

## THE DEVELOPMENT OF AGRICULTURAL PRODUCTION IN ROMANIA IN THE PERIOD 2010-2019 - A STATISTICAL APPROACH

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**Abstract.** *The study aimed to analyze the evolution of Romania's agricultural production in the period 2010-2019, based on the data provided by National Institute of Statistics and using the fixed index, trend equations, and determination coefficient. The main indicators taken in account were: GDP created in agriculture, agricultural production value and the contribution of vegetal and animal production, cultivated area and productions for the main crops, livestock and production for the main animal farm species, as well as output per inhabitant. In 2019, agriculture proved to continue to have an important contribution to GDP (4.3%), the production value reached Lei 89.9 Billion (+39.5% versus 2010), of which 69.9% is produced by the vegetal sector and only 28% by the animal sector. Agriculture is dominated by cereals, maize and wheat being on the top positions with a share of 63.7% in the cultivated area and 82.15% in the cereals production. Oils seeds cover 20.6% of the cultivated surface, and sunflower achieves 69% of the oils seeds output. The livestock of bovines, pigs and poultry declined, while the number of sheep and goats, and also the bee colonies increased. Meat production in terms of live weight at slaughter raised by 14.5%, and the contribution of the farm species to meat output is: poultry 44.9%, pigs 34.2%, sheep and goats 8.5%. Milk output declined by 15.3% and egg production by 10.2%, while honey and wool output increased by 13.7% and, respectively, by 16.4%. As a result, production per inhabitant increased in general, but a decline was registered in case of milk, eggs, vegetables and potatoes. In consequence, the requirements of agro-food products on the domestic market have to be covered by imports. For sustaining the continuous development of the agricultural production there are needed effective solutions to the problems Romania's agriculture is facing at present as mentioned in this study.*

**Keywords:** agriculture, vegetal production, animal production, development, Romania

### 1. Introduction

Agriculture is an important sector of the country economy assuring the raw materials for food industry and other processing industries, for assuring food security for population, products for export from the production surplus, income for agricultural producers and also contributes to the preservation of biodiversity, landscape and traditions conservation and environment protection [7, 43].

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The complexity of agriculture as being a branch of material production is given by the specificity of farm structure, technologies, production systems and processes run in the vegetal and animal sector and labor force, and the economic performance is determined by the manner in which the three production factors: agricultural land, fixed, working and financial capital and human capital are used in a balanced way under the impact of the climate factors and changes [4, 21, 49].

Romania has 3.42 million farms and agriculture is considered a family business as long as 99.9% are family farms. Of the total 12.5 million ha utilized agricultural land (UAA), 54.8% is worked by family farms and the remaining by commercial companies. Agriculture is dominated by small farms, the average farm size is 3.64 UAA, by 4.55 times smaller than the EU-28 average [6].

In terms of standard output (SO), the most complex indicator reflecting the economic efficiency in agriculture, Romania comes on the 8th position for Euro 3,537 SO per farm in the EU-28 after France, Italy, Germany, Spain, United Kingdom, Poland and Netherlands.

The performance in agriculture is given by the people dealing with agriculture regarding its number, age and gender structure, training level and managerial skills.

Romania is considered a rural country as long as 45.9% of the population lives in the rural areas and its main occupation is agriculture [48]. In 2019, in agriculture labor force accounted for 1,331 Agricultural Work Units (AWU), meaning by 8.8% less than in 2010. The declining trend is not specific only to Romania, it is a general feature in the EU countries, due to many factors such as: ageing and changes in age structure, and migration to urban areas. The seasonality of the activities and production in agriculture determines as a low number of employed persons in agriculture, part time jobs are specific to this economic sector. In 2020, a number of 154 AWU belonged to the employed people in agriculture, meaning by 26.7% less than in 2010. As a result, the share of employed people in total labor force in agriculture is only 11.5% [12, 20]. Also, labor productivity in agriculture is smaller than in other economic sectors taking into account the small sized farms which dominates Romanian agriculture [39, 40, 50].

In this context, the paper aimed to analyze the dynamics of the agricultural production in Romania during the last decade, more exactly in the interval 2010-2019, using the empirical data provided by National Institute of Statistics. The main purpose was to identify the trend in the level of the main indicators characterizing agriculture development: GDP created in agriculture, agricultural production value and the contribution of vegetal and animal production, cultivated area and productions for the main crops, livestock and production for the main animal farm species, as well as production obtained per inhabitant.

## 2. Materials and Methods

This research is based on the data provided by National Institute of Statistics for the main indicators characterizing agriculture in the last decade, more exactly, in the period 2010-2019.

The indicators analyzed in this study were: GDP obtained in agriculture, the share of GDP produced in agriculture in Romania's GDP, agricultural production value and the contribution of vegetal and animal sector to agriculture output, cultivated area and its structure by the main crops (cereals, oil seed plants, oleaginous plants, medicinal and aromatic plants), vegetal production for the main crops, livestock (bovines, swine, sheep and goats, poultry, bee colonies) and animal production (meat in terms of live weight at slaughter, milk, egg, honey, wool).

Also, at the end it was presented the production level per inhabitant.

From a methodological point of view, Fixed basis index,  $I_{FB\%} = (y_n/y_1) \times 100$  was used in order to show how much increased or declined the level of an analyzed indicator in the year 2019 compared to its level in 2010.

Regression equations of different types either linear or polynomial of the 2nd degree,  $Y = bx + a$ , and, respectively,  $Y = ax^2 + bx + c$  were used for explaining the trend line of the analyzed indicators over the time.

Also, the coefficient of determination,  $R^2$ , was used for reflecting in which measure the variation of an indicator was influenced by the time variation.

The results were illustrated in charts and tables, and were accompanied by the corresponding comments. The main ideas resulting from this research work have been drawn at the end of the statistical research and included in the conclusions.

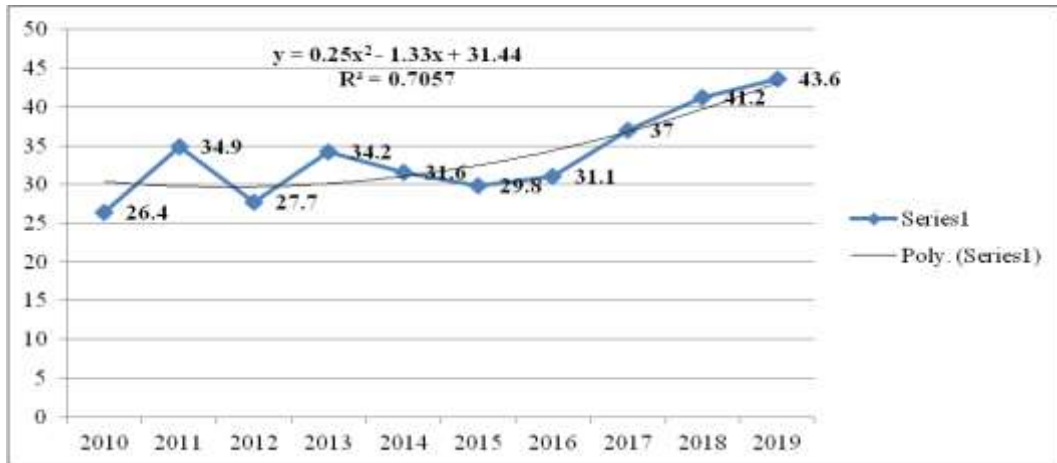
## 3. Results and Discussions

### 3.1. Dynamics of Gross Domestic Product in agriculture

One of the forms in which agriculture development is quantified and represent its contribution to the economic growth is reflected by the evolution of the gross domestic product created in this sector of the national economy [7, 8, 21]. During the analyzed decade, GDP created in Romania's agriculture increased from Lei 26.4 Billion in 2010 to Lei 41.2 Billion in the year 2019, meaning a surplus of +56%. The general increasing trend was marked by a few inflexions in the years when agricultural production was deeply affected by climate factors especially by drought in 2010, 2012 and 2015 (Fig. 1).

If in 2010, the share of the GDP created in agriculture in Romania's GDP accounted for 4.9%, in 2019 its weight declined to 4.3%. It is a normal trend explained by the high growth rate in other sectors of the economy, and even

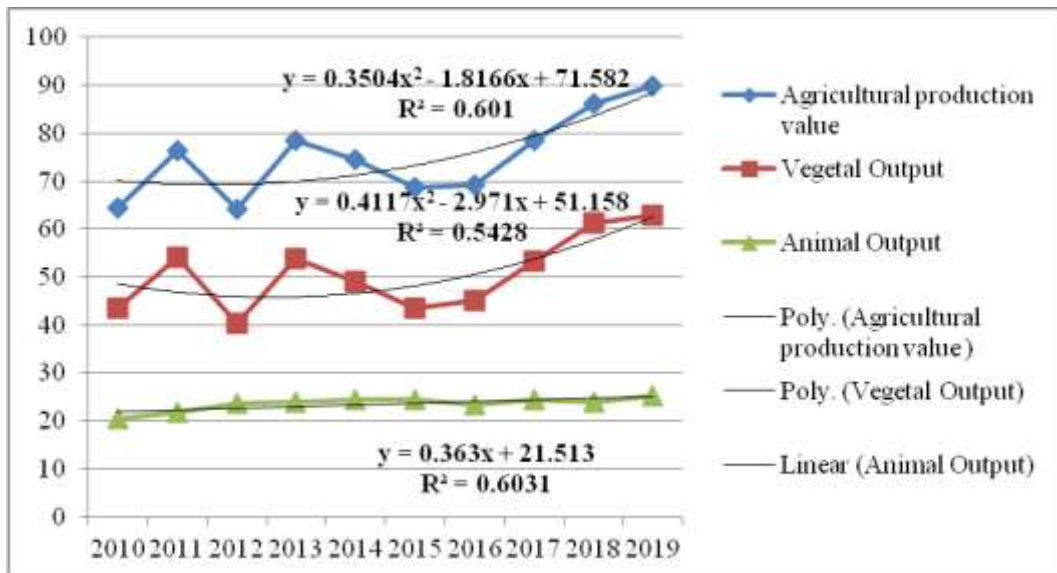
though the agricultural GDP raised, its growth rate is lower than the average growth rate in the national economy.



**Fig. 1.** Dynamics of GDP in Romania's agriculture in the period 2010-2019 (Lei Billion)  
Source: Own design and processing based on NIS Data, 2021 [11].

### 3.2. The value of agricultural production

The value of agricultural production is one of the main indicators of the national accounts in the field whose dynamics reflects the development of agriculture [1, 3].



**Fig. 2.** Dynamics of Romania's agricultural output by the two main sectors in the period 2010-2019 (Lei Billion)

Source: Own design and processing based on NIS Data, 2021 [11].

Regarding the total agricultural output, Romania registered a relatively general ascending trend from Lei 64.4 Billion in 2010 to Lei 89.9 Billion in 2019, meaning +39.5%. In the vegetal sector, the growth rate on the whole period was +44.5%, as the production value raised from Lei 43.5 Billion in the first year of the analysis to Lei 62.9 Billion in the last one. Compared to the vegetal sector, the animal sector registered only +23.5% growth rate in the analyzed decade, its production value increasing from Lei 20.4 Billion in 2010 to Lei 25.2 Billion in 2019 (Fig. 2).

Taking into account the absolute values, the share of the two main sectors of agriculture has changes over the time, but it proved that the vegetal sector has the highest contribution to agricultural output: 67.5% in 2010 and 69.9% in 2019, while the animal sector diminished its weight from 31.6% in 2010 to 28% in 2019. Therefore, in Romania, the main feature of agricultural output is the unbalanced contribution of the main sectors, the vegetal sector producing 2.5 times more production value than the animal one.

### **3.3. Development of the vegetal sector**

The development of the vegetal sector was deeply influenced by farms structure, crop structure in close relation to their suitability to the local soil and climate conditions, the varieties and hybrids production potential, resistance to drought, pests and diseases, technologies applied, farmers' training level and managerial skills.

Production level was also determined by the cultivated area which has been extended year by year reaching 8,737 thousand ha in 2019, when it was by 24.7% higher than in 2010.

The main groups of crops cultivated in Romania are: cereals (maize, wheat, barley, oats, sorghum etc) [35, 44, 46], oil seeds crops (sunflower, rape, soy bean) [16, 36, 42, 45, 47], the leguminous plants (beans, peas etc), vegetables (tomatoes, cucumbers, egg plants, green peppers, carrots etc) [19, 29] and medicinal and aromatic plants.

However, the main attention is paid to cereals, oil seeds and also to vegetables which have to cover the needs of the domestic market and also to contribute to Romania's export with agricultural products.

#### ***Cultivated area by main crops***

In 2019, the cereals were cultivated on 5,560 thousand ha, by 10.4% more than in 2010, the extended areas were mainly for maize and wheat and also for sorghum. Cereals cover 63.7% of the cultivated area being on the top position.

Oil seed plants come on the 2nd position with a share of 20.6% in the cultivated area in 2019, meaning 1,801 thousand ha and vegetables are on the 3rd position with a share of only 2.6% in the cropped surface.

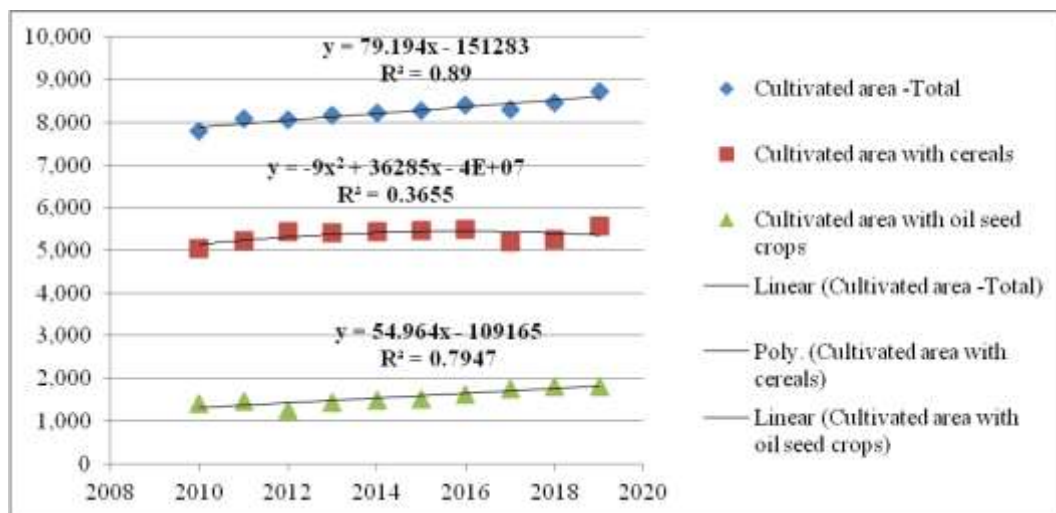
However, if the cereals, oil seed crops and leguminous plants are cultivated on higher areas in 2019 compared to 2010, the surface cultivated with vegetables declined in the last decade by 13.33% and the one cultivated with medicinal and aromatic plants decreased by about 89.4% (Table 1).

**Table 1.** Cultivated area by main crops in Romania in 2019 versus 2010 (Thousand ha)

	Cultivated area- Total	of which:				
		Cereals	Oil seed crops	Vegetables	Leguminous plants	Medicinal and aromatic plants
2010	7,807	5,040.6	1,410	262.7	37.6	15.9
2019	8,737.3	5,569	1,801	227.7	115.9	1.7
2019/2010 %	124.7	110.4	127.7	86.67	308.2	10.6
Share in the cultivated area in 2019 (%)	100.0	63.7	20.6	2.6	1.3	0.01

Source: Own calculation based on the data from NIS, 2021 [11].

Therefore, in Romania's agriculture, cereals and oil seed plants have a share of 84.3% in the total cultivated area, being the dominant crops (Fig. 3).



**Fig. 3.** Dynamics of the cultivated area: total, cereals and oil seed crops, 2010-2019 (Thousand ha)

Source: Own design and processing based on NIS Data, 2021 [11].

**Vegetal production by main crops**

Cereals production increased by 81.9% reaching 30,412 thousand tons in 2019. The main cereal is maize whose production accounted for 17,432 thousand tons, representing 57.3% of the total cereal output. Maize production was by 92.7% higher in 2019 compared to 2010.

On the 2nd position is wheat which produced 10,297 thousand tons grains in 2019 by 77.16% more than in 2010. its share in the cereal production is 33.85%.

Also, barley and two row barley produced 1,880 thousand tons, by 43.4% more than in 2010, and the contribution of this crop to the total cereal production is 6.18%.

Sorghum registered almost a triple production in 2019, accounting for 320.8 thousand tons, compared to 2010, its weight in the cereal output accounting for 1.05% [9, 10].

Regarding oil seed crops, their total output in 2019 accounted for 4,792.4 thousand tons including only three crops: sunflower, rape and soybean. The highest share belongs to sunflower, 69% due to its importance in oil industry and also for export. Its seed production reached 3,569 thousand tons being by 182.5% higher than in 2010. Rape produced 798 thousand tons, 5.74 times more in 2019 than in 2010, while soybean reached 425.4 thousand tons being 2.8 times higher than in the first year of the studied period.

Vegetable production registered a decline in connection with the reduced cultivated area and high input costs. In 2019, there were produced 3,530 thousand tonnes vegetables by 8.65% less than in 2010 [29].

Potatoes, which are a basic food in the population consumption, produced an output of 2,627 thousand tons being by 20% smaller in 2019 compared to 2010.

Also, in horticulture there were many problems related to the ageing of the plantations, the need of investments in new plantations, the damages produced by extreme weather phenomena during flowering which affected production, storage etc. [28].

**Table 2.** Agricultural production by main crops in Romania in 2019 versus 2010 (Thousand tons)

	Cereals production	of which:				Oil seed production	of which:			Vegetables	Potatoes
		Maize	Wheat	Barley	Sorghum		Sunflower	Rape	Soybean		
2010	16,713	9,042	5,812	1,311	18.7	2,377.6	1,263	139	150	3,864	3,284
2019	30,412	17,432	10,297	1,880	60.0	4,792.4	3,569	798	798	3,530	2,627
2019/ 2010 %	181.9	184.7	177.1	143.4	320.8	201.5	282.5	574.0	532.0	91.3	79.9

Source: Own calculation based on the data from NIS, 2021 [11].

This was caused by the high production costs, climate change and the cheaper import from Poland which invaded the market and affected local producers [5]. In this situation, the internal production could not satisfy consumption needs and imports were claimed to complete the offer (Table 2).

### 3.4. Development of animal sector

#### *Livestock dynamics*

The number of farm animals registered a general decline regarding bovine species, pigs, poultry and horses and an increase in sheep and goats and also in bee colonies [9, 10].

Cattle livestock accounted for 1,923 thousand heads in 2019, being by 3.9% smaller than in 2010. The number of swines diminished by -29.37% so that in 2019 in the country there were only 3,834 thousand pigs compared to 2010. The decline in pig livestock reflects the crisis of this species, despite that pork is traditional in the Romanians' consumption, but pig breeders have been and still are deeply affected by the African fever, high input costs, the lack of piglets in the market, and the cheaper pork imports [22, 25, 41].

In case of sheep and goats, their number raised by 23.07% and, respectively 28.5%, accounting for 10,359 thousand sheep and 1,595 thousand goats in 2019. This reflected the continuous tradition in raising sheep for milk, cheese and wool and the fact that live sheep are exported to the Arab countries and also the increased importance of goats for their special milk quality [18, 33].

Poultry livestock decreased by 6.78%, accounting for 75,365 thousand heads in 2019. The decline affected especially the laying hens due to the imported eggs and in a lower measure broilers fattening, because Romania is an exporter of poultry meat of high quality. Horses lost 33.6% of its livestock, remaining just 406 thousand heads in 2019 in the rural households.

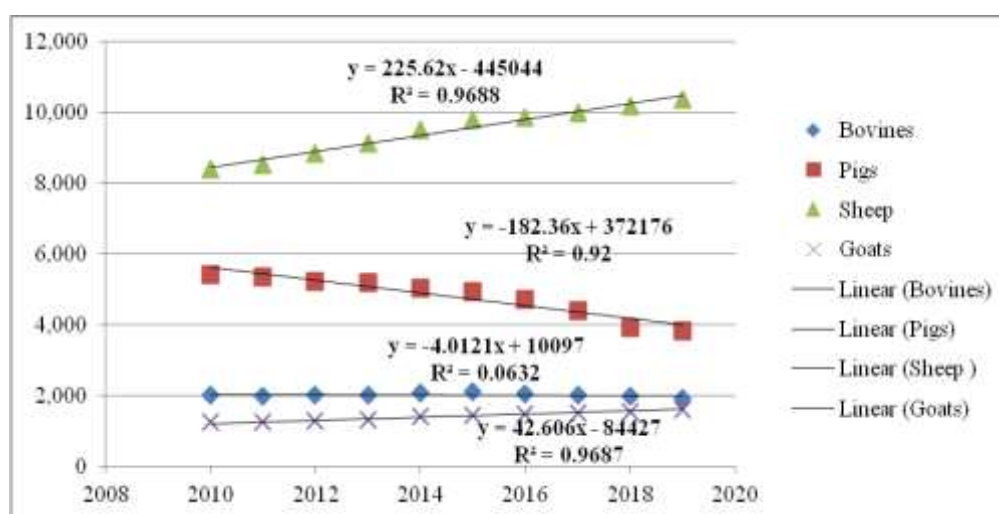
Bee families increased their number to 1,843 thousand colonies in 2019, being by 44.5% more than in 2010 due to their importance for producing honey and other bee products, for intensifying the export of high quality honey, for their role in crop and wild flora pollination, and for maintaining the landscape and biodiversity [13, 17, 26, 27, 32, 38] (Table 3).

**Table 3.** Dynamics of the livestock by species in 2019 versus 2010 (Thousand)

	Bovines	Pigs	Sheep	Goats	Horses	Poultry	Bee families
2010	2,011	5,428	8,417	1,241	610.8	80,844	1,275
2019	1,923	3,834	10,359	1,595	406	75,365	1,843
2019/2010 %	96.1	70.6	123.0	128.5	66.4	93.22	144.5

Source: Own calculation based on the data from NIS, 2021 [11].





**Fig. 4.** Dynamics of livestock: bovines, pigs, sheep and goats, 2010-2019 (Thousand heads)  
 Source: Own design and processing based on NIS Data, 2021 [11].

### **Animal production**

The decline in animal livestock at a several species had a negative impact on production level.

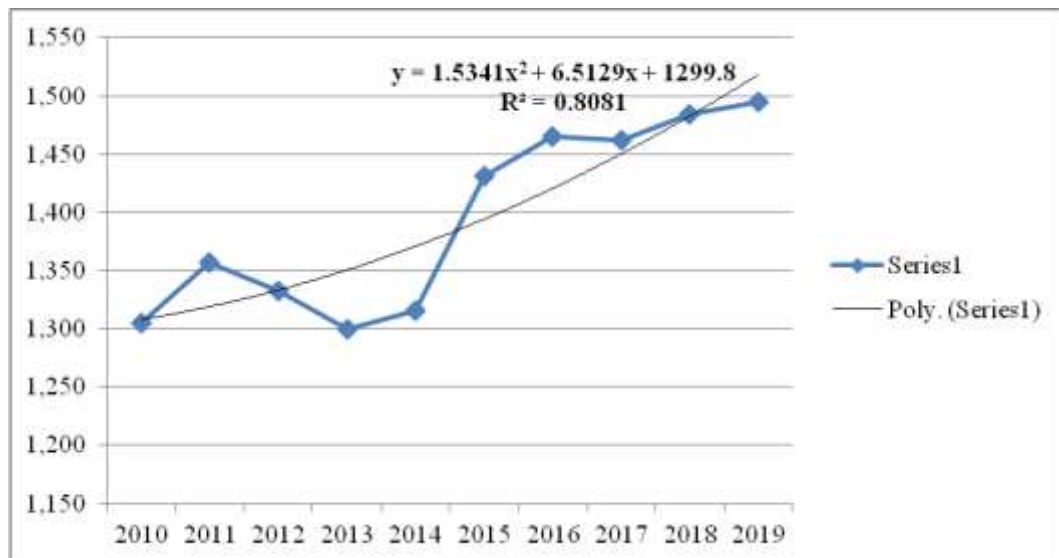
*Meat production* in terms of animal live weight at slaughter registered 1,495 thousand tons in 2019, being by + 14.5% higher than in 2010, while the total live weight at slaughter for bovines declined by 12.85, for swine by 7.3%, but for poultry and sheep and goats raised by 50.6% and, respectively, by 27.8% in the analyzed decade [30, 41].

Therefore, in the total live weight at slaughter in 2019, which accounted for 1,495 thousand tons, the contribution of various species was: 11.92% for bovines, 34.27% for swine, 44.96% for poultry and 8.5% for sheep and goats (Table 4 and Fig. 5).

**Table 4.** Dynamics of meat production in terms of live weight at slaughter by species in 2019 versus 2010 (Thousand tons)

	Live weight at slaughter	of which:			
		Bovine	Pigs	Sheep and goats	Poultry
2010	1,305	205.3	552.7	99.5	446.4
2019	1,495	179.2	512.4	127.2	672.3
2019/2010 (%)	114.5	87.2	92.7	127.8	150.6
Share in total live weight in 2019 (%)	100.0	12.0	34.3	8.6	45.1

Source: Own calculation based on the data from NIS, 2021 [11].



**Fig. 5.** Dynamics of meat production in terms of animal live weight at slaughter, 2010-2019 (Thousand Tons)

Source: Own design and processing based on NIS Data, 2021 [11].

*Milk production* declined in the analyzed period by 6% from 44,799 thousand hl in 2010 to 42,113 thousand hl in 2019. This was due to the decrease of the number of dairy cows and heifers and female buffaloes and had a negative impact on milk offer for processing industry. Therefore, consumption of milk and dairy products had to be covered by imports [31, 34].

Analyzing milk production by species, cow and buffalos milk output decreased by 7.35 from 38,494 thousand hl in 2010 to 35,706 thousand hl in 2019. As a result, the contribution of the cows and buffalos to total milk production declined from 85.9% in 2010 to 84.7% in 2019.

At the same time, milk production from sheep and goats increased by 1.6%, accounting for 6,407 thousand hl in 2019. As a result, its share in total milk output went up from 14.07% in 2010 to 15.21% in 2019.

*Egg production* recorded a decline as a result of the decrease in the number of laying hens. In 2019, egg production accounted for 5,564 million pieces, by 10.25% less than in 2010 [37].

*Honey production* was sustained by subsidies from the EU which encouraged beekeepers to raise more bee families. In 2019, Romania achieved 25,269 tons honey by +13.7% more than in 2010. The high quality of the Romanian honey stimulate its export especially to the countries from the Western Europe [15, 32, 34, 38].

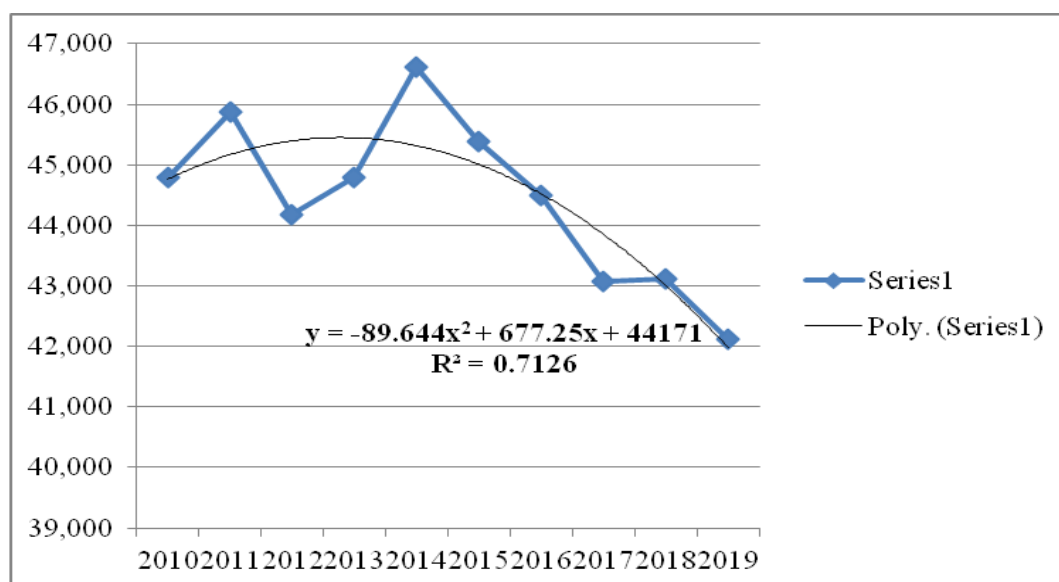
*Wool production* registered a surplus of +16.4% in the last decade as the livestock of sheep increased. In 2019, Romania achieved 23,824 tons wool but it could be

not industrially processed only in an artisanal manner by various sheep breeders (Table 5).

**Table 5.** Dynamics of milk, egg, honey and wool production in Romania, in 2019 versus 2010

	Milk production (Thousand hl)	of which:		Eggs Million pieces	Honey Tons	Wool Tons
		Cow and buffalos milk				
2010	44,799	38,494	6,305	6,199	22,222	20,457
2019	42,113	35,706	6,407	5,564	25,269	23,824
2019/2010 %	94.0	92.7	101.6	89.75	113.7	116.4

Source: Own calculation based on the data from NIS, 2021 [11].



**Fig. 6.** Dynamics of total milk production, 2010-2019 (Thousand hl)  
 Source: Own design and processing based on NIS Data, 2021 [11].

### 3.5. Production per inhabitant

The changes in vegetal and animal production and also in the number of population in the last decade in Romania has resulted in a different level of production per inhabitant from a year to another [11].

Taking into consideration the main agricultural products, in the interval 2010-2019, production per inhabitant increased 2 times in case of maize grains, 1.85 times for wheat, 2.95 times for sunflower seeds, 1.1 times for fruit, 1.2 times for meat. Also, production per inhabitant declined by 6.4% in case of potatoes, by

4.51% for vegetables, by 1.82% in case of milk and by 6.21% in case of eggs (Table 6).

**Table 6.** Dynamics of production per inhabitant in Romania, in 2019 versus 2010

	Maize kg	Wheat kg	Sunflower seeds kg	Potatoes kg	Vegetables kg	Fruit kg	Meat kg	Milk liters	Eggs Pieces
2010	446.6	287	62.4	162.2	190.8	70.1	64.5	242.7	306
2019	899.9	531.6	184.3	135.6	182.2	76.8	77.2	238.3	287
2019/ 2010 (%)	201.5	185.2	295.3	83.6	95.4	110.1	119.6	98.1	93.7

Source: Own calculation based on the data from NIS, 2021 [11].

### **3.6. The main problems which have to be solved in Romania's agriculture to increase agricultural production**

The main challenges Romania's agriculture is facing at present are the following ones:

- the impact of climate change on the agricultural production; the extreme weather phenomena and especially the long and severe droughts have affected production and many farmers were in danger to fail; for escaping from their critical financial situation, some farmers sold a part of their assets (land and equipments) in order to pay their debts, employees and to survive, especially in the South Eastern part of the country;
- the decline in the number of the companies operating in agriculture due to the pressure of the climate change negative impact [23];
- the lack of investments in agriculture, mainly in irrigation systems and especially in the South and South East of Romania which are the most affected regions by droughts;
- the lack of land reclamation measures such as drainage works and against soil erosion;
- farm structure dominated by small farms, which have to joint their forces in order to be able to apply modern technologies and get a higher productivity and economic efficiency;
- the low endowment in agriculture, where over 90 % of small farms have no tractor;
- the gap between the production performance in the vegetal sector compared to the animal sector, in term of contribution to the agricultural output;
- the high prices for farm inputs which increase production costs and the low acquisition price offered to the agricultural producers at the farm gate, which have a deep impact on gross margin and net income of the farmers [14, 24];

- the insufficient subsidies, aids and compensations offered to the farmers [2];
- the aging of labor force, improperly age structure of the population working in agriculture, migration, the small number of young farmers and low training level of the farm workers and managers;
- the use on a large scale of uncertified seeds, especially by the small farmers, the lack of support offered for seed treatments in order to assure plant protection;
- the lack of a viable credit system which could financially support the farmer managers under advantageous conditions.

### **Conclusions**

(1) The study proved that despite the big problems Romania's agriculture is facing, agricultural production increased and was impelled by the country's accession to the EU, which has been a pressure factor for the fast reform in the Romanian agriculture.

However, the multitude of small holdings and their problems related to technical endowment, labor force and financial capital has led to a slow development compared to other countries with high developed agriculture in the EU.

(2) Despite all the challenges in Romania's agriculture, agriculture remains an important branch in the national economy giving its contribution to food security, industry and export development, and 4.3% to GDP.

(3) Romania's agriculture is dominated by the vegetal sector which contributes by 69.9% to the total agricultural output accounting for Lei 89.9 Billion in 2019. Cereals are the main crops accounting for 63.7% in the cultivated area country and their contribution to agricultural production is 21% and 32% in vegetal production. Maize and wheat have the highest share in the cereal production: 57.3% and, respectively, 33.8%.

(4) Also, the oil seed plants come on the second position occupying 20.6% of the cultivated surface, being important for oil industry and export and as a valuable resource for producing renewable energy. Sunflower has 69% weight in oil seeds output.

(5) Vegetables cover the internal market and offer a surplus for export, but also import is required in the extra season to cover the needs of the domestic market. Fruit sector is in decline and the climate change affected production during the last decade, and this claimed as important amounts of fruit to be imported to enlarge the offer.

(6) Animal sector is in a deep decline, contributing with only 28% to the agricultural production value, determining a huge discrepancy compared to vegetal sector compared to other EU countries. The decline in bovine, pigs, and poultry livestock and the growth in sheep and goats number and bee colonies had a deep influence on production, export, import and agro-food trade balance.

(7) The contribution of the species to the live weight at slaughter is 44.9% poultry, 34.% pigs, 8.5 % sheep and goats. Milk output declined by 15.3% and egg production by 10.25, while honey production increased by 13.7% and wool by 16.4%.

(8) Imports of food of animal origin, fruit and even vegetables are higher and higher to cover the consumption requirements on the domestic market.

(9) The agricultural potential of Romania has to be much better valorized for increasing agricultural production. The solutions which have to be found to the challenges determined by the main problems of the Romanian agriculture as presented above could be welcome to boost agriculture production development.

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