THE EVOLUTION OF AGRICULTURE IN 2020 SEVERELY AFFECTED BY THE HEALTH AND ECONOMIC AND FINANCIAL CRISIS

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Abstract

Agriculture, especially through the way the territory of Romania is divided, had to represent, as it has been since ancient times, one of the branches of the national economy that always brings income. Income for domestic consumption needs, but also to ensure exports.

The objective of this article is to identify how agriculture evolved in 2020, registering large areas of uncultivated land, the impossibility of irrigation, limiting the use of fertilizer and other modern agrotechnical means, all coupled with a drought that Romania does not he has been recording it for a very long time.

The authors seek to explain the causes that led to this decline, so that by 2020 agriculture will make a contribution to the formation of Gross Domestic Product of only 3.8%.

The methodology used is that of the study of data provided by the National Institute of Statistics and Eurostat for the interpretation of evolutionary trends for different spheres of activity, crop production, animal production, subdivision and the possibility of efficient processing of agricultural land. At the same time, a series of comparisons, especially during the last year, are at hand in order to highlight how agriculture has evolved over time.

In order to highlight all these aspects, we approached a spectral analysis, precisely to highlight the trend of this branch of the national economy.

These data will help those who study this phenomenon, those who are concerned with improving activity in agriculture, to understand more leisurely what should be done both by landowners, but also by the authorities, state institutions and even The European Union to support the recovery of Romanian agriculture and its launch on a track in line with the geo-meteorological conditions that Romania offers.

Keywords: agriculture, crop production, animal production, GDP, developments, crisis.

JEL classification: C10, Q10.

Introduction

The authors began in the analysis of this field of activity by presenting some essential aspects and then in the analysis of vegetable production, which has always been an asset of the Romanian economy, even if it led to the idea that Romania is an agrarian country obtains the necessary for domestic consumption, also provides a sufficiently large surplus to be able to export with a variety of products in the field of field crops. At the same time, animal production which has always been another outlet for the national economy, ensuring through the herd that was quite well developed, both the increase of production and supply of the domestic market, as well as the realization of income-generating exports that contribute to the growth of the Product Gross Internal.

The main crops that Romania had in 2020 are analysed, with the decreasing productions in all chapters compared to 2019 and with comparisons regarding the cultivated area, the realized production, which highlights a reduction of this field of activity.

Tables, graphs are presented, which highlight more clearly the situation in Romania. We also did some research compared to a number of countries in the European Union that have the potential to ensure agricultural production, such as France, Germany, Poland, Spain, Italy, Bulgaria, Hungary, the Czech Republic, Denmark, Greece, Belgium, The Netherlands or Slovakia, pointing out that the areas in our country were larger than in these countries, and the productions were commensurate, although at the level of agrotechnics at the moment we are a bit far from what is happening in the European Union.

We also referred to horticulture, viticulture, which provided year after year the necessary production to supply domestic consumption, but also to contribute to the exports made by Romania.

Some references relate to the production of milk, meat and the dairy and meat industries, which are also in a state of circumspection, reduction and consequent path leading to an increase in imports with an enormously wide range of products, which could be made and have been made over time in our country.

We also presented a spectral analysis of the evolution of agriculture to find out how the participation of this branch in the formation of Gross Domestic Product through Gross Value Added in agriculture decreased year by year, reaching in 2020 3.8% of Gross Domestic Product, which and so it

was greatly diminished due to the economic and financial crisis generated by the coronavirus pandemic.

Literature review

Angelsen (2010) presented a series of notions related to agricultural production. Anghel, Anghelache and Panait (2017) analysed the results obtained in agriculture in the European Union, as a whole and each Member State. Anghelache, Samson and Stoica (2019) studied the main elements of the European Union's strategy in the field of agriculture. Anghelache (2018) conducted a complex study on the evolution of Romanian agriculture. A similar topic is researched by Anghelache, Dumitru and Stoica (2020). Bezemer and Headey (2008) sought to identify measures that can be taken to develop agriculture. Hansen et al. (2013) conducted a study that revealed the negative effect of forestry in some areas. Islam (2011) conducted a comparative study on the various incentives leading to the development of agriculture. Lowder, Bertini and Croppenstedt (2017) presented data and perspectives on the evolution of agriculture. Mogues, Fan and Benin (2015) studied the role of public investment in agriculture. Quamrul and Michalopoulos (2015) analysed how climate volatility influences agricultural activity.

Methodology

In order to facilitate the understanding of the study carried out by the authors, some methodological aspects used by the National Institute of Statistics and Eurostat are given below. Thus, the source of the data is the statistical research Plant production in the main crops, carried out in accordance with the Regulation of the European Parliament and of the Council no. 543/2009 regarding the vegetal production, with the subsequent modifications and completions. This research was conducted on the basis of a representative sample at national level, macro-regions, development regions and counties, and the sample volume consisted of 54,195 agricultural holdings, of which 22,884 agricultural holdings with legal personality and 31,311 agricultural holdings without legal personality.

As for the cultivated area, it represents the area sown / planted in its own field, in the reference agricultural year, i.e. 1 October - 30 September, with a main crop occupying the land for the longest period of time or in previous agricultural years for biennial crops, triennial or perennial.

Also, the vegetal agricultural production represents the physical production obtained in the reference period, the year in which the harvest is made, less the losses at harvest, expressed in physical units according to the nature of the products and product groups and includes: production of own

crops, the production of intercropping, the production of successive crops and the production obtained in family gardens (for vegetables, potatoes and grapes). The average production represents the quantity of products obtained per unit of cultivated area in own field.

Regarding livestock and meat, the statistical research is exhaustive, the data being collected from about 200 economic operators and is addressed to all enterprises throughout the country that have main or secondary activity Meat production and preservation, class 1011 or Processing and preserving of poultry meat class 1012 according to CANE classification Rev.2.

Thus, in cattle, the weight in the carcase represents the weight of the body of the slaughtered animal, whole, after removal of the skin, blood and internal organs, without head, udder, tail, kidney fat and legs. In pigs, the carcass weight is the body weight of the animal slaughtered after bleeding, without internal organs, hair, hooves, tongue, bone and diaphragm. In sheep and goats, the carcass weight is the weight of the body of the slaughtered animal, after bleeding and removal of the skin, without internal organs, without head and legs. Kidneys and kidney fat are included in the carcass. In birds, the carcass weight represents the weight of the slaughtered bird, after bleeding, without flakes, down, internal organs, head, neck and claws.

Data, results and discussions

As for the area cultivated in 2020, it decreased compared to 2019 for cereals for grains, oil plants, legumes for grains, potatoes and vegetables. Also, the agricultural vegetable production decreased in 2020, compared to the previous year, for cereals for grains, oil plants, legumes for grains, vegetables and increased for potatoes. Table number 1 structures the data regarding the cultivated area and the production of the main crops.

Cultivated area and production of main crops

Table 1

	Cultivated area		Total production		Differences (±) year 2020[2)] compared to the year 2019	
	- Thousand ha-		- Thousand tons-			
	2019	2020[2)]	2019	2020[2)]	-Thousand ha -	Thousand tons -
Grain cereals	**5569**	**5435**	**30412**	**18968**	**-134**	**-11444**
from which:						
-wheat	2168	2146	10297	6410	-22	-3887
-barley and barley	449	438	1880	1121	-11	-759
-oat	161	103	362	199	-58	-163
-corn grains	2679	2639	17432	10844	-40	-6588
Grain legumes	**116**	**107**	**236**	**122**	**-9**	**-114**
Oily plants	**1800**	**1736**	**4792**	**3111**	**-64**	**-1681**
from which:						
-Sunflower	1283	1223	3569	2072	-60	-1497
-soy beans	158	165	416	306	+7	-110
-rape	353	342	798	728	-11	-70
Potatoes	**170**	**166**	**2627**	**2683**	**-4**	**+56**
Vegetables[1)]	**228**	**225**	**3530**	**3517**	**-3**	**-13**

[1)] Includes cultivated area and production of vegetables grown in fields, greenhouses and solariums and in family gardens

[2)] Provisional data

Source: INS communique no. 80/31 March 2021

Interpreting the structured data in table number 1 we find that the cultivated area with grain cereals decreased by 2.4% and the production decreased by 37.6%, compared to the previous year, due to the pronounced drought in the main periods of crop vegetation and lack of irrigation, which led to low yields in most crops. Also, the area cultivated with corn grains in 2020, represented 48.6% of the area cultivated with grain cereals, and the one cultivated with wheat 39.5%. In the same vein, the production of grain legumes decreased compared to the previous year by 48.3%, while the cultivated area by only 0.9%. In oil plants, the production decreased by 35.1%, and the cultivated area by 3.6%. Decreases in production were recorded for sunflower (-41.9%), soybeans (-26.4%) and rapeseed (-8.8%), and the area cultivated with potatoes decreased by 2.4%, and production increased by 2.1% compared to the previous year. Vegetable production decreased by 0.4%, due to the decrease of the cultivated area compared to the previous year.

Data on the area under fruit vineyards and fruit tree plantations grape production and fruit production are structured in the following table.

Area of fruit vineyards and fruit tree plantations, grape production and fruit production

Table 2

	Surface		Total production		Differences (±) year 2020[2)] compared to the year 2019	
	- Thousand ha -		- Thousand tons-			
	2019	2020[2)]	2019	2020[2)]	Thousand ha -	Thousand tons-
Live on fruit [1)]	**178**	**177**	**978**	**938**	**-1**	**-40**
Fruit tree plantations (fruit orchards)	**135**	**138**	**646**	**837**	**+3**	**+191**

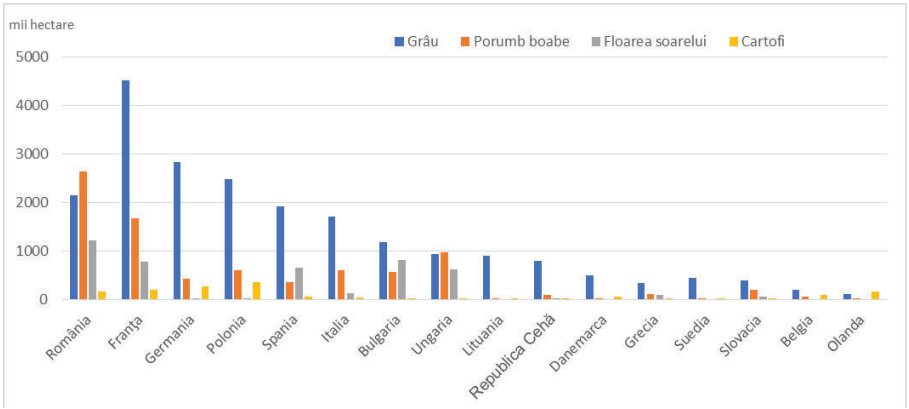
[1)] It includes the cultivated area and the production of grapes from the vineyards cultivated in the field and in the family gardens.
[2)] Provisional data
Source: INS communique no. 80/31 March 2021

Interpreting the data presented in table number 2 we find that grape production decreased in 2020 by 4.1%, due to the decrease in yield per hectare (-3.5%), compared to the previous year, but also the cultivated area (- 0.6%). On the other hand, the production of fruits from orchards increased compared to the previous year by 29.6%, due to the increase of cultivated areas but also of yields per hectare.

Graphs 1 and 2 show the situation of cultivated areas and productions made of wheat, corn, sunflower and potatoes, in Romania and in some Member States of the European Union, in 2020.

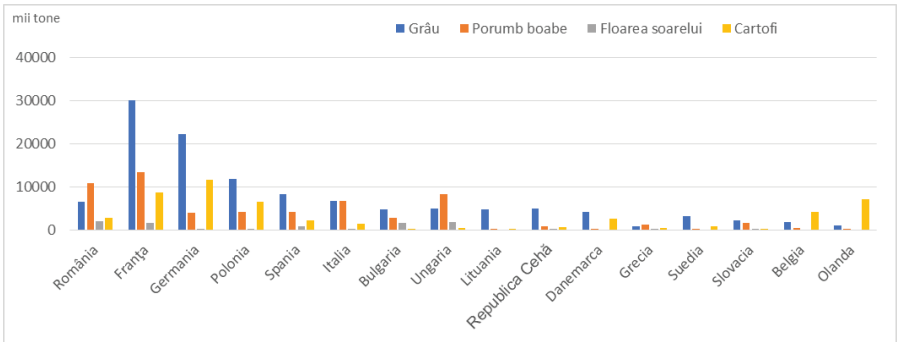
Cultivated area (thousand hectares)

Graph 1



Production achieved (thousand tons)

Graph 2



The situation of Romania compared to some Member States of the European Union in 2020 is the following: for corn grains it was on the first place in the cultivated area and on the second place in the realized production, after France; to the sunflower in the first place, both to the cultivated surface and to the realized production; wheat ranks fourth in the area under France, Germany and Poland and sixth in production after France, Germany, Poland, Spain and Italy, and potatoes ranks fourth in the area under Poland, Germany, France and sixth place in production after Germany, France, the Netherlands, Poland and Belgium.

In the animal sector we present some data on animal slaughter, poultry and meat production. Thus, in January 2021 compared to December 2020, the number of slaughter and carcass weight decreased in all species of animals and birds, and compared to January 2020, the number of slaughter and carcass weight increased in cattle, pigs and in sheep and goats, and in birds decreased, the data being summarized in tables numbers 3 and 4.

Slaughter of animals and birds (%)

Table 3

	Slaughtered animals and birds		Weight in the housing	
	January 2021 *) compared to:		January 2021 *) compared to:	
	January 2020	December 2020	January 2020	December 2020
Cattle - total	**112,8**	**72,1**	**115,1**	**73,0**
of which: in specialized industrial units (slaughterhouses)	100,0	84,6	98,3	80,5
Pigs - total	**102,0**	**34,2**	**101,8**	**33,7**
of which: in specialized industrial units (slaughterhouses)	110,0	68,5	110,3	70,4
Sheep and goats - total	**103,8**	**29,0**	**109,0**	**32,0**
of which: in specialized industrial units (slaughterhouses)	50,0	47,6	48,0	48,0
Birds - total	**91,4**	**94,1**	**89,3**	**92,1**
of which: in specialized industrial units (slaughterhouses)	91,4	99,3	90,0	99,2

*) Provisional data

Source: INS communique no. 55/9 March 2021

Average carcass weight in slaughtered animals and birds (Kilograms)

Table 4

	Average weight in the housing		
	January 2020	December 2020	January 2021*)
Cattle - total	**165,7**	**167,0**	**169,0**
of which: in specialized industrial units (slaughterhouses)	237,9	245,8	233,8
Pigs - total	**90,7**	**91,9**	**90,5**
of which: in specialized industrial units (slaughterhouses)	89,1	87,0	89,5
Sheep and goats - total	**15,2**	**14,4**	**15,9**
of which: in specialized industrial units (slaughterhouses)	21,2	20,1	20,3
Birds - total	**1,8**	**1,8**	**1,7**
of which: in specialized industrial units (slaughterhouses)	1,8	1,8	1,8

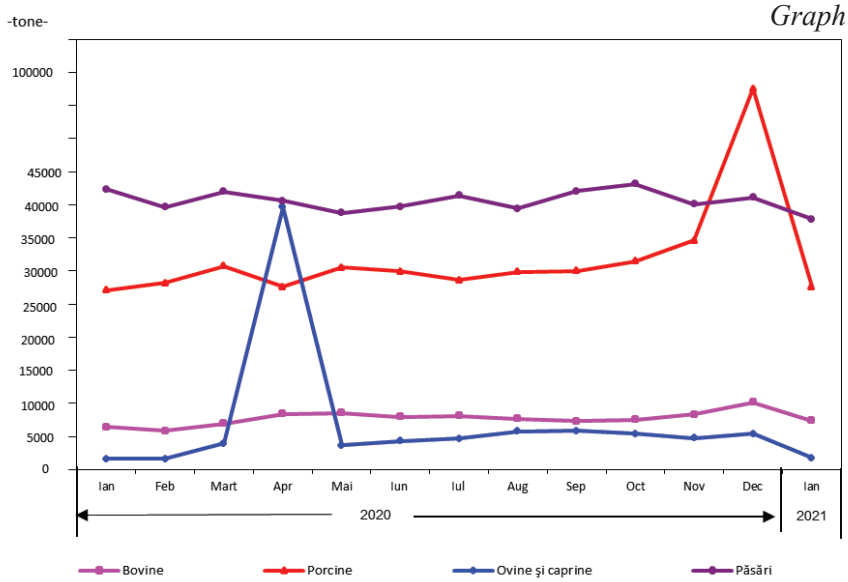
*) Provisional data

Source: INS communiqué no. 55/9 March 2021

For a better visualization and interpretation of the data structured above, the following chart has been drawn up.

Evolution of carcass weight of slaughtered animals and birds during the period January 2020 - January 2021

Graph 3



According to graph number 3 we find significant increases in the number of slaughtering's in specific periods when the consumption of sheep and goats is excessive, namely in April - May and also in the case of pigs in December - January. During the rest of the annual period, the carcass weight of the slaughtered animals and birds has a somewhat constant evolution, with slightly higher oscillations in the case of birds.

Regarding the cow's milk collected by the processing units and the production of dairy products, we specify that in January 2021, the quantity of cow's milk collected from farms and collection centres by the processing units increased by 1.8% compared to the month December 2020 and by 2.1% compared to January 2020. Data on the quantity of cow's milk collected by processing units and dairy products obtained are summarized in Table 5.

Quantity of cow's milk collected by processing units and dairy products obtained

Table 5

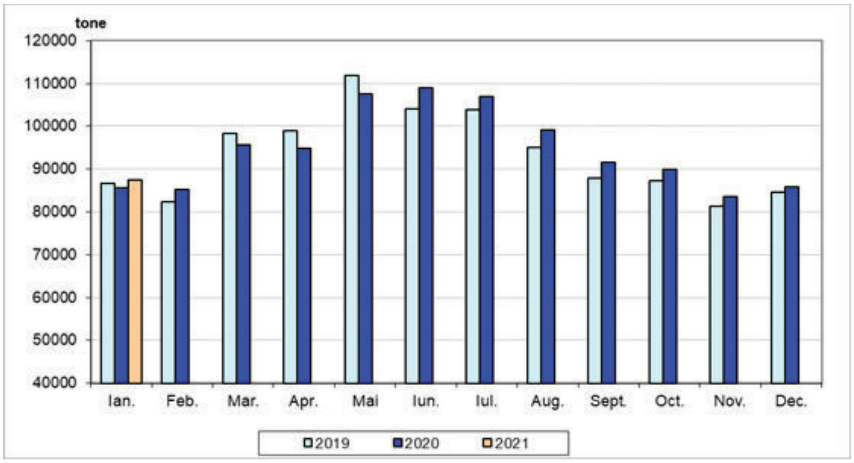
	U.M.	January 2020	December 2020	January 2021
Cow's milk collected by processing units	tons	85641	85881	87405
Average fat content	%	3,90	3,90	3,86
Average protein content	%	3,31	3,30	3,30
Imported raw milk	tons	13021	12834	12804
Dairy products obtained				
Drinking milk	tons	31160	32507	30273
Consumable cream	tons	5947	6551	5627
Sour milk *)	tons	20859	17430	19013
Butter	tons	917	1532	974
Cheeses - total -	tons	7276	6826	7368
of which: n only from cow's milk	tons	6840	6335	7007

*) Includes yogurt, drinking yogurt, whipped milk and other similar dairy products.
**) Data for cumulative periods may differ from those resulting from the summation of months due to revision of monthly data and rounding
Source: INS communiqué no. 59/11 March 2021

The following graph shows the evolution of the amount of cow's milk collected by the processing units.

Evolution of the quantity of cow's milk collected by the processing units

Graph 4



The quantity of cow's milk collected by the processing units increased in January 2021 compared to the previous month by 1524 tons, i.e. by 1.8%. Production also increased in January 2021 compared to December 2020 in sour milk (yoghurt, drinking yoghurt, whipped milk and other similar dairy products) by 1,583 tonnes, i.e. 9.1% and in cheeses by 542 tonnes, that is, by 7.9%. In terms of production of some dairy products, it decreased to 558 tonnes of butter (-36.4%), 924 tonnes of sour cream (-14.1%) and 2234 tonnes of milk consumption (-6%). 9%). At the same time, the quantity of raw milk imported by the processing units decreased in January 2021 compared to the previous month by 30 tons (-0.2%).

In January 2021, the quantity of cow's milk collected by the processing units increased compared to the corresponding month of the previous year by 1764 tons, i.e. by 2.1%. Also, increases in production were recorded for the following dairy products: butter by 57 tons, i.e. by 6.2% and cheese by 92 tons, i.e. by 1.3%. At the same time, production decreased for sour milk (yogurt, drinking yogurt, whipped milk and other similar dairy products) by 1846 tons (-8.8%), cream for consumption by 320 tons (-5.4%) and drinking milk by 887 tons (-2.8%). Also, the quantity of raw milk imported by the processing units decreased in January 2021 by 217 tons (-1.7%) compared to the corresponding month of the previous year.

Next, in order to highlight the trend of this branch of the national economy, we approached a spectral analysis using the data provided by the National Institute of Statistics. Thus, the quarterly data regarding the quarterly volume indices of agriculture in the period 2000-2020 are structured in the following table:

Agriculture in the period 2000-2020, volume indices (%)
(Quarterly average of 2000 = 100 - Seasonally adjusted data)

Table 6

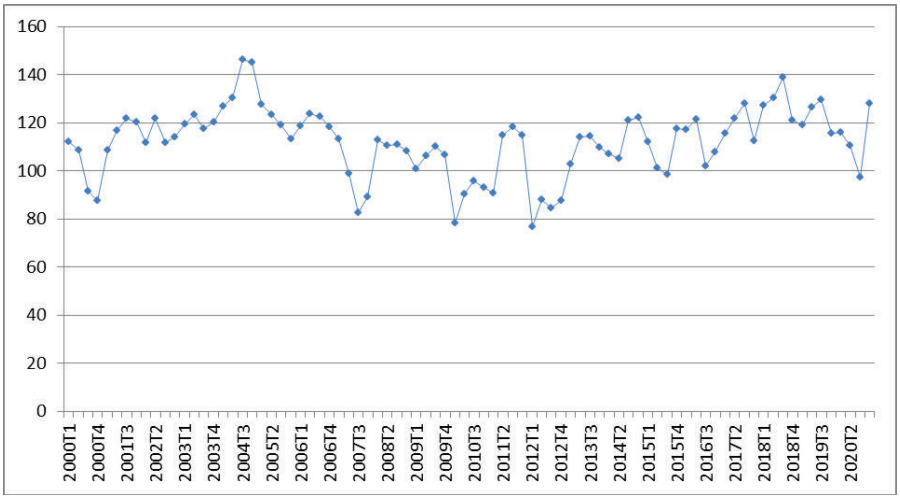
2000T1	**112,1**	2005T2	**123,3**	2010T3	**95,8**	2015T4	**117,6**
2000T2	**108,8**	2005T3	**119**	2010T4	**93,2**	2016T1	**117,2**
2000T3	**91,6**	2005T4	**113,4**	2011T1	**90,7**	2016T2	**121,6**
2000T4	**87,5**	2006T1	**118,6**	2011T2	**114,8**	2016T3	**102,2**
2001T1	**108,7**	2006T2	**123,9**	2011T3	**118,3**	2016T4	**107,7**
2001T2	**116,8**	2006T3	**122,4**	2011T4	**114,9**	2017T1	**115,5**
2001T3	**121,8**	2006T4	**118,3**	2012T1	**76,9**	2017T2	**121,8**
2001T4	**120,1**	2007T1	**113,3**	2012T2	**87,9**	2017T3	**128**
2002T1	**111,9**	2007T2	**98,9**	2012T3	**84,4**	2017T4	**112,6**
2002T2	**121,7**	2007T3	**82,6**	2012T4	**87,7**	2018T1	**127,3**
2002T3	**111,7**	2007T4	**89,1**	2013T1	**102,6**	2018T2	**130,3**
2002T4	**114**	2008T1	**112,9**	2013T2	**114**	2018T3	**138,7**
2003T1	**119,6**	2008T2	**110,5**	2013T3	**114,6**	2018T4	**120,9**
2003T2	**123,5**	2008T3	**110,8**	2013T4	**109,6**	2019T1	**119,1**
2003T3	**117,7**	2008T4	**108,3**	2014T1	**107**	2019T2	**126,5**
2003T4	**120,4**	2009T1	**100,7**	2014T2	**105,2**	2019T3	**129,4**
2004T1	**126,8**	2009T2	**106,4**	2014T3	**121,1**	2019T4	**115,5**
2004T2	**130,2**	2009T3	**110,1**	2014T4	**122,1**	2020T1	**116**
2004T3	**146,4**	2009T4	**106,5**	2015T1	**112,1**	2020T2	**110,4**
2004T4	**145,2**	2010T1	**78,2**	2015T2	**101,3**	2020T3	**97,2**
2005T1	**127,5**	2010T2	**90,3**	2015T3	**98,4**	2020T4	**127,9**

Source: INS communiqué no. 54/9 March 2021

For a better visualization of the evolution of the agricultural sector in Romania in the period between 2000 and 2020, graph number 5 was drawn up.

The evolution of the agricultural sector in Romania between 2000 and 2020

Graph 5



The spectral analysis of an oscillating economic phenomenon as shown in graph number 5, which highlights the evolution of the agricultural sector in Romania in the period 2000-2020, has as a starting point the possibility to approximate an oscillation using a Fourier series as a basis. Thus, for the analysis of the oscillation intensity of the analysed process, the data of the numerical series were entered in the STATISTICA statistical-econometric analysis program, and the results regarding the oscillation frequency, Euler-Fourier coefficients, as well as the periodogram and density values are structured in table number 7.

Results of spectral analysis on agriculture in the period 2000-2020

Table 7

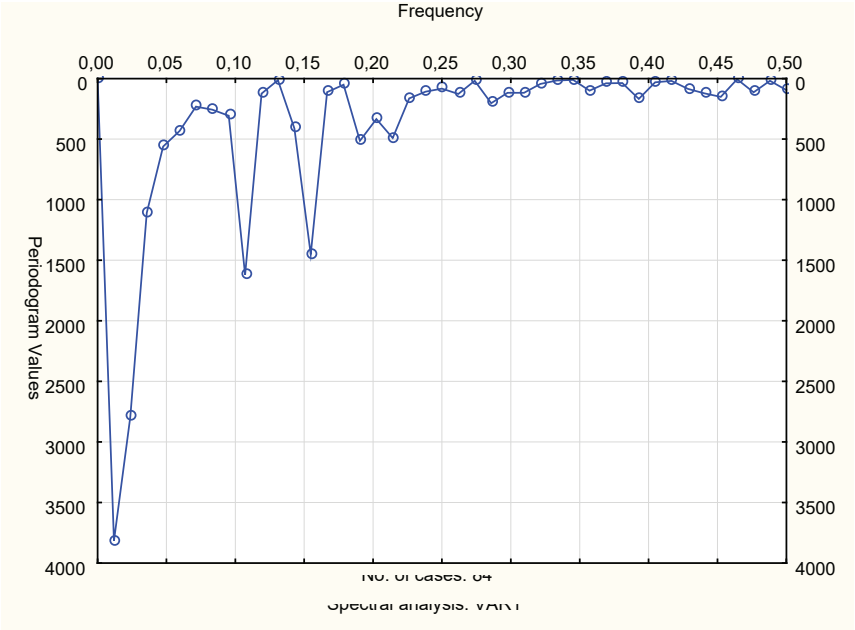
Spectral analysis: VAR1 (Spreadsheet1.sta) No. of cases: 84 Largest Periodog. values

	Frequency	Period	Cosine - Coeffs	Sine - Coeffs	Periodogram	Density
1	0,011905	84,00000	9,03961	3,03004	3817,616	2553,552
2	0,023810	42,00000	-8,00093	-1,57675	2793,043	2454,509
9	0,107143	9,33333	3,39842	-5,20230	1621,755	837,518
13	0,154762	6,46154	5,80943	0,89845	1451,380	776,625
3	0,035714	28,00000	-3,37447	-3,87403	1108,594	1455,352
4	0,047619	21,00000	-0,79918	-3,56727	561,293	730,234
16	0,190476	5,25000	2,72946	2,18794	513,954	343,964
18	0,214286	4,66667	2,45511	-2,38037	491,135	361,667
5	0,059524	16,80000	-1,91111	2,58034	433,040	433,160
12	0,142857	7,00000	-1,43671	-2,78118	411,562	545,171

The values of the periodogram related to the oscillation frequency are presented in graph number 6.

Representation of the periodogram by frequency

Graph 6



Interpreting the results of the structured spectral analysis in table number 7 and represented in graph number 6, we find that the existence of the trend is signalled due to high amplitude values (column 6 of table number 7) for frequencies lower than the unit value (column 2 of table number 7) . Also, due to the large amplitudes recorded for periods longer than one year (84 quarters, 42 quarters), lead to the conclusion that we can confirm the presence of cyclicality of the evolution of the agricultural activity sector. This aspect is also confirmed by the minimum values recorded by this macroeconomic indicator during the economic crisis of 2008-2010 highlighted by chart number 5. Also, the current crisis, the economic and financial crisis generated by the coronavirus pandemic crisis has negative effects on this activity sector.

In terms of seasonality, due to the values of high amplitude for periods longer than 12 months (in the case analysed at 84 quarters and 42 quarters) no significant influence can be reported, which is expected otherwise, because the data series used in this analysis is seasonally adjusted with the DEMETRA program package, using the TRAMO / SEATS method, with which the extreme values were corrected, although we know that Romania benefits from a climate with all four seasons, and the harvest periods (summer and autumn) bring a plus value of this sector of activity.

Conclusions

The article published on the basis of the study carried out by the authors highlights a series of aspects regarding the evolution of the Romanian economy in general and of agriculture in particular in the following period. A first conclusion is that the agrotechnical level being worked on in Romania is quite low and therefore, without irrigation system, without complete mechanization, fertilization, improvement of soil quality, no special results can be obtained.

On the other hand, the lack of these agro-technical measures compared to the oscillating nature, which ensures either too much water leading to floods or does not ensure those quantities leading to drought and consequently to uncertainty about the way agricultural areas cultivated in the vegetable field, viticulture, fruit growing, can give the results that would be possible.

At the same time, there are few prospects for the irrigation system to be completed, improved, developed, subsidies to increase, subsidies from the European Union to be sufficient, so that the outlook for agricultural developments remains uncertain for some time to come.

In other words, in the conditions of the economic and financial crisis we are facing, agriculture will benefit from few sources, and production is far from being necessary for the internal market. On the other hand, the costs

will increase, which within the European Union, based on the directive on the free movement of goods, Romania will import more and more agricultural products, thus thwarting the efforts of domestic producers, who will be discouraged and perhaps in many circumstances, determined to give up in the perspective of improving agricultural production in its complexity, but also on the two segments, vegetable production and animal production.

References

1. Angelsen, A. (2010). Policies for reduced deforestation and their impact on agricultural production. *Proceedings of the National Academy of Sciences, 107* (46), 19639-19644
2. Anghel, M.G., Anghelache, C., Panait, M. (2017). Evolution of agricultural activity in the European Union, *Romanian Statistical Review, Supplement*, 6, 63-74
3. Anghelache, C., Dumitru, D., Stoica, R. (2020). Study on the evolution of agricultural activity in Romania in 2019. *Romanian Statistical Review, Supplement*, 4, 171-183
4. Anghelache, C., Samson, T., Stoica, R. (2019). European Union policies on rural development of agriculture and industry. *Romanian Statistical Review, Supplement*, 1, 176-187
5. Anghelache, C. (2018). Structural analysis of Romanian agriculture. *Romanian Statistical Review, Supplement*, 2, 11-18
6. Bezemer, D., Headey, D. (2008). Agriculture, Development, and Urban Bias. *World Development, 36* (8), 1342-1364
7. Hansen, M. C., Potapov, P. V., Moore, R., et al. (2013). High-resolution global maps of 21st-century forest cover change. *Science, 342* (6160), 850–853
8. Islam, N. (2011). Foreign Aid to Agriculture. *Review of Facts and Analysis*. International Food Policy Research Institute, Discussion Paper 01053
9. Lowder, S., Bertini, R., Croppenstedt, A. (2017). Poverty, social protection and agriculture: Levels and trends in data. *Global Food Security*, 15, 94-107
10. Mogues, T., Fan, S., Benin, S. (2015). Public Investments in and for Agriculture. *The European Journal of Development Research, 27* (3), 337–352
11. Quamrul, A., Michalopoulos, S. (2015). Climatic Fluctuations and the Diffusion of Agriculture. *The Review of Economics and Statistics, 97* (3), 589-609