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# EVOLUTION OF THE AMOUNT OF CHEMICAL AND NATURAL FERTILIZERS USED IN ROMANIA BETWEEN 2007 AND 2016

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**Abstract:** *Along with irrigation, chemical and natural fertilizers play an important role in producing high yields, providing nutrients for plants, thus increasing or maintaining optimal yields. Regarding the use of chemical and natural fertilizers in general, a downward trend has been observed between 1990 and 2000, so that the application of these fertilizers in this interval has decreased by more than 800%, a period considered not very happy in the case of the Romanian agriculture. The largest producers of chemical fertilizers used by Romanian farmers come from the European Union, so that they have discovered the opportunity of the Romanian agriculture market, they have opened their representative offices in Romania, where they provide farmers with consultants meant to offer them solutions dedicated to their needs. In Romania, an overwhelming natural fertilizer is used (over 90% of the total amount of fertilizer applied) because they are at hand and cheaper. These fertilizers may come from secondary livestock farming.*

**Keywords:** *fertilizers, nutrients, Romanian agriculture, environmental hazard*

**JEL Classification:** *Q1, Q5*

## INTRODUCTION

The Romanian agricultural sector continues to represent an individual and main component of the Romanian private economy. [3]

In Romania, industrial agriculture has unfortunately led to negative environmental effects, so that by 1990 the production activity generated various types of pollution, such as soil pollution, air pollution, water pollution, and due to the fact that the fertilizers over time have been widely used without regard to the specific needs of culture, the timing of their application and the way they should be applied. [6]

Deficient administration of chemical or natural fertilizers can have negative effects on both production and soil quality, the most polluting effect being due to the excessive use of nitrates.

Nowadays, due to the technologies aimed at obtaining large productions, the Romanian agriculture risks poverty, so the distribution of nutrients plays an important role in the practical agriculture. For this reason, farmers should constantly receive informations and advices on the use and application of fertilizers, to implement them in order to obtain a fair agricultural practice. [5]

Increasing the efficiency of fertilizer use with regard to their non-discriminatory use leads to environmental hazards. [1]

Appropriate treatment adds to the normal course of fertilization of both plants and soil as it plays a role in controlling preventive and curative nutrient imbalances, improving plant growth and growth. We mention that the application of chemical and natural fertilizers stimulates the formation of the root system, flourishing and fructification, and also supports resistance to disease.

## MATERIAL AND METHOD

As research methods, we used documentation, analysis and data processing, secondary analysis. These methods are based on the processes of synthesis, analogy and comparative analysis. Once the information was defined, known and interpreted, the next step was the detailed documentation of the field of interest.

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The data used in this study was provided by the Romanian National Institute of Statistics (INSSE, 2018).

In the analysis activity, the study and documentation for the field or for the analyzed system is a starting point. These allow the analysis to get the first knowledge and information.

Documentation also involved analyzing legislation and comparing analysis of different sources studied. Proper assessment and establishment of the nutrient requirement for plants are based on: local technological conditions, soil, climate, the expected output of production, soil behavior of applied fertilizers, especially those with nitrogen, etc.

The nitrogen fertilization plan and other nutrients allow proper management of the fertilizer in an economic and environmental way.

## RESULTS AND DISCUSSIONS

Today, economic and environmental challenges have a high interest in the efficiency of nutrient use. Higher prices for both crops and fertilizers have increased interest in technologies and practices to improve efficiency and economic productivity.

Moreover, losses of nutrients that harm the air and water quality can be reduced by improving the efficiency of nutrient use, especially for nitrogen (N) and phosphorus (P). [2] According to the statistics, Romania has some of the cleanest and fertile soils in Europe, because the financial possibilities of the Romanian farmers are small, based on the natural qualities and natural characteristics of the soil and on the technologies of culture. The real economy must serve through its results and through the mechanisms it uses to improve human health and the protection of the environment, as living generations that coexist and inevitably succeed in the evolution of our microcosm. [4]The fertilizer industry faces a permanent challenge to improve the efficiency of its products. This is done either by improving the fertilizers already used or by developing new types of fertilizer. [9]

The fertilizer is in many forms, from chemicals to old grass cuttings. By supplying nutrients like nitrogen, fertilizers help plants grow despite the threat of weeds and diseases. Natural fertilizers, such as manure, improve soil fertility by feeding microorganisms into the soil, reducing erosion and ensuring continuous soil hydration. On the other hand, the real effects of chemical fertilizers are not widely presented. This is partly due to the fact that they are largely untested. We understand that there is a risk of groundwater contamination and we are aware of the environmental problems it causes, but we do not fully realize what it means for our long-term health, so instead of trying to buy as many natural fertilizers possible, just shrug to it. [13]

The limited financial resources of the Romanian farmers make the application of fertilizers without adequate grounding, without a soil analysis, to show clearly what the deficiencies are. So, farmers apply a single substance, and in the long run, these irrational fertilizer applications turn into serious soil deficiencies in microelements. [8]

With the accession of Romania to the European Union, new markets were opened in 2007, culminating in an increasing growth of agricultural products. This can be covered by increasing production using the latest and most innovative substances that help feed the plants. However, Romanian farmers have understood the need to become as competitive as possible, in order to compete with Western European countries. This explains why, after 2007, Romania registered an evolution of the average yields obtained from the main crops of wheat, maize, sunflower and rape. However, permanent dependence on weather conditions and still poor technical endowment make Romanian agriculture a rudimentary one.

### **Advantages of chemical fertilizers**

- Because nutrients are available immediately, amelioration takes place and is visible in a few days;
- The N-P-K ratio is rigorously established, making it easy to choose the grain depending on the stage of plant development;

- They are cheap and the way of use is easy to understand.

#### **Disadvantages of chemical fertilizers:**

- In most cases they are made from unconventional sources, including fossil fuels;
- They grow and develop plants but do nothing to sustain the life and health of the soil, because they do not replace many elements that are gradually exhausted from crops, which in the long run leads to soil deterioration;
- Because nutrients are easily accessible, there is a danger of overcharging. This not only can kill plants, but can disturb the whole ecosystem;
- Chemical fertilizers should be applied cyclically, which leads to the toxic accumulation in the soil of substances such as arsenic, cadmium and others, which can also be transferred to vegetables;
- Their long-term use can change the pH of the soil, affect the destruction of beneficial microbial ecosystems, may even stimulate certain harmful factors.

#### **Advantages of natural fertilizers**

- In addition to breaking down nutrients, natural fertilizers improve the structure of the soil and increase its ability to maintain water and nutrients. In the long run, they will increase soil health and fertility;
- Since slow-release fertilizers are used, they cannot produce super fertilization that damages plants;
- The risk of accumulation of toxic substances for plants is excluded or very low;
- Natural fertilizers are renewable, biodegradable, sustainable and environmentally friendly;
- Buying from commerce, natural fertilizers are expensive, but they can be obtained at low cost in the household by processing manure or composting.

#### **Disadvantages of natural fertilizers:**

- The raw material from which natural fertilizers are obtained must decompose to release the nutrients into the soil. This decomposition is done according to the laws of nature, so immediate benefits are not seen in administering these grains but only after 2-3 months;
- While largely solving plant needs, the N-P-K report is generally unknown and most often inappropriate to the plant development phase.

Table 1. Amount of chemical and natural fertilizers used in agriculture

Year	Categories of fertilizers	Chemical	Nitrogen	Phosphate	Potash	Natural
2007	Tons 100% active substance	387.216	265.487	103.324	18.405	13.497.929
2010	Tons 100% active substance	480.586	305.757	123.331	51.500	15.231.715
2010/2007	%	19,43	13,17	16,22	64,26	11,38
2011	Tons 100% active substance	486.944	313.333	126.249	47.362	14.510.194
2011/2010	%	1,31	2,42	2,31	-8,74	-4,97
2012	Tons 100% active substance	437.972	289.963	113.035	34.974	13.292.617
2012/2011	%	-11,18	-8,06	-11,69	-35,42	-9,16
2013	Tons 100% active substance	491.831	344.468	113.823	33.540	13.580.267
2013/2012	%	10,95	15,82	0,69	-4,28	2,12
2014	Tons 100% active substance	452.239	303.562	118.574	30.103	16.261.702
2014/2013	%	-8.75	-13.48	4.01	-11.42	16.49
2015	Tons 100% active substance	532.702	357.352	132.657	42.693	15.212.325
2015/2014	%	15.10	15.05	10.62	29.49	-6.90

<b>2016</b>	<b>Tons 100% active substance</b>	514.126	344.311	126.189	43.626	14.927.199
<b>2016/2015</b>	<b>%</b>	-3.61	-3.79	-5.13	2.14	-1.91

Source: Calculations obtained on the basis of data provided by the Romanian National Institute of Statistics (2018)

Over the three year period from 2007 to 2010 there is an upward trend, where the interest for potassium fertilizers increased by 64.26%, while the lowest increase is recorded among the natural ones of only 11.38%.

Year 2012, compared to 2011, reduces the quantities of fertilizers used, so that potassium compounds again show a decrease of 35.42%, while the lowest decrease is reported for nitrogenous substances.

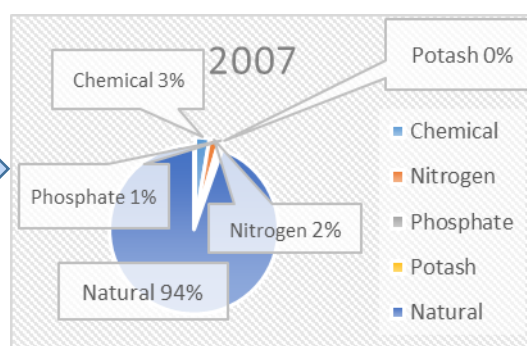
In 2013, only potassium fertilizers dropped to 4.28, while the remainder of the fertilizer yields increases, with the highest nitrogen content of 15.82%.

The year 2014 compared to 2013 shows decreases at the level of all fertilizers, excluding natural fertilizers, which register an increase of 16.49%.

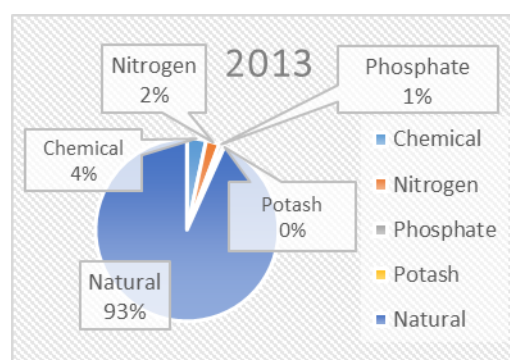
As far as the year 2015 is concerned, compared to 2014, the upward trend is only observed for natural fertilizers, which is a decrease of 6.90%, the highest increase being made for potassium fertilizers, of 29.49%.

During 2016, negative values are recorded among chemical fertilizers, nitrogenous, phosphatic and natural fertilizers, except potassium fertilizers, which show an increase of 2.14%.

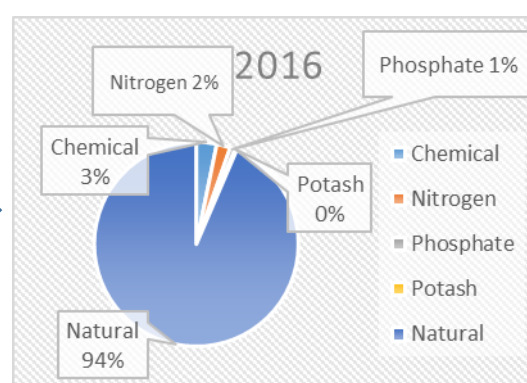
**Figure 1. The weight of fertilizers used in Romanian agriculture, at the level of 2007**



**Figure 2. The weight of fertilizers used in Romanian agriculture, at the level of 2013**



**Figure 3. The weight of fertilizers used in Romanian agriculture, at the level of 2016**



Overall, the amount of chemical and natural fertilizers used in agriculture shows a oscillating trend, largely due to the evolution of agricultural research that brought new products to market, which are applied in smaller quantities but have a stronger action.

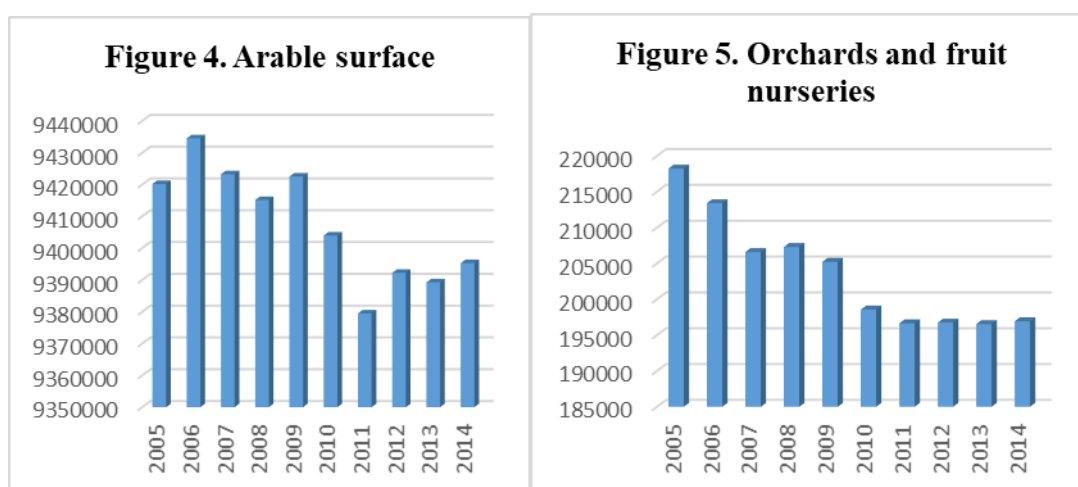
The surface area of the Romanian land stock does not change significantly during the analyzed period, 2005-2014, especially after 1989, when most of the land was considered to have been owned by those who owned them before 1945, or to the heirs of these people.

Table 2. The surface of the land fund

Use of land fund	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Unit: Hectares										
<b>Agricultural</b>	14741214	14730956	14709299	14702279	14684963	14634436	14621427	14615057	14611883	14630072
<b>Arable</b>	9420205	9434542	9423255	9415135	9422529	9404008	9379489	9392262	9389254	9395303
<b>Pastures</b>	3364041	3334375	3329984	3333028	3313785	3288725	3279251	3270610	3273961	3272165
<b>Meadows</b>	1514645	1524922	1531491	1532342	1528046	15 29561	1554680	1544957	1541854	1556246
<b>Vineyards and viticulture nurseries</b>	224082	223701	217968	214463	215382	213571	211347	210475	210270	209417
<b>Orchards and fruit nurseries</b>	218241	213416	206601	207311	205221	198571	196660	196753	196544	196941

Source: Romanian National Institute of Statistics, (2018)

Throughout the analyzed period, the land fund did not show any significant changes. As can be seen from Table 2, the most important share of the land fund structure is owned by Romania's arable land, which at the year 2014 is 9,395,303 hectares.



At the opposite pole, with the slightest stretch, there are the orchards and nurseries that have an area of 196,941 hectares.

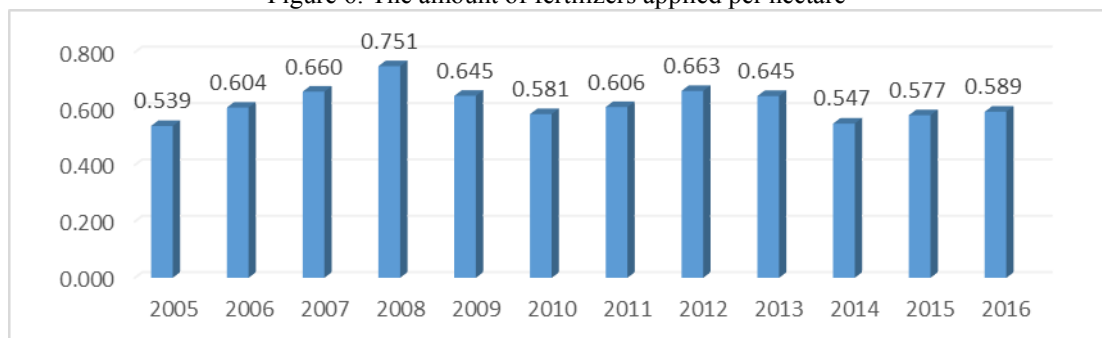
Table 3. The amount of fertilizers applied per hectare

Specification	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
UM: tons active substance												
Arable	9420205	9434542	9423255	9415135	9422529	9404008	9379489	9392262	9389254	9392262	9389254	9395303
Fertilizers	1749259 2	1562598 8	1427236 1	1254407 0	1460072 1	1619288 9	1548408 2	1416856 1	1456392 9	1716618 0	1627772 9	15955451
Applied fertilizers per hectare	0,539	0,604	0,660	0,751	0,645	0,581	0,606	0,663	0,645	0,547	0,577	0,589

Source: Calculations obtained on the basis of data provided by the Romanian National Institute of Statistics (2018)

Analysing the amount of chemical and natural fertilizers applied per hectare, it is found that it has a oscillating evolution, so that the largest quantity of chemical and natural fertilizers was applied in 2008, more exactly a quantity of 0.751 tonnes per hectare, with the mention that over 93% of this quantity was represented by natural fertilizers and only 7% were chemical fertilizers.

Figure 6. The amount of fertilizers applied per hectare



The lowest amount of chemical and natural fertilizer per hectare was administered in 2005, when farmers gave a quantity of 0.539 tonnes per hectare. It is worth noting that this year the farmers have administered over 94% of this amount was represented by the administration of fermented manure.

## CONCLUSIONS

In conclusion, although it is still a controversial topic, the use of fertilizers from both chemical and natural sources will continue to be done to develop and support plant production to meet the growing population demand in the future. The use of chemical and natural fertilizers plays an essential role in establishing the final production. Thus, failure to apply them or poor application of these substances can lead to a decrease in production and can seriously affect the quality of the soil.

Excessive nitrogen management during the communist period has led to the manifestation of a phenomenon that currently affects certain areas of the country. Applied in excessive amounts this nitrogen has resulted in deficiencies in microelements.

It is found that the proportion of fertilizers applied to the soil is largely represented by natural fertilizers, over 90% of the amount of fertilizer applied is represented by natural fertilizers. This shows that fertilizers have a very important contribution to the quantity of agricultural products obtained by farmers. The large proportion of natural fertilizers is explained by the fact that they are at hand and the purchase price of these fertilizers is very low and sometimes comes from their own livestock activity. The fact that chemical fertilizers have a low share in the total fertilizer applied (max. 7%) is explained by the fact that the Romanian farmers allocate limited financial resources to the purchase of inputs for agriculture.

After 2007, on the Romanian market of agricultural inputs emerged important companies that provide consultancy services for the purchase of chemical fertilizers, offering integrated solutions that correspond to the needs of the farmers. Over time, a wide range of plant-based products has grown, so today, complete solutions such as N-P-K are found on the market, and they also contain essential nutrients in plant nutrition and nutrition.

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