

Ecological Agriculture and Impact of Selected Aspects of Agriculture on Environment

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Abstract

The ecological crisis is an issue having impact on every inhabitant of our planet. The climate change and deterioration of the environment constitute the existential threat for Europe as well as the whole world. In 2019 the European Parliament proclaimed the climate emergency and the European Commission prepared subsequently the European Green Deal, which was approved on December 11, 2021. The principal objectives of the Deal are the decrease of fine emissions of greenhouse gases till 2030, at least by 55% in comparison with the year 1990, and also ensuring the economic growth that will not depend on the usage of sources.

The agricultural basic production ranks among the significant contaminators of the environment. It has the negative impact on the environment predominantly by application of pesticides and mineral fertilizers, and also the formation of greenhouse gases. The agricultural production creates approximately 11% of the total formation of emissions, out of it 70% comes from animal production. The ecological agricultural production presents the alternative way of utilization of agricultural soil targeted at the production of healthier foodstuffs and the elimination of harmful impact on environment.

In our paper we analyse the selected indicators of the ecological agriculture in the Slovak Republic. The long-term increase is observed in the area of ecologically cultivated soil and the number of farms of ecological farming. According to the type of areas, we have the most significantly presented the ecologically cultivated permanent grasslands. The numbers of animals kept within the ecological agricultural production vary, depending on the individual species. The application of pesticides is growing from the long-term aspect, however, in the recent evaluated year there was recorded a slight decrease.

Keywords: *agricultural soil, ecological agriculture, mineral fertilizers, pesticides, sustainable agriculture.*

JEL Classification: *Q1, Q5, Q 15*

1. Introduction

Agriculture as one of the sectors of national economy has its irreplaceable role also in the world of the dynamic changes, which is more and more based on the services and information. The significance of agriculture – predominantly in its primary economic perception – is higher in less industrialized countries. However, it does not mean that in the developed countries its importance is lower. In the given cases it is very difficult even dangerous to simplify the significance of agriculture just by quantification and calculation of benefits.

This fact consists mostly in the heterogeneity of functions provided by agriculture, where the economic functions are only ones of many. Agriculture performs mainly the following functions:

- it ensures the production of healthy foodstuffs of high quality,
- it maintains and protects the natural resources and cultural landscape by the appropriate soil cultivation,
- it contributes to the preservation of viable countryside.

All the mentioned functions are related to the problems of the long-lasting sustainability.

In order the agriculture can fulfil these functions, the sector must be economically sustainable, which means it must secure the permanent restoration of its production factors. In so doing, the decisive role is played by the reimbursement of costs of the entrepreneurial entities in the sector of prices of their commodity outputs (agricultural products and services) and also other compensations, as a rule from the public sources, which cover the costs of the non-commodity outputs (e.g. environmental services) that have not been evaluated via the market so far. Therefore, the economic sustainability should be completed necessarily also by the environmental sustainability, without it the assurance of the economic sustainability is not possible.

In this regard the definition of the sustainable agriculture is often related to the ecological agriculture. The ecological agricultural production is the crop production where the special sowing procedures are being used, also green fertilization, the fertilization by organic fertilizers, permitted natural inorganic fertilizers, the mechanical, physical and biological methods for the crop protection, as well as the animal breeding, where only the feeds originated from the ecological plant production are used. A special veterinary care is provided to these farm animals.

The regulations of the ecological agricultural production in the Slovak Republic (SR) are set by the Act No. 282/2020 Col. on the ecological agricultural production which replaced the original Act No. 189/2009. The ecological agriculture is the area of the agricultural production which is developing fast in the EU countries and also in Slovakia. This development is the consequence of the increased consumer demand for biofoodstuffs, and also the reaction to the changes in the protection of environment. From January 1, 2022 the EU has introduced the new norms in this area with the objective to make the legal regulations more efficient for this sector. The new rules for the producers will be included into these regulations that will simplify the transition to the ecological production of the small farmers and support of control system with the effort to build the consumer confidence in the system of the ecological agricultural production (EAP).

The farmers have a significant impact on the environment through their activity. The soil degradation ranks among the negative impacts of the agricultural activities, also the waste production, discharge of waste water and emissions of greenhouse gases. The agricultural soil

and its properties are affected significantly by the usage of pesticides and industrial fertilizers. The alternative forms of soil cultivation strive to eliminate the negative impacts of agricultural activities, the ecological agriculture ranks among those forms.

2. Data and Methods

The objective of the paper is to evaluate and analyse the development of the selected factors of the ecological agricultural production in the Slovak Republic in the period 2012 - 2020. The paper summarizes these indicators and provides a new view of the ecological agriculture, predominantly from the aspect of the participative indicators. The concluding part involves the analysis of the development of the utilization of pesticides and industrial fertilizers in the agriculture of the Slovak Republic.

In the paper the methods of analysis, synthesis, comparison and simple mathematic-statistical methods were applied.

We obtained the relevant data mostly from the secondary sources of the Ministry of Environment, Ministry of Agriculture and Rural development of the SR and Statistical Office of the SR.

3. Results

The development of the selected indicators of the ecological agriculture in the Slovak Republic in the period 2012 – 2020 is given in the Table 1. The table indicates the development of the area of ecologically cultivated soil, its proportion out of the total area of agricultural soil, the number of farms of ecological farming and the average area of these farms. The first three evaluated indicators show the rising trend, but the average area of farms is declining. The area of ecologically cultivated land (including the areas in conversion) has increased from 168, 602 ha to 222,896 ha, which constitutes the growth by 54, 294 ha. Still more significant rise was recorded with the proportion of ecologically cultivated soil out of the total area of agricultural soil. In 2012 in Slovakia 8.43 % of agricultural land was cultivated ecologically, in 2020 the percentage achieved 11.67 % out of the total area, so the growth was 38 %.

Table 1 Development of selected indicators of ecological agriculture

Year	Area of ecologically cultivated land (ha)	Proportion of total agricult. land (%)	Number of farms of ecological agriculture	Average area of farms (ha)
2012	168, 602	8.43	362	465.7
2013	162, 029	8.40	341	475.2
2014	180, 365	9.39	399	452.0
2015	186, 483	9.70	416	448.2
2016	187, 010	9.75	430	434.9
2017	189, 147	9.90	439	430.9
2018	192, 143	10.02	535	359.1

2019	196, 210	10.24	567	346.0
2020	222, 896	11.67	698	319.0
Index 20/12	1.32	1.38	1.93	0.68

Source: Author, according to the data of the Central Control and Testing Institute in Agriculture

The objective is to reach the minimal level of 13.5 % in the SR. This target can be considered to be realistic one. The most significant growth is observed in the number of the farms which are farming according to the principles of the ecological agriculture. In 2020 their number achieved 698, in 2012 there were only 362 farms, which means the rise by 336 farms. In 2012 the average area was 465.7 ha, in 2020 it constituted 319.0 ha (decline by 146.7 ha).

The Table 2 indicates the development of the totally used arable soil and the proportion of arable soil registered in the ecological system of farming in the period 2012 – 2020. We also evaluated the development of grasslands. The area of totally used arable soil decreased by 13,932 ha (1 %). The area of arable soil registered in ecological agricultural production increased from 54, 264 ha to 75,592 ha (growth by 39 %). The arable soil registered in ecological agricultural production constitutes 5.62 % out of the total arable soil. The permanent grasslands (PG) registered in ecological agricultural production achieved a higher proportion out of the total permanent grasslands in the whole evaluated period. In the last evaluated year this proportion reached almost 28 %. The total area of these grounds is relatively stabile. In 2020 it achieved 520,334 ha, it increased by 5,392 ha (1 %) during the whole period.

Table 2 Development of arable soil and permanent grasslands

Year	Used arable soil in total (ha)	Arable soil in EAP (ha)	Arable soil in EAP (%)	PG in total (ha)	PG in EAP (ha)	PG in EAP (%)
2012	1,359,979	54, 264	3.99	514, 942	113, 075	21.96
2013	1,362,002	53, 181	3.90	513, 704	107, 622	20.95
2014	1,359,091	62, 279	4.58	510, 801	116, 528	22.81
2015	1,350,180	60, 890	4.51	520, 581	123, 855	23.79
2016	1,347,293	60, 302	4.47	521, 441	124, 807	23.94
2017	1,342,885	62, 978	4.69	517, 679	124, 230	23.80
2018	1,348,019	64, 821	4.81	523, 552	125, 366	23.95
2019	1,348,919	66, 560	4.93	518, 415	127, 619	24.62
2020	1,346 047	75, 592	5.62	520, 334	145, 209	27.90
Index 20/12	0.99	1.39	1.41	1.01	1.28	1.27

Source: Author, according to the data of Green Deal

The area of ecologically cultivated land according to the type of ground in 2020 is indicated in the Table 1. In the long term the highest proportion belongs to the permanent grasslands, which formed 65.2% out of the total ecologically cultivated agricultural land, followed by arable soil (33.9%) and orchards (0.8%). The area of the ecologically cultivated vineyards was neglectable (0.1%). These data prove that it is the simplest way to cultivate ecologically the permanent grasslands (meadows and pastures). On the other hand, it is very difficult to cultivate ecologically vineyards, and at the same time to achieve the positive result of farming. The same argument is related to the fruit growing. The permanent grasslands in our country are used mostly for sheep breeding, therefore just these animals are bred in the ecological way in the category of farming animals.

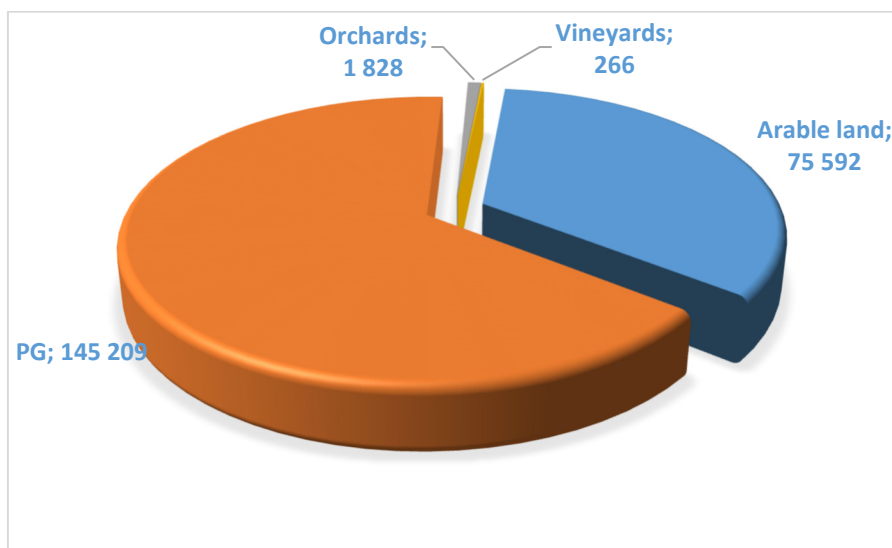


Fig. 1 Agricultural soil registered in EAP in 2020 according to the type of ground (ha)

Source: Author, according to the data of Green Deal 2021

In this part we analyse the selected indicators of the animal husbandry of ecological agricultural production. The animals bred in EAP must have the free range and their natural needs must be taken into consideration. The Table 3 illustrates the development of numbers of the selected species of farming animals registered in EAP in the period 2012 – 2020. The table indicates the numbers of sheep, cattle, poultry, pigs, horses and the total number of animals. It also includes the animals in conversion. The Table 4 shows the percentage representation of the individual categories of farming animals out of the total number of animals of the given category. In spite of the 25% drop in the period of evaluated years, the number of sheep prove the highest proportion in the long term. The numbers of cattle are growing, but the numbers of poultry, goats and horses are decreasing. We monitor the considerable rise in the number of pigs. In 2012 their number in EAP was 146 individuals and in 2020 the number achieved 1,478 individuals. The total numbers of farming animals bred in EAP decreased by 4% from 162, 278 individuals in 2012 to 155, 585 in 2020.

Table 3 Development of number of farming animals according to species bred in EAP (pieces)

Year	Sheep	Cattle	Poultry	Goats	Pigs	Horses	Total
2012	107,327	43,293	8,849	2,052	146	611	162,278
2013	106,713	43,142	8,708	1,979	187	659	161,388
2014	96,976	44,772	8,250	1,005	175	569	151,747
2015	97,239	58,945	4,110	1,527	503	643	162,967
2016	93,596	65,724	5,311	1,429	438	590	167,088
2017	102,000	61,655	4,111	1,349	164	541	169,820
2018	84,912	63,340	5,340	1,419	547	541	156,099
2019	96,955	64,244	6,316	1,814	732	529	170,590
2020	80,978	64,991	6,054	1,619	1,478	565	155,585
Index 20/12	0.75	1.50	0.68	0.79	10.1	0.92	0.96

Source: Author, according to the data of Green Deal and Statistical Office of SR

The proportion of the particular categories of farming animals bred in EAP out of the total number of animals is indicated in the Table 4. During the whole monitored period the highest proportion is evident with sheep. In 2020 this proportion was 31.1%. The growth was recorded also in the numbers of cattle and goats. The proportion of poultry is very low in the long term, however, there was a rise in the last year. The proportion of pigs is similar.

Table 4 Proportion of selected categories of farming animals bred in EAP out of total number of animals (%)

Year	Sheep	Cattle	Poultry	Goats	Pigs	Total
2012	26.2	9.2	0.1	5.9	0.0	8.28
2013	26.7	9.2	0.1	5.6	0.0	8.32
2014	24.8	9.6	0.1	2.9	0.0	7.48
2015	25.5	12.9	0.0	4.2	0.1	8.54
2016	25.4	14.7	0.0	3.9	0.1	8.82
2017	27.9	14.0	0.0	3.6	0.0	9.10
2018	24.2	14.4	0.0	3.8	0.1	8.50
2019	30.2	14.9	0.1	5.1	0.1	10.08
2020	31.1	15.7	0.1	8.9	0.3	12.50
Index 20/12	1.19	1.71	1.00	1.51	-	1.51

Source: Author, according to the data of Green Report and Statistical Office of SR

In this part we deal with the selected negative impacts of agriculture on the environment. We evaluate the development of pesticides and industrial fertilizers usage. Pesticides are the effective chemical substances used in agriculture for the crop protection against the harmful organisms, pests, diseases and weeds. In the world more than one thousand of the different types of pesticides are being utilized. Their incorrect usage leads to the pollution of soil, water and air. Slovakia is below the European average in the use of pesticides. The annual sale of pesticides per hectare achieves 1.3 kg. Some countries in the EU have the usage threefold even fourfold higher. As a part of the strategy “From Farm to Fork“ with the objective to support the transition of the EU to the sustainable food system and decrease the use of the chemical pesticides, on August 31, 2022 the European Commission passed the new regulations for the availability of the ecological preparations for the crop protection for the usage in the member states of the EU. The new regulations mitigate the permitting of microorganisms usage as the effective matters in pesticides and offer other possibilities for the farmers of EU to substitute the chemical preparations for the crop protection by the more sustainable alternatives.

The development of the total pesticides usage in the agriculture of the SR in the period 2012 – 2020 is indicated in the Fig. 2. The utilization of pesticides increased by 1,479 tonnes in the evaluated period. In the period 2018 – 2020 the pesticides usage is relatively stable. In 2020 mostly herbicides were used (2,742 t), 1,244 t of fungicides, 378 t of insecticides and 1,057 t of other pesticides. According to the plans of the EU the pesticides usage should be decreased by a half till 2030 in the EU. In accordance with the opinion of the authors of this paper, to achieve this target will be difficult because the pesticides usage was growing in the majority of the EU countries in the period 2011 – 2020. The decrease was monitored only in seven countries, leading country is Portugal (drop by 42%), followed by Ireland (drop by 28%) and the Czech Republic (drop by 27%).

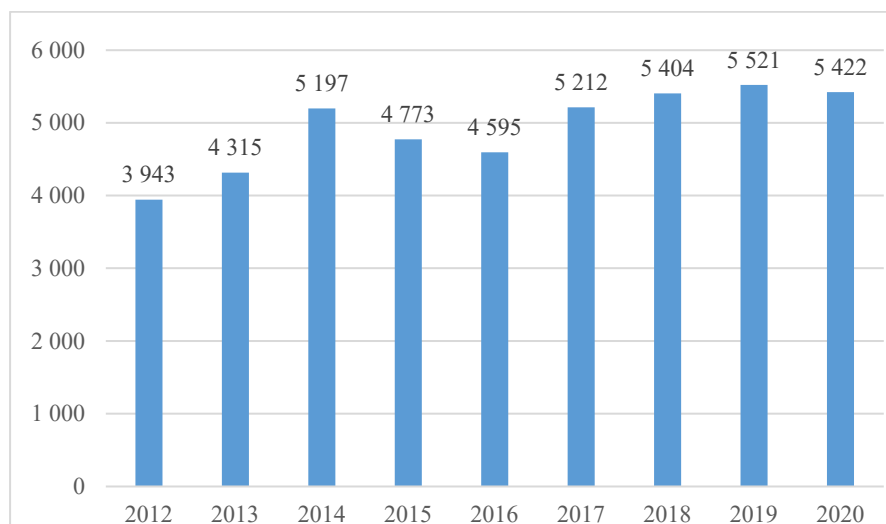


Fig. 2 Development of pesticides usage in agriculture of SR in 2012 – 2020 (t)
Source: Author, according to the data of the Central Control and Testing

Institute in Agriculture

The application of industrial fertilizers (NPK) in kg of the pure nutrients per hectare of the agricultural soil in the SR in the period 2012 – 2020 is shown in the Fig.3. In 2012 the usage was 85.8 kg.ha⁻¹, in 2020 it was 103,4 kg.ha⁻¹, which means the growth by 17.6 kg.ha⁻¹. The

lowest utilization was monitored in 2016 (88.2 kg.ha⁻¹). After this year there was recorded the rise in the use above 100 kg.ha⁻¹.

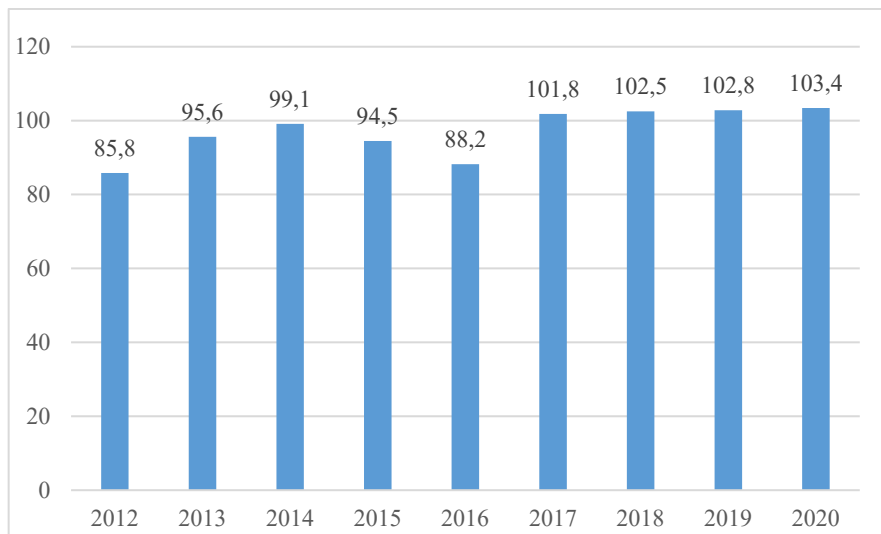


Fig. 3 Development of industrial fertilizers usage in agriculture of SR in 2012 – 2020 (kg.ha⁻¹)
Source: Author, according to the data of the Central Control and Testing Institute in Agriculture

4. Discussion

The primary role of agriculture is to provide the sufficiency of healthy food of high quality needed for assurance of population nutrition. For longer time the other non-production functions of agriculture are being emphasized. Out of them the most significant one is the assurance of the sustainable usage of the natural sources and maintenance of viable countryside. The ecological agriculture fulfills the idea of the sustainable development in agriculture. It represents the alternative approach of the agrarian policy and strives for the continuous production of the healthy foodstuffs in the way which has the minimal negative impacts on the environment.

The interest in this form of farming is increasing constantly. In 2020 the area of ecologically cultivated agricultural land achieved 222,896 ha. It constitutes more than 11% out of the total agricultural land. According to the type of grounds, the permanent grasslands (145,209 ha) and arable soil (75,592 ha) are ecologically managed to the highest level. The total number of the registered participants was 1,037, farmers 698. These numbers are also growing continuously.

One of the measures targeted at the ecologization of agriculture are so called bio-belts, which constitute the prerequisite for the acquisition of funds from the eco-schemes of the new Common Agricultural Policy. The mandatory part of the regulations for the farming companies is to divide large soil areas, which exceed the maximal acreage 50 ha, or 12 ha in the protected area. The ideas related to the formation of bio-belts differ. Many farmers are aware of the necessity and obligation of a higher ecologization of agriculture, the others do not like the introduction of this duty. The criticism also comes from the areas where the fields are divided by ties or alleys formed individually in the past, whereby the given area is exceeded only by a couple of hectares. If these producers want to comply with conditions, they will have to divide such fields again.

Emil Macho, the chairman of the Slovak Agriculture and Food Chamber said: “After the 1 January 2023 nobody will claim that the farmers are given money for doing nothing and they get the subsidies only for some wheat or rape. The fact is that we will receive less money for more work. The majority of agriculturists knew about the necessity to introduce the bio-belts, therefore they were prepared and most of them will do it.”

Andrej Gajdoš, the executive chairman of the Slovak Agriculture and Food Chamber and adviser of eco-schemes stated: “The farmers have to be informed about the conditions under which they can enter into the eco-schemes as soon as possible and what exactly their duties will be. It is not that easy to form smaller areas out of large fields and also to sow the appropriate crop selection, which should bring the sufficient yield on the one hand, and to attract new animals, bees and butterflies on the other hand.”

5. Conclusion

The total number of animals bred in EAP is falling. According to the individual categories we recorded the decrease of sheep, poultry, goats and horses. The significant growth in the number of pigs is observed, a moderate increase in the number of cattle.

Agriculture affects the environment in the different ways, among them there is also the usage of pesticides and industrial fertilizers. In 2020 the total utilization of pesticides in agriculture achieved 5,422 tonnes. In comparison with the year 2012 it means the rise by 1,479 tonnes (38%). The decrease of usage of chemical pesticides is not an easy way. This process takes several years. The reaction could be taking some steps – the utilization of the precise technique, growing more resistant plant species, or the support of science and research in the field of preparations for crop protection.

A moderate increase is also observed in the development of usage of industrial fertilizers. In 2012 it was at the lowest level (85.8 kg.ha⁻¹), in 2020 it reached the highest level (103.4 kg.ha⁻¹). Overall, the growth is by 17.6 kg.ha⁻¹ (20.5%).

The ecological agriculture ranks among the alternative forms of soil cultivation with the enormous perspective of the further development, resulting from the urgent needs of the society and the increased demand for the biofoodstuffs. In the following period the faster development of the ecological agriculture in the EU and Slovakia can be supported by the Common Agricultural Policy with the increased subsidies for this form of farming. The farmers, who would like to begin their ecological farming, are discouraged also by a high administrative burden associated with the ecological farming.

The key program EU aimed at the funding research and development Horizon Europe also emphasizes the sustainable agriculture. The declarations of the program are targeted at a better management of nutrients, the integrated protection against pests and looking for the alternatives of the chemical pesticides and synthetic fertilizers. These appeals are included in one of the supported areas entitled Fair, healthy and environmentally-friendly food systems from primary production to consumption FARM2FORK.

In the following period our farmers can expect new challenges. Apart from the preservation of the economically effective enterprising, which will become very difficult with the continuous growth of inputs, they will also have to meet the environmental objectives resulting from the new regulations of the Common Agricultural Policy 2023 – 2027.

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