

ROMANIA'S VEGETAL PRODUCTION IN THE POST ACCESS PERIOD TO THE EUROPEAN UNION

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Abstract

The paper analyzed the dynamics of cultivated area, production and yield in vegetal sector of Romania's agriculture in the period 2007-2020 and also in the decade 2014-2020 versus 2007-2013 in order to quantify the effects of the implemented agricultural strategy aligned to the EU CAP. The data from National Institute of Statistics were processed using fixed basis indices, structural indices, growth rate, mean, regression models, R square and comparisons between the two decades. In 2020, Romania had 8,263,672 ha cultivated by +6.25% more than in 2007. Crop structure included: cereals 64.6%, oil plants 20.3%, vegetables 2.4%, leguminous plants 1.3% and 1% potatoes. The area cultivated with cereals raised by +4.07% reaching 5,338,067 ha in 2020, of which maize and wheat 87.9%. In the decade 2014-2020 versus 2007-2013, it was registered a larger total cultivated area and also with cereals (wheat and maize), leguminous crops, oil crops (sunflower), but a reduced area with vegetables and potatoes. Cereals production increased by +132.29% accounting for 18,153,714 tons in 2020, of which maize 55.61% and wheat 35.2%. In the period 2007-2020, important production gains were carried out in leguminous grains, oil seeds, fruits and vegetables, but potatoes production declined by -49.63%. In the period 2014-2020 versus 2007-2013, production gains were registered in cereals, wheat, maize, leguminous grains, in oil seeds, sunflower seeds and fruits, but losses by -4.14% in vegetables and -21.26% in potatoes. In 2020 versus 2007, yield level was accounted for 3,400 kg/ha cereals (+123.24%), 2,966 kg/ha wheat (+92.47%), 3,977 kg/ha maize (+160.61%), 1,858 kg/ha sunflower seeds (+184.09%), 15,843 kg/ha potatoes (+15.95%), 21,858 kg/ha tomatoes (+57.07%). In the period 2014-2020 versus 2007-2013, yield gain accounted for: +50.08% cereals grains, +44.7% wheat, +54.18% maize, +61.5% sunflower seeds, +13.13% potatoes and +12.83% tomatoes. In conclusion, the implementation of Romania's strategy of agriculture development in the vegetal sector aligned to CAP has resulted in higher productions and yields of the analyzed groups of crops, except potatoes production which declined by about 50% in 2020 compared to 2007, and also, in the 2nd decade 2014-2020 versus 2007-2013, it was registered a decrease by -4.14% in vegetables and by -21.26% in potatoes, which is justified by the decline in cultivated area. This performance is due to the efforts made by farmers to obtain better results in their business and to the financial support given by the EU and Romanian Government.

Key words: vegetal sector, cultivated area, production, yield, main agricultural crops, Romania

INTRODUCTION

In Romania's economy, agriculture one of the most important sectors as it plays a unique role to provide food for nourishing the

population, raw materials for industry and forages for animal rearing.

With 2.88 million farms, most of them family semi subsistence farms with about 4.2 ha average farm size, four times smaller than the EU average accounting for 17.4 ha and about

20% of the population employed in agriculture, Romania is able to produce about 10% of the EU grains and oil seeds production [4].

Its production potential is favoured by its geographical position, soil fertility, long tradition in vegetal production mainly in cereals and oil seeds plants cultivation.

There is no doubt that cereals, vegetables and fruits continue to be special components in human diet grace to the rich content in a large variety of bio-active substances like carbohydrates, fats, protein, vitamins, minerals and fibers [5, 31].

Besides France, Germany, Italy, Spain, Poland, Greece, Romania is an important producing country able to contribute by about 10% to the EU grain and oil seeds output [14]. The access of Romania into the EU in January 1st, 2007 has been in the benefit of the both sides:

-for Romania to align its strategy for the development of agriculture according to the EU Common Agricultural Policy and benefit of financial support for farmers and of the advantages of an open unique market without barriers stimulating the trade exchange and the competitiveness among the market players [3];

- for the EU to extend its market of material and human resources and of agro-food products.

Cereals are produced on large surfaces in Romania. Maize and wheat are the main cereals produced in the country, but also barley, oats and sorghum [12].

Their favorable zones are situated in South Muntenia, South Eastern Romania, South West Oltenia, and West [17, 18].

Maize and wheat are cultivated both in family farms but also in commercial farms, the last ones being deeply market oriented [21]. For its high performance, Romania is situated among the top maize producers in the EU [8].

When the internal requirements are covered, the surplus is destined to export and maize and wheat are the top exported agricultural products [9, 23].

When the domestic market is facing an insufficient production, imports are required to cover the deficit, and this leads to a

negative trade balance, reflecting a low efficiency in agro-food commerce [26, 27].

Climate change has become more visible in Romania during the last decades with a deep negative impact on the performance in agriculture due to the extreme meteorological phenomena like drought, low precipitations and high temperatures which also influence market price [16, 29, 30].

Oil seeds crops are also a well developed subsector of vegetal agriculture as their seeds are more and more called in edible oil industry, in energy industry and also for producing meals for animal feeding [5]. Larger surfaces are cultivated with sunflower and smaller areas with rape and soybean [13, 25].

Production performance is high and oil seeds are subject of export, Romania being among the top producing and exporting countries in the EU [24, 28].

A large range of vegetables are grown in Romania: tomatoes, cucumbers, green peppers, egg plants, pumpkins and roots (carrots, parsley, parsnip, celery, onion, garlic etc). However, the field production is of high risk for the farms where irrigation systems are missing or not enough, and for this reason cultivation in protected spaces like green houses has been intensified [7, 1].

The highest share in vegetables production belongs to tomatoes [15].

However, the domestic market needs have to be also covered by imports mainly in extra season [20].

Potatoes are a basic food in Romania but the cultivation areas declined and production as well due to the expensive farm inputs, climate change and invasion of imported potatoes at lower prices which disadvantaged local producers who carried out higher production costs [10, 11],

Fruit offer in internal market is not sufficient as production declined taking into account the reduction in the number of fruit trees and the surface of orchards. Romania could produce many types of fruits like: apples, plums, apricots, peaches, nuts, and also strawberry, raspberry, blueberry and black berry. But internal demand is not covered by domestic

output and imports are compulsory to complete the offer [2, 19].

Also, fruit production structure changed, plums passing on the top position and apples on the second one, as Romanians are accustomed to use plums not only as such or for preparing jams and canned fruit, but also for producing the traditional "plum brandy" [19, 22].

In this context, the purpose of this research paper was to analyze the dynamics of cultivated areas, production and yield for the main groups of crops: cereals, oil seeds plants, leguminous plants, vegetables, potatoes and fruits. The study was done separately for two periods of time after Romania's access into the EU: 1st decade 2007-2013 and 2nd decade 2014-2020 in order to identify the differences and find out if the adopted strategies for the development of the vegetal sector of agriculture aligned to the EU CAP reforms have been successful.

MATERIALS AND METHODS

The paper is based on the data provided by National Institute of Statistics for the period 2007-2020 regarding cultivated areas, agricultural production and yields for the main groups of crops: cereals, leguminous plants, oil seeds plants, vegetables and potatoes. Also, there were picked up data for production of fruits and tomatoes.

The main methods and procedures for processing the data were: the calculation of mean, using the formula: $\bar{x} = \frac{\sum xi}{n}$, where xi are the values of the cultivated areas/productions/yields across the time series 2007-2020 (i); n = number of years considered (n= 20); Fixed basis indices, $I_{FB} = (X_n/X_1) \times 100$; $S\%$ = structural indices, reflecting the share of each crop in the cultivated area or production; Growth rate $\bar{R} = (\bar{I} \times 100) - 100$; Regression models based on polynomial equations of second degree, $y = ax^2 + bx + c$, and coefficient of determination R^2 .

Comparisons were made along the considered period as a whole and also divided into two

decades: 2007-2013 and 2014-2020 in order to identify in what measure cultivated areas, productions and yields progressed after Romania's access into the EU when different CAPs were applied.

The results were illustrated in suggestive graphics and also in tables where the absolute and percentage differences between the 2nd decade 2014-2020 and the 1st decade 2007-2013 were emphasized.

RESULTS AND DISCUSSIONS

Cultivated area with agricultural main crops

Romania is one of the EU countries with a large cultivated area after Poland, Italy, Spain, France and Germany.

In the period 2007-2020, the two decades after Romania's access into the EU on January 1st, 2007, the cultivated area increased from 7,777,174 ha in 2007 to 8,263,672 ha in 2020, meaning +6.25% (Fig. 1).

In 2007, the crop structure in the cultivated area was the following one: 65.9% cereals, 17.25 oil plants, 3.4% potatoes, 3.2% vegetables, 0.5% leguminous plants and 9.8% other crops.

In the year 2020, in the total cultivated area, the cereals maintained their top position with a share of 64.6%, followed by oil plants with 20.3%, vegetables were ranked the 3rd with 2.4%, leguminous plants with 1.3% and 1% for potatoes. In the analyzed period, these changes in crop structure was caused by:

(a) the increased cultivated area with cereals by +4.07% from 5,129,183 ha in 2007 to 5,338,067 in 2020, by +25.35% growth in cultivated area with oil plants from 1,340,374 ha in 2007 to 1,678,832 ha in 2020, by +13.5% in cultivated surface with vegetables from 228,124 ha in 2007 to 259,029 ha in 2020 and by +146% increased cultivated area with leguminous crops for grains from 43,659 ha in 2007 to 107,443 ha in 2020;

(b) the decreased cultivated area with potatoes by -63.26% from 268,091 ha in 2007 to 98,498 ha in 2020 (Fig. 2).

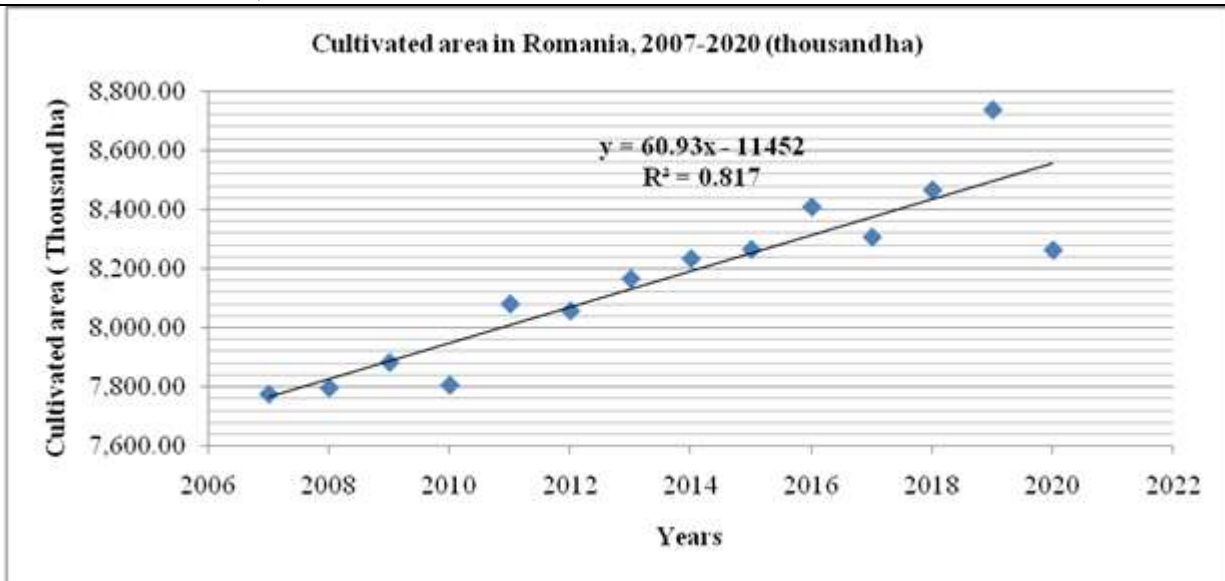


Fig. 1. Dynamics of the cultivated area in Romania in the period 2007-2020 (Thousand ha)
 Source: Own calculation and design based on the data from National Institute of Statistics.

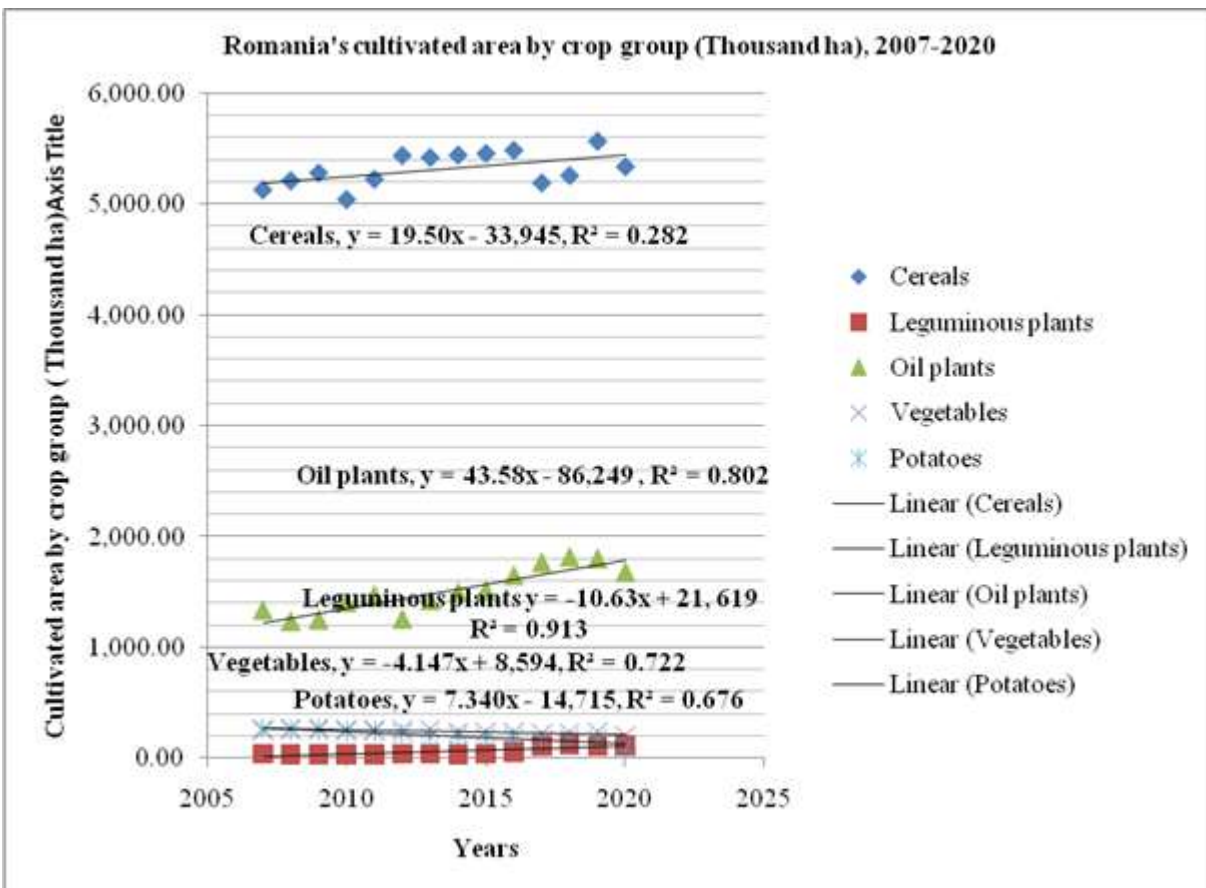


Fig. 2. Dynamics of the cultivated area by crops group in Romania in the period 2007-2020 (Thousand ha)
 Source: Own calculation and design based on the data from National Institute of Statistics.

Within cereals crops, maize and wheat are cultivated on the largest surface, whose dynamics in the studied period was the following one:

- in case of maize, the cultivated area increased by +0.49% from 2,524,706 ha in 2007 to 2,537,104 ha in 2020;
- in case of wheat, the cultivated surface increased by +9.12% from 1,975,022 ha in 2007 to 2,155,254 ha in 2020.

Therefore, maize and wheat keep together 4,499,728 ha, that is 87.7% in the cultivated area with cereals in 2007 and 4,692,358 ha, that is 87.9% in the year 2020 (Fig. 3).

The difference is covered by barley, oats and sorghum which are cropped on smaller surfaces.

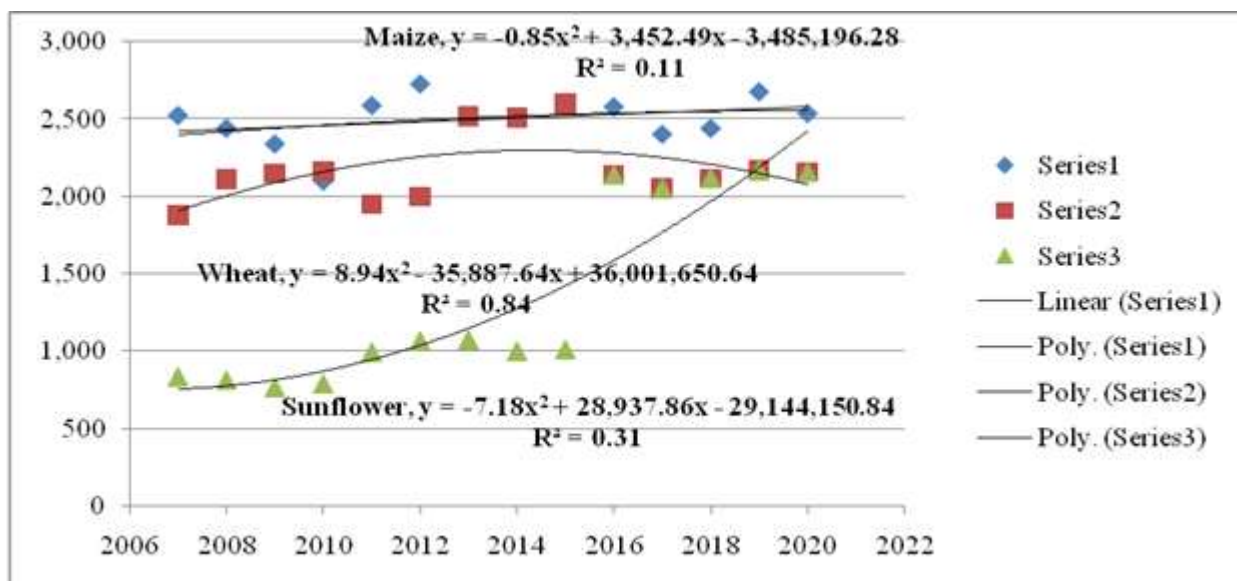


Fig. 3. Dynamics of the cultivated area with the main three crops: maize, wheat and sunflower in Romania in the period 2007-2020 (Thousand ha)
 Source: Own calculation and design based on the data from National Institute of Statistics.

Comparing the average cultivated area in the decade 2014-2020 with the one in the decade 2007-2013, we may easily notice important increases as follows: +5.59% in total cultivated area, + 2.73% in cereals areas, +2.8% in wheat area, +2.98% in maize area,

+115.64% in the area covered by leguminous plants, +24.42% in the area cropped with oil plants, +17.97% in sunflower area, but a decline by -13.47% in the cultivated area with vegetables and also by -30.29% in the cultivated area with potatoes (Table 1).

Table 1. Dynamics of the average cultivated area with the main agricultural crops in the decade 2014-2020 versus the decade 2007-2013 (ha)

Crop	Average 2007-2013 1st decade	Average 2014-2020 2nd decade	Differences 2nd decade - 1st decade	
			Absolute differences, ha	% differences
Total cultivated area	7,939,071	8,383,425	+444,354	105.59
Cereals	5,249,883	5,393,588	+143,705	102.73
Wheat	2,063,590	2,121,412	+57,822	102.80
Maize	2,463,060	2,536,640	+73,580	102.98
Leguminous plants for grains	41,086	88,601	+47,515	215.64
Oil plants	1,343,394	1,671,571	+328,177	124.42
Vegetables	261,872	226,602	-35,270	86.53
Potatoes	241,363	168,263	-73,100	68.71

Source: Own calculation based in the data from National Institute of Statistics.

These changes will have a deep impact on total productions and could justify the increase in export amounts of cereals and oil seeds grains and the imported quantities in vegetables and potatoes.

Production for the main agricultural crops
Cereals production increased from 7,814,825 tons in 2007 to 18,153,714 tons in 2020, meaning by +132.29%.

This was determined by the raised production in maize from 3,853,918 tons in 2007 to 10,096,689 tons in 2020, that is by 161.96% more and in wheat from 3,044,465 tons to 6,392,369, meaning a surplus of +109.96%. In consequence, the share of maize in total cereals production increased from 49.3% in

2007 to 55.61% in 2020, while the share of wheat declined from 38.95% to 35.2%. However, these two cereals crops have together the highest share in cereals production, as in 2007 they produced 6,898,383 tons grains, accounting for 88.27% and 16,489,058 tons in 2020, accounting for 90.83% (Fig. 4).

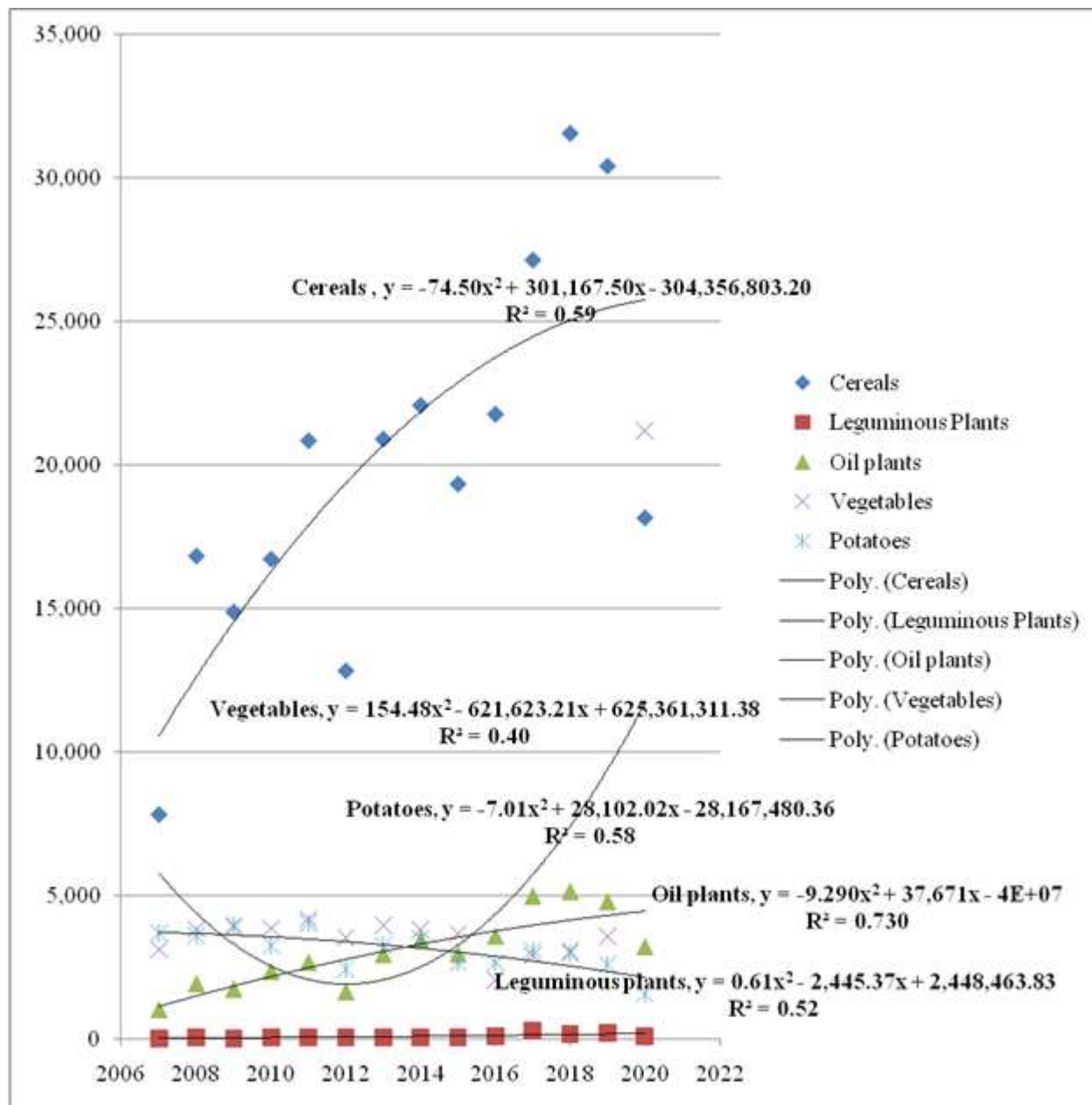


Fig. 4. Dynamics of the agricultural production for cereals, leguminous plants, oil plants, vegetables and potatoes in Romania in the period 2007-2020 (Tons)
 Source: Own calculation and design based on the data from National Institute of Statistics.

Leguminous grains production also had an ascending trend from 36,185 tons in 2007 to 121,978 tons in 2020, meaning by +237.09% more.

Oil seeds production increased by 208.51 % from 1,046,558 tons in 2007 to 3,228,766 tons in 2020.

Sunflower is the main crop with the highest contribution to oil seeds production and in a low measure rape and soybean.

Sunflower seeds production raised by 288,14% from 546,922 tons in 2007 to 2,122,865 tons in 2020. As a result, the contribution of sunflower to oil seeds output is the highest, accounting for 52.25% in 2007 and for 65.74% in 2020, due to the importance given to this crop not only in oil industry but also in energy industry for producing diesel.

Vegetable production also recorded an ascending trend from 3,116,801 tons in 2007 to 3,483,035 tons in 2020, reflecting a surplus of +11.75%. The main contribution to vegetable production is given by tomatoes and in a lower measure by other vegetables like cucumbers, pumpkins, onion, green peppers, carrots, celery, parsnip, garlic etc.

Potatoes production registered a decline from 3,116,801 tons in 2007 to 1,601,239 tons in 2020, meaning a loss of 48.63%. This was caused by many factors such as: climate change with high temperatures and low precipitations in the specific zones where potatoes are cultivated, the lack of irrigation systems and high tariff for irrigation water, the high price for other farm inputs (certified

seeds, fertilizers, pesticides etc) which resulted in a decline in the cultivated area and yield.

In consequence, the domestic market requirements had to be covered by imports which came mainly from Poland, being commercialized at lower prices affecting Romanian producers (Fig. 4).

Fruit production registered an ascending trend from 1,085,756 tons in 2007 to 1,590,795 tons in 2020, meaning +46.51% (Fig. 5).

This happened despite that the number of fruit trees declined by -23.66% from 96,384,568 in 2007 to 73,586,476 in 2020. But, the extend of new intensive plantations and use of varieties of high production potential favoured the growth of fruit production. However, it is still below the needs in the internal market and that is why imports are required not only for exotic fruits, but also for apples, pears, cherries, apricots, peaches etc.

The main contribution to fruit production is given by plum and apple trees and in a lower measure by cherry, apricot, peach, nuts trees and also by strawberry, raspberry, blueberry and blackberry plantations.

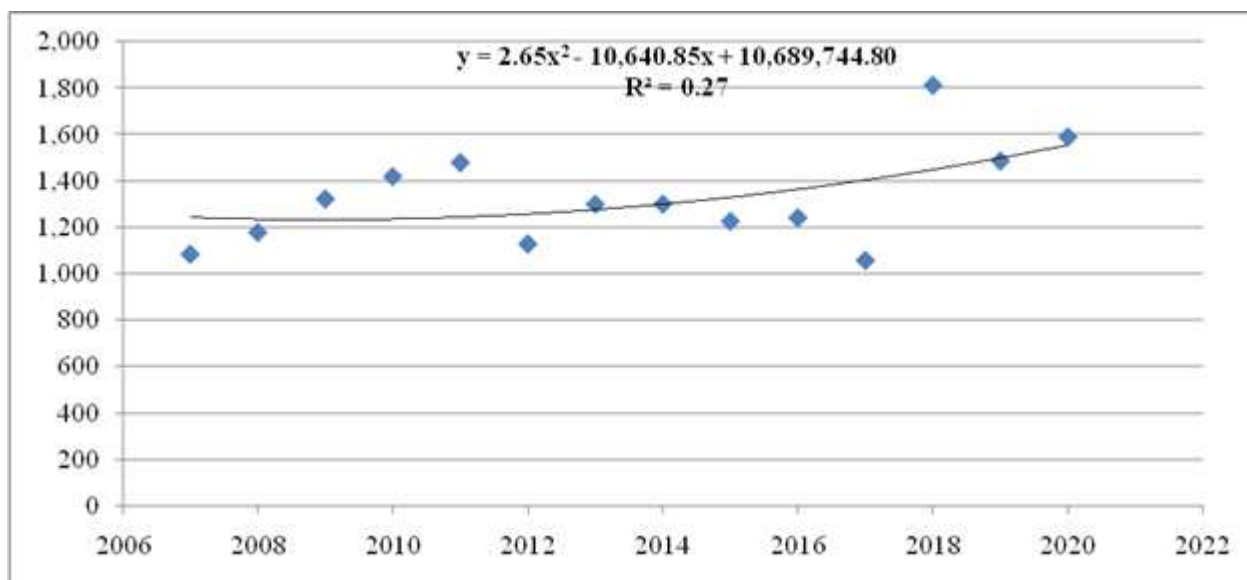


Fig. 5. Dynamics of the fruit production in Romania in the period 2007-2020 (Tons)
 Source: Own calculation and design based on the data from National Institute of Statistics.

While in 2007, apples accounted for 43.78% and plums for 34.31% in total fruit production, in the year 2020, on the top position there are plums with 48.39% and on

the second position came apples with 34.32%. This change is explained by the fact that in Romania it is prepared a traditional "plum

brandy" named "tzuica" which requires more plums.

Making the comparison between vegetal production carried out in the 2nd decade 2014-2020 with the one obtained in the 1st decade 2007-2013, we may identify the following aspects:

- the growth of production for cereals by +53.82%, for wheat by +48.53%, for maize by

+59.93, for leguminous grains by +157.21%, for oil seeds by +95.03%, for sunflower seeds by + 87.88% and for fruit production by +5.64%;

- a lower production for vegetables accounting for -4.14% and for potatoes by -21.26% (Table 2).

Table 2. Dynamics of vegetal production by main crops in the decade 2014-2020 versus the decade 2007-2013 (Tons)

Crop		2007-2013 1st decade	2014-2020 2nd decade	Differences 2nd decade - 1st decade	
				Absolute differences	% differences
Cereals	Mean	15,827,211	24,346,668	+8,519,457	153.82
	Total	110,790,477	170,426,676	+59,636,199	153.82
Wheat	Mean	5,852,214	8,692,353	+2,840,139	148.53
	Total	40,965,498	60,846,471	+19,880,973	148.53
Maize	Mean	8,242,047	13,182,184	+4,940,137	159.93
	Total	57,694,329	92,275,288	+34,580,957	159.93
Leguminous grains	Mean	60,983	156,860	+95,877	257.21
	Total	426,881	1,098,020	+671,139	257.21
Oil seeds	Mean	2,064,518	4,026,555	+1,962,039	195.03
	Total	14,451,626	28,185,885	+13,734,259	195.03
Sunflower seeds	Mean	1,343,921	2,524,981	+1,161,060	187.88
	Total	9,407,447	17,674,867	+8,267,420	187.88
Potatoes	Mean	3,497,245	2,753,777	- 743,468	78.74
	Total	24,480,715	19,276,439	-5,204,276	78.74
Vegetables	Mean	3,767,825	3,611,850	-155,975	95.86
	Total	26,374,775	25,282,950	-1,091,825	95.86
Fruits	Mean	1,273,721	1,388,410	+114,689	109.00
	Total	8,916,046	9,718,873	+802,827	109.00

Source: Own calculation based in the data from National Institute of Statistics.

Average production for the main agricultural crops

Yield performance is a result of many factors among which could be mentioned: geographical position of the farm, soil and climate conditions, farm size, technical endowment, technology applied, crop varieties and hybrids and their production potential, resistance to drought, diseases and pests, farm inputs in terms of seed quality, fertilizers and pesticides, farmers training level and his management skills and capacity and experience, and also the allotted subsidies by Government and the EU.

In Romania, after its access into the EU, the dynamics of yield for the main crops has performed as described below:

-In case of cereals, yield increased from 1,523 kg/ha in 2007 to 3,400 kg/ha in 2020

(+123.24%). The peak of average production was 5,999 kg/ha achieved in the year 2018 which was the most favourable agricultural year for cereals in Romania.

-Wheat yield increased from 1,541 kg/ha in 2007 to 2,966 kg in 2020, meaning by + 92.47%, but the peak of average production was 4,888 kg recorded in the year 2017. The worst years with droughts for wheat were 2007, 2009, 2012 and 2020.

-Maize yield went up from 1,526 kg/ha in 2007 to 3,977 kg in the year 2020, when it was by +160.61% higher. The peak of average production per surface unit accounted for 6,502 kg in the year 2019, the most favourable year for this crop. However, in the years 2007, 2012 and 2020, maize yield was deeply influenced by extreme meteorological

phenomena, drought being on the top position.

- *Sunflower seeds yield* increased from 654 kg/ha in 2007, the lowest level in the analyzed interval to 1,858 kg/ha in the year 2020, which means by +184.09% more. The peak of yield was 3,041 kg per surface unit recorded in the year 2018. The unfavourable years for sunflower crop which diminished drastically the yield were 2007, 2012, 2015 and 2020.

- *Potatoes yield* increased from 13,663 kg/ha in 2007 to 15,843 kg/ha in 2020, meaning by +15.95% more. The unfavourable years for potatoes crop were 2007, 2010, 2012 and 2015.

- *Tomatoes yield* raised from 13,916 kg/ha in 2007 to 21,858 kg/ha in 2020, which means a surplus of +57.07%. The peak of the average production accounted for 21,858 kg/ha in the year 2020 and the lowest level for 13,761 kg was registered in the year 2012 (Fig. 6).

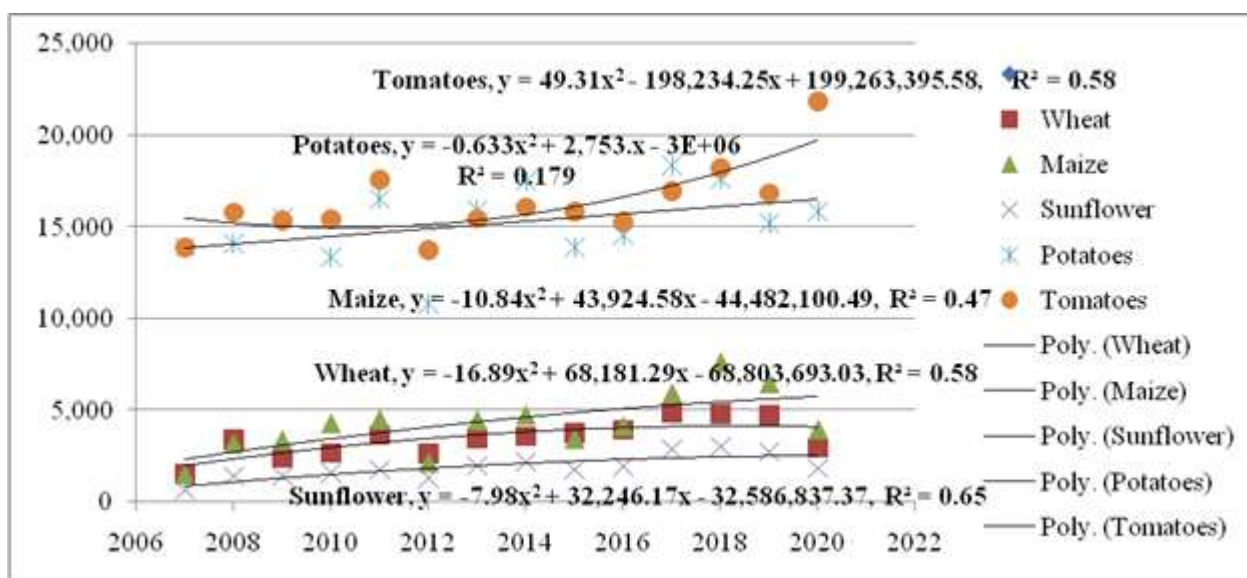


Fig. 6. Dynamics of the agricultural yield for wheat, maize, sunflower, potatoes and tomatoes in Romania in the period 2007-2020 (kg/ha)

Source: Own calculation and design based on the data from National Institute of Statistics.

Table 3. Yields by main crops and decades (kg/ha)

Crops	Average 2007-2013 1st decade	Average 2014-2020 2nd decade	Differences	
			Absolute differences	% differences
Cereals	3,011	4,519	+1,508	+150.08
Wheat	2,834	4,101	+1,267	+144.70
Maize	3,379	5,210	+1,831	+154.18
Sunflower	1,460	2,358	+898	+161.50
Potatoes	14,172	16,147	+1,875	+113.13
Tomatoes	15,345	17,315	+1,970	+112.83

Source: Own calculation based on the data from National Institute of Statistics.

Taking into account the average production performance in the 2nd decade 2014-2020 compared to yields level recorded in the 1st decade, we may notice important increases as follows: +50.08% for cereals grains, +44.7% for wheat, +54.18% for maize, +61.5% for sunflower seeds, +13.13% for potatoes and +12.83% for tomatoes (Table 3).

CONCLUSIONS

In the period 2007-2020, the cultivated area increased +6.25%, accounting for 8,263,672 ha in 2020. In 2020, in the total cropped area, cereals have a share of 64.6%, oil plants 20.3%, vegetables 2.4%, leguminous plants 1.3% and 1% potatoes.

The cultivated area with cereals raised by +4.07% from 5,129,183 ha in 2007 to 5,338,067 in 2020.

Maize and wheat are cropped on 4,499,728 ha, accounting for 87.9% of the cultivated area with cereals in the year 2020.

Compared to the decade 2007-2013, in the decade 2014-2020, the cultivated area increased by +5.59%, by + 2.73% in cereals areas, by +2.8% in wheat area, by +2.98% in maize area, by +115.64% in the area with leguminous plants, by +24.42% in the area with oil plants, by +17.97% in sunflower area, but it decreased by -13.47% in the area with vegetables and also by -30.29% in the cultivated area with potatoes.

Cereals production increased by +132.29% accounting for 18,153,714 tons in 2020, of which maize 55.61% and wheat 35.2%.

Leguminous grains production also increased by +237.09% and reached 121,978 tons in 2020.

Oil seeds production raised by 208.51 % and accounted for 3,228,766 tons in 2020, of which 65.74% sunflower seeds.

Vegetable production recorded a lower growth of +11.75% so that in 2020 it accounted for 3,483,035 tons in 2020.

Potatoes registered a decline of 49.63% of production and reached 1,601,239 tons in 2020.

Fruit production had an ascending and accounted for 1,590,795 tons in 2020, meaning by +46.51% more than in 2007.

Compared to the 1st decade 2007-2013, in the 2nd decade 2014-2020 it was carried out a higher production by +53.82% in cereals, by +48.53% in wheat grains, by +59.93 in maize grains, by +157.21% in leguminous grains, by +95.03% in oil seeds, by + 87.88% in sunflower seeds and by +5.64% in fruit. However, production declined by -4.14% in vegetables and by -21.26% in potatoes.

Yield level increased in the last 20 years by +123.24% in cereals, reaching 3,400 kg/ha in 2020, by + 92.47% in case of wheat which performed 2,966 kg in 2020, by +160.61% in case of maize which achieved 3,977 kg/ha in 2020, by +184.09% in case of sunflower which reached 1,858 kg/ha in 2020, by +15.95% in potatoes which achieved 15,843

kg/ha in 2020, by +57.07% in tomatoes which accounted for to 21,858 kg/ha in 2020.

Taking into account the average production performance in the 2nd decade 2014-2020 compared to yields level recorded in the 1st decade, the surplus of yield was: +50.08% for cereals grains, +44.7% for wheat, +54.18% for maize, +61.5% for sunflower seeds, +13.13% for potatoes and +12.83% for tomatoes.

Therefore, as final conclusion, even though we did not discuss anything about the detailed implementation of the EU CAP reforms in Romania in its own strategy of agriculture development, at the end of this study we could conclude that along the whole period of time and mainly in the 2nd decade, that is 2014-2020 it was noticed a real progress regarding productions and yields of the analyzed groups of crops in the vegetal sector.

The only exceptions are:

- the decline by about 50% in potatoes production in 2020 versus 2007;
- in the 2nd decade 2014-2020 versus 2007-2013, it was registered a decrease by -4.14% in vegetables and by -21.26% in potatoes, which is justified by the decline in cultivated area.

The efforts made by farmers to obtain better results in their business have not been in vain and the financial support given by the EU and Romanian Government have been of much help to sustain the development of agriculture in general, and especially the vegetal sector.

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