and has, to some extent, contributed to their production.

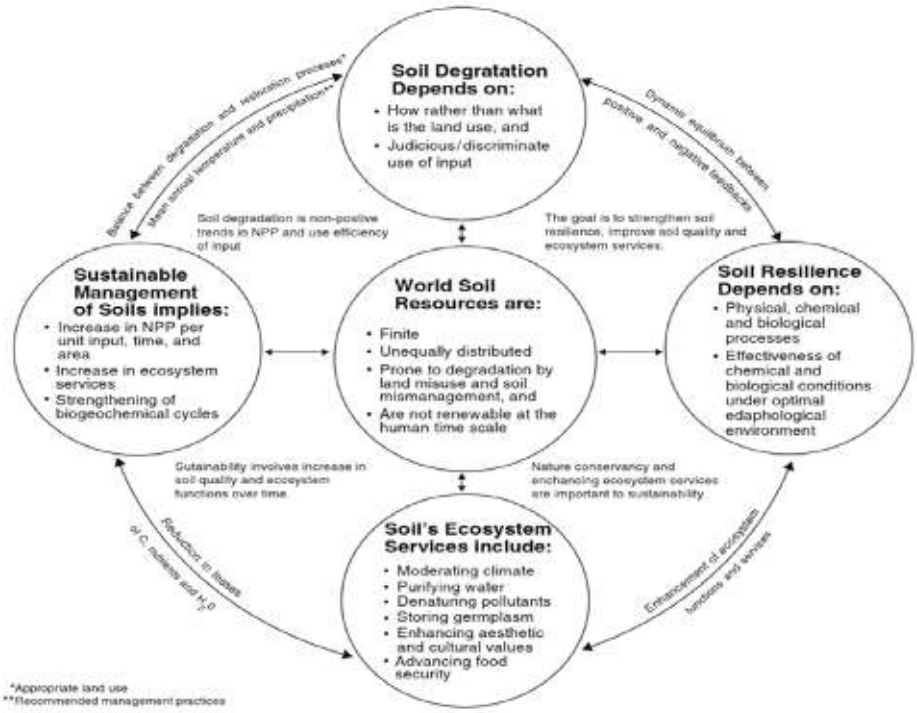
Thus, the way of organizing and conducting agricultural processes, the irrational or without predetermined limits exploitation of natural resources, the lack of logical coordination of the activities involved in the development of human society and civilization have led, over time, to the strong degradation of the environment.

This results in phenomena with visible effects such as: decrease of soil fertility, diminishing the resistance of plants, animals and humans to diseases and pests, pollution of water and air with harmful substances resulting from industrial or zootechnical activities, changes significant climate. Chemical agriculture, that has been practiced for 50-70 years is subject to drastic changes in the near future and has caused, particularly, serious consequences for the environment: its pollution by chemicals and alteration of natural biogeochemical cycles. In this context, organic farming aims to

remove all the shortcomings and not to further cause damages to the environment. It is also intended to ensure that agricultural techniques are applied in close interdependence with environmental factors.

In figure no.5 is shown the connection between practices and processes that contribute to soil degradation:

Figure no.5 Properties, processes and practices that govern soil degradation and resilience



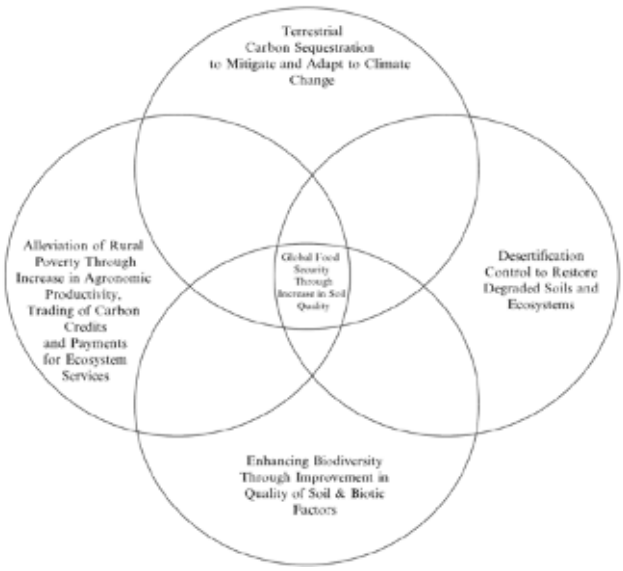
Source: (Eric Lichtfouse et al. 2009, p10)

A significant percentage of conventional food products contain legally excess pesticide residues exceeding maximum residue limits authorised in Europe and the USA. As a result, most people have pesticide residues in their bodies (100% of people tested in the USA), but the level can be drastically reduced by adopting a diet with organic products. Legally defined, ' (MRL) 'are not a 'zero health risk' guarantee, since maximum residue limits established by governments are not always established on the basis of health criteria. For example, in the EU maximum residue limits (expressed in mg/kg) are based on good agricultural practice data (GAP).

Therefore, derived foods that comply with MRL are intended to be toxicologically acceptable. In this case, MRL are only indicators of violation or non-infringement of good agricultural practices and not an indication of health risk.

As can be seen in the Figure 6 the author aims to underline the value of soil quality in attaining food security

Figure no.6 The synergetic interaction between desertification control, biodiversity, climate change mitigation and food security



Source: Eric Lichtfouse et al. 2009, p21

However, a recent study showed that an organic diet provides a dramatic and immediate protective effect against pesticide residues. Organic production is a global system of agricultural and food production that combines best environmental practices with a high level of biodiversity, conservation of natural resources, application of high animal welfare standards and a method of production in in accordance with the preferences of certain consumers for products made from natural substances and processes.

International studies have similarly reported a higher level of contaminants in the conventional system compared to organic plant products. An Italian residue study reported ten times higher contamination in conventional (27%) compared to organic products (2.6%), residues were reported in 8.8% of conventional products and only 0.8% of organic samples.

Data from the USA show that organic foods record consistently, about a third of samples as having residues, compared to conventionally grown foods, which show pesticide residues in 26.7% of samples, respectively 2.6% of the organic system. Organic farming relies primarily on prevention measures and only as a last resort on natural pesticides. Therefore, the application of pesticides is not a habit, as in conventional agriculture. Mineral inputs used in organic farming should contain as few heavy metals as possible.

Due to the lack of an alternative, and because of traditional use in organic farming, copper and copper salts are exceptions for the time being, certification bodies place many restrictions on the use of copper (often limited to 6 kg/ha per year) and/or require that if farmers use copper, then conduct and soil tests to ensure that no toxicity has occurred.

Contrary to what most people think, "environmentally friendly" does not automatically mean *pesticide free*. In fact, according to the laws of most states, farmers are allowed to use a wide variety of chemicals and powders for their crops. This means that these pesticides, if used, must come from natural and not synthetically manufactured sources. These pesticides must also be applied by means of equipment which has not been used to apply other synthetic substances, and the land has not been contaminated with chemicals in the last three years.

Pesticides are classified as organic and conventional pesticides. Organic pesticides are derived from natural sources, and conventional pesticides are man-made chemicals specifically for use as pesticides. Since they are man-made chemicals and are therefore synthetic, pesticides used in conventional agriculture are more likely to have a level of residues that could exceed the maximum residue limits allowed to be in fruit. For example, Folpet or Captan has an MRL of 3 mg/kg in pome fruit, but mancozeb, has MRL of approximately 5 mg/kg. All these substances are used against scab. An alternative to these synthetic substances is fungicides derived from natural

sources, such as copper and sulphur compounds, traditionally used in organic farming against scab and powdery mildew. (Groza et al. 2015).

Organic farming differs fundamentally from conventional agriculture, as the process and technologies for the production of organic products are governed by very strict rules and production principles, which start from the quality that the soil must have to the actual production of the final product. (Eckert et al. 2000, p337-351)

In the practice of organic farming, farmers must have minimal knowledge of this production sector and use only those fertilisers and pesticides that are allowed in organic farming for land fertilisation and crop maintenance (according to HG 917/2001).

Genetically modified organisms and their derivatives are prohibited in organic farming. Organic farming aims to obtain certified organic agri-food products of plant and animal origin, of high quality, in close connection with the environment and to limit the risk of pollution, with the maintenance of soil fertility.

We can mention that there are intentions on the part of agricultural producers, who are aware of the importance of practicing this type of agriculture in order to achieve the following objectives:

- avoiding all forms of pollution both at the level of products and at the level of the environment.
- maintaining the natural fertility of soils, thereby being able to sustainably ensure food security in the world
- production in sufficient quantities and at the appropriate quality level of food
- products on which consumer health depends in support of agricultural associations and farmers of great use is compliance with the Code of Good Agricultural Practices
- a comprehensive document transposed from European legislation

7. Impact of activities in the agricultural sector on the environment

It is known that agriculture has a particular impact on the environment, this impact is primarily due to chemicals that have been synthesized in pesticides, fertilizers, growth stimulators as well as other ancillary products. The sources of pollution whose pollutants are pesticides are found in all three environmental factors – water, air, soil – which ultimately affects the entire food chain. Surface water, like underground water, can be a source of pollution, with the pesticide reaching them quite quickly, especially during the rains.

Their use without complying with the prescriptions for the use of each individual product, the dose and the age of application, has negative consequences on soil, water and plants and implicitly on the consumer.

To avoid pesticide pollution that can have quite severe consequences it is good to take a number of preventive measures such as:

- use only of approved pesticides
- the administration of pesticides is carried out only by approved plant protection units
- training of persons to handle pesticides on how to properly use them and safety and labour protection rules
- carrying out a rigorous control of the administration of pesticides and carrying out laboratory tests with a view to detecting possible pollution
- prohibit the marketing of agri-food products containing pesticide residues above the permitted limits
- prohibition of the application of plant protection substances by aviation in both agriculture and forestry of pesticides in groups I and II of toxicity.

The unreasonable use of chemical fertilizers without taking into account soil and plant requirements can also lead to nitrate pollution of surface and groundwater.

In addition to those mentioned, the mechanisation of agriculture plays a particularly important role from an ecological point of view. By making available by mechanization, the appropriate technical solutions, it becomes possible to practice sustainable agriculture, the maintenance of soil and water from the soil, the maintenance of the global atmosphere and the near environment. The mechanized execution of agricultural works is accompanied at the same time by some negative effects of

different magnitude, these effects are in principle inevitable, but through rational operation of machines and judicious choice of technologies they can be kept at a low level.

8. Findings

Starting from our analysis of the situation before Common Agricultural Policy reform in 2014, where the concept of "greening" was proposed and sustained by spending 30% of direct payments specifically for the improved use of natural resources and if in 2010, only 180,706 ha were ecological cultivated in Romania, this number has increased to 326,259.55 ha in 2018, according to previous data made public by MADR in Figure no.6, which means almost double. After Romanian farmers began receiving financial support for the conversion from conventional to organic farming in 2010, their number has increased significantly from less than 3,000 that year to 9,000 in 2018 and is expected to increase by about 10,000 in the next few years and then it will stabilize.

Figure no.7 Dynamics of operators and areas in organic agriculture

Dynamics of operators and areas in organic agriculture

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total number of operators certified in organic farming	3,155.00	9,705.00	15,544.00	15,194.00	14,470.00	12,231.00	10,562.00	8,434.00	9,006.00
Total area in organic farming (ha)	182,706.00	229,946.00	288,261.00	301,148.00	289,251.79	245,923.90	226,309.00	258,470.93	326,259.55
Cereal total (ha)	72,287.80	79,167.00	105,149.00	109,105.00	102,531.47	81,439.50	75,198.31	84,925.51	114,427.49
Dried legumes and protein crops for the production of grains (including seeds and mixtures of cereals and legumes) (ha)	5,560.22	3,147.36	2,764.04	2,397.34	2,314.43	1,834.35	2,203.78	4,594.66	8,751.13
Total tuberculate and root plants (ha)	504.36	1,074.98	1,124.92	748.75	626.59	667,554.00	707,026.00	665.54	505.66
Industrial crops (ha)	47,815.10	47,879.70	64,788.70	51,770.80	56,145.17	52,583.11	53,396.86	72,388.33	80,193.08
Green harvested plants (ha)	10,325.40	4,788.49	11,082.90	13,184.10	13,493.53	13,676.48	14,280.55	20,350.75	28,253.75
Other crops on arable land (ha)	539.61	851.64	27.77	263.95	29.87	356.22	258.47	88.25	112.79
Fresh vegetables (including melons) and strawberries (ha)	734.32	916.08	896.32	1,067.67	1,938.36	1,210.08	1,175.33	1,458.78	983.10
Permanent crops beef orchards, fruit shrubs, nuts, etc. (ha)	3,093.04	4,166.62	5,781.33	9,401.31	9,438.53	11,117.26	12,019.81	13,165.41	18,569.27
Permanent grassland and grassland crops (ha)	31,579.10	78,197.50	105,836.00	103,702.00	95,684.78	75,853.57	57,611.65	50,685.74	66,890.44
Uncultivated land (ha)	10,216.80	9,758.55	8,810.73	9,514.33	9,058.66	7,225.85	9,457.20	9,747.94	7,572.80

* Eurostat classification

Source: Communications inspection and certification bodies

9. Conclusions

If in 2010, farmers in the organic sector received aid amounting to 2 million euros, this aid increased to 7 million euros for the period 2012-2013. Organic agriculture will continue to receive support under the common agricultural policy 2014-2020 and according to it farmers would need to fulfil certain criteria such as crop diversification, maintenance of permanent pasture, the preservation of environmental reservoirs and landscapes.

Although there is no official information about the size of the organic market in Bucharest, it is estimated that Romanians spent between 50 and 80 million euros on organic products last year, with a growing demand, according to data made public by Bio Romania. Most local consumption is covered by imports, Romania remains a net exporter of organic raw materials, such as cereals and fruits. In the future market observation after UE's regulation is to be followed.

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