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# ANALYSIS OF TECHNICAL AND ECONOMIC INDICATORS FOR MAIZE CULTURE IN THE PERIOD 2007-2017

DANIELA NICOLETA BĂDAN<sup>1</sup>

**Summary:** *Maize, original from America, ranks third in the top of cereal crops as importance and ranks second in the international top, after wheat cultivation, these positions being acquired due to a series of particularities I presume: high production capacity, wide area spreading, ecological elasticity and the fact that it is a good precursor for most crops. The present study analyzes, at national level, both the technical indicators (cultivated area, average production) and economic indicators (prices, subsidies granted per hectare, economic balance) for maize crop in the period 2007-2017. By using the methods of statistical analysis, we will follow the evolution of the statistical data series studied, the purpose of the paper being to highlight both the technical and economic aspects of the studied culture, the dynamics and the importance of the maize culture referring to the demand of the internal market.*

**Keywords:** *indicators, average production, price, economic balance*

**JEL classification:** *Q 10, Q 11, Q18*

## INTRODUCTION

Maize represents the third cereal crop, as important and is placed second after the wheat, in the top of international trade. This position can be motivated by the prism of some series of particularities that are held by this crop, phytotechnical and biological, such as: the production capacity greater than 50% than the other cereals, it has a high propagation coefficient, it adapts very well to the dry climatic conditions and in the heat, etc.

Regarding the use of maize, about 20% of the world production is used for human nutrition, with a substantial difference in the consumption of maize grains in food in developed countries compared to developing countries, 7% and 60% respectively. In the zootechnical sector, this category of cereals is used for animal feed, having a decisive role in its modernization and development.

In the specialized literature we find a lot of specialized works on maize crop research, being of national and international interest the development of maize hybrids resistant to climate change and with high yield, but also of the evolution of the prices of this cereal product.

## MATERIALS AND METHODS

The study aims to highlight the importance of maize culture by qualitatively analyzing the evolution of technical and economic indicators during 2007-2017.

The statistical data used in the study were provided from the specialized sites such as: National Institute of Statistics (INS), MADR, Trade Map and Eurostat and specialized documents.

The paper includes a study that goes on for a long period (10 years), taking into consideration the variable surfaces and total yields for the grain maize crop.

The processing of the chronological data series will be carried out with the help of absolute, relative and average indicators. The statistical analysis of some chronological series is based on a system of indicators that can characterize multiple quantitative relationships within the series and during the period to which the data taken in the study refer.

Absolute indicators indicate how much the level of an indicator has changed over a particular period over a long period as a basis of comparison. These are:  $y_i$  - the absolute levels of the series terms;  $\Delta_{i/0}$  - absolute change calculated on a fixed basis;  $\Delta_{i/i-1}$  - absolute change calculated based on the chain.

The relative indicators indicate the dynamic index that shows how many times the variable increases / decreases from one unit of time to another. These are:  $I_I$  - the dynamic index calculated as a fixed basis;  $I_{I/I-1}$  - the dynamic index calculated based on the chain;  $R_{I/0}$  - the rate of increase /

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decrease found in the specialized literature and under the name of index of the rate of increase, calculated on a fixed basis;  $R_{I/I-1}$  - the rate of increase / decrease calculated based on the chain;  $A_{I/0}$  - the absolute value of an increase / decrease percentage with a fixed base;  $A_{I/I-1}$  - the absolute value of a percentage increase / decrease based on the chain. [1]

Average indicators will indicate the average level and absolute changes.

- The average dynamic index:  $I = \sqrt[n]{\prod I_t/t - 1} = \sqrt[n-1]{y_n/y_1}$ .

- The average growth rate shows how much the respective phenomenon has increased in relative sizes, over the analyzed period, on average from one interval unit to another.  $R = I * 100 - 100$ .

## RESULTS AND DISCUSSIONS

In 2017, Romania was in the first place among the member states of the European Union regarding the cultivated areas and the production obtained with corn kernels and sunflower, according to the NIS data.

In 2017, the area cultivated with corn represented 47% of the area cultivated with cereals for grains, and that of wheat by 39.7%. According to the data in table no. 1, it was found that the evolution of the areas cultivated with maize followed an increasing trend in the period 2007-2015 (2.5 million ha, respectively 2.6 million ha). During the period analyzed 2007-2017, the area cultivated with maize registered an annual rate of decrease of 0.50%.

Table 1. Evolution of grain corn surfaces and yields

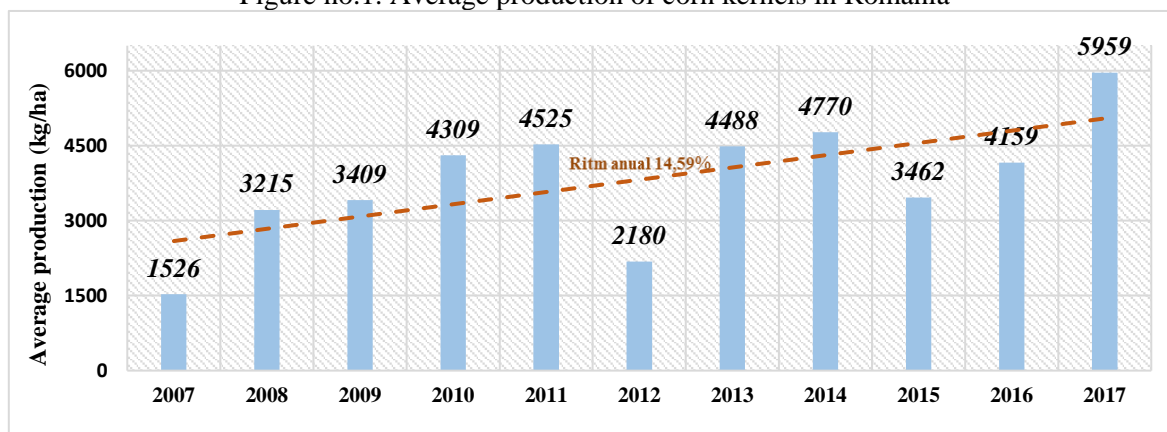
Specifications	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Annual ritm
Area (thousands ha)	2525	2445	2339	2098	2590	2730	2518	2513	2605	2581	2402	-0.50
Total production (thousand tons)	3854	7849	7973	9042	11718	5953	11305	11989	9021	10746	14326	14.03

Source: INSSE

In terms of grain maize production, it followed an increasing trend throughout the study period, registering an annual rate of 14.03%.

The average production of maize registered an annual rate of 14.59% for the period 2007-2017. The maximum value of this was 5.95 tonnes / ha in 2017, and the minimum value was registered in 2007, with an average production of 1.5 tonnes / ha.

Figure no.1. Average production of corn kernels in Romania



Source: INS data processing

With the help of the data from table no.1, the calculation methods mentioned above can be applied. In the tables no.2 and 3 can be observed changes of the surface as well as of the production for the maize crop both from one year to another but also compared to the base year, in this case, the year 2007.

Table no.2 Absolute changes in the area of maize

Year	Area (ha)	Absolute changes (ha)	
		With a fixed base $\Delta t/t-1=y_t-y_1$	Chain based $\Delta t/t-1=y_t-y_{t-1}$
2007	2524706		
2008	2441461	83245	-83245
2009	2338766	185940	-102695
2010	2098394	426312	-240372
2011	2589667	-64961	491273
2012	2730157	-205451	140490
2013	2518268	6438	-211889
2014	2512809	11897	-5459
2015	2605165	-80459	92356
2016	2580975	-56269	-24190
2017	2402082	122624	-178893

Source: processing based on statistical data

Table no.3 Absolute changes in the production of maize

Year	Production (tonns)	Absolute changes( tonns)	
		With a fixed base $\Delta t/t-1=y_t-y_1$	Chain based $\Delta t/t-1=y_t-y_{t-1}$
2007	3853918		
2008	7849083	-3995165	3995165
2009	7973258	-4119340	124175
2010	9042032	-5188114	1068774
2011	11717591	-7863673	2675559
2012	5953352	-2099434	-5764239
2013	11305095	-7451177	5351743
2014	11988553	-8134635	683458
2015	9021403	-5167485	-2967150
2016	10746387	-6892469	1724984
2017	14326097	-10472179	3579710

Source: processing based on statistical data

Analyzing the average rhythm of dynamics, which can be found in table no. 4, we can observe a significant change in the area cultivated with maize corn, registering a decrease in the chain from 2013 to 2014. The absolute value of 1% of the dynamics of the grain maize surface compared to 2007 is equal with an absolute increase of 25247.06 hectares, and the absolute value of 1% of the rate with a mobile base is an increasing quantity.

Table no.4 Relative changes in the area of maize (ha)

Year	Area (ha)	Dynamics index		Dynamic rhythm (%)		The absolute value of a percentage of the dynamic rate (hectares)	
		With a fixed base $It/1=y_t1/y_1$	Chain based $It/t-1=y_t1/y_{t-1}$	With a fixed base $Rt=It1*100-100$	Chain based $Rt/t-1=It/t-1*100-100$	With a fixed base $At/1=y_1/100$	Chain based $At/t-1=y_{t-1}/100$
2007	2524706						25247.06
2008	2441461	0.97	0.97	-3.30	-3.30	<b>25247.06</b>	24414.61
2009	2338766	0.93	0.96	-7.36	-4.21		23387.66
2010	2098394	0.83	0.90	-16.89	-10.28		20983.94
2011	2589667	1.03	1.23	2.57	23.41		25896.67
2012	2730157	1.08	1.05	8.14	5.43		27301.57
2013	2518268	1.00	0.92	-0.25	-7.76		25182.68
2014	2512809	1.00	1.00	-0.47	-0.22		25128.09
2015	2605165	1.03	1.04	3.19	3.68		26051.65
2016	2580975	1.02	0.99	2.23	-0.93		25809.75
2017	2402082	0.95	0.93	-4.86	-6.93		24020.82

Source: processing based on statistical data

Analyzing the average rate of dynamics for maize corn production, we can see in table no.5 a significant increase (74%) of the value of production in 2007 compared to 2017.

In the case of the absolute value of 1% of the dynamics rate, it shows us that by analyzing with fixed base the size of a percentage of the maize production of any year compared to the base year is equal to an absolute increase that has the value of 38539.18 tons, and the absolute value of 1% of the dynamic rate with the chain base is a size that has successively different values.

Table no.5 Relative changes in the production of maize (to)

Year	Production (tons)	Dynamics index		Dynamic rhythm (%)		The absolute value of a percentage of the dynamic rate (hectares)	
		With a fixed base $It/1=yt1/y1$	Chain based $It/t-1=yt1/yt-1$	With a fixed base $Rt=It1*100-100$	With a fixed base $It/1=yt1/y1$	Chain based $It/t-1=yt1/yt-1$	With a fixed base $Rt=It1*100-100$
2007	3853918					<b>38539.18</b>	38539.18
2008	7849083	2.04	2.04	103.67	103.67		78490.83
2009	7973258	2.07	1.02	106.89	1.58		79732.58
2010	9042032	2.35	1.13	134.62	13.40		90420.32
2011	11717591	3.04	1.30	204.04	29.59		117175.91
2012	5953352	1.54	0.51	54.48	-49.19		59533.52
2013	11305095	2.93	1.90	193.34	89.89		113050.95
2014	11988553	3.11	1.06	211.07	6.05		119885.53
2015	9021403	2.34	0.75	134.08	-24.75		90214.03
2016	10746387	2.79	1.19	178.84	19.12		107463.87
2017	14326097	3.72	1.33	271.73	33.31		143260.97

Source: processing based on statistical data

For the period 2007-2017, the average area of the area was 10810.1 hectares and the area of maize increased yearly for the analysis period by 12.34 thousand hectares.

On average, the surfaces decreased during the period 2007-2017 by 0.95 times, the average dynamic rate indicating that the surfaces changed on average by 1.7% annually.

The average level of grain maize production for the period considered was 9434.25 thousand tons and maize production increased by 1323.71 thousand tons annually. On average, production increased by 3% annually.

Table 6. Economic indicators of maize culture

Specification	Average production	Average purchase price	Income / ha without subsidies	Income / ha + subsidies	Cost of production / ha	Profit without subsidy	Profit + subsidies	Profit rate without subsidies	Profit rate + subsidies	Subsidies
	Kg/ha	lei/kg	lei/ha	lei/ha	lei/ha	lei/ha	lei/ha	%	%	lei
2007	1526	0.55	839.3	1165.50	833	6.3	332.50	0.76	39.92	326.20
2008	3215	0.72	2314.8	2716.84	2300	14.8	416.84	0.64	18.12	402.04
2009	3409	0.48	1636.32	2124.60	1645	-8.68	479.60	-0.53	29.16	488.28
2010	4309	0.57	2456.13	3015.74	2400	56.13	615.74	2.34	25.66	559.61
2011	4525	0.79	3574.75	4154.60	3520	54.75	634.60	1.56	18.03	579.85
2012	2180	0.87	1896.6	2598.49	1910	-13.4	688.49	-0.70	36.05	701.89
2013	4488	0.74	3321.12	4035.80	3300	21.12	735.80	0.64	22.30	714.68
2014	4770	0.61	2909.7	3688.98	2885	24.7	803.98	0.86	27.87	779.28
2015	3462	0.6	2077.2	2797.47	2200	-122.8	597.47	-5.58	27.16	720.27
2016	4159	0.62	2578.58	3348.94	2590	-11.42	758.94	-0.44	29.30	770.36
2017	5959	0.6	3575.4	4382.24	3626	-50.6	756.24	-1.40	20.86	806.84

Source: calculations performed within ICEADR

Regarding the economic indicators of the corn crop, according to the studies carried out by ICEADR, the average purchase prices varied between 0.55 lei / kg and 0.87 lei / kg, an influence on these variations being the cultivated area as well as the production obtained.

The highest price was noted in 2012, of 0.87 lei / kg, higher by 37% compared to the reference year 2007, while the average purchase price recorded in 2017 is 12% higher than in 2007.

The financial aid (Subsidies) granted for the grain maize crop per hectare increased from year to year, so that in 2017 the value of the subsidy granted was 806.84 lei / ha, being 2.47 times higher than the the year 2007 when the subsidy was only 326.2 lei / ha.

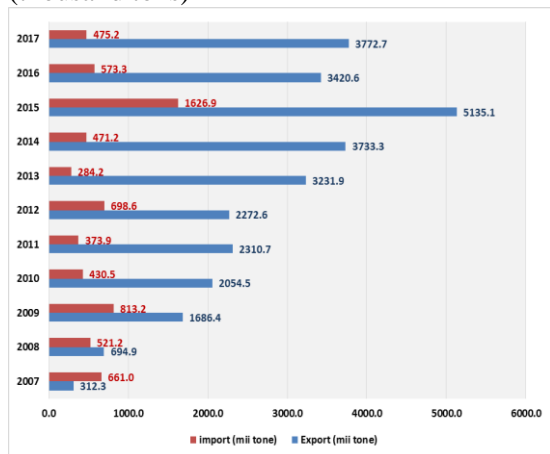
It can be seen from table no. 6, that by capitalizing on the maize grain production at the farm price, farmers without the aid of the subsidies granted do not make a profit.

The value of the profit with subsidies increases with the value of the support granted, from 336.5 lei / ha to 756.24 lei / ha, the rate of profit in 2017 being kept at 20.86%.

In the period 2007-2017, observing the profit without subsidy, we can say that without the aid of the supports, the very low profit, in 2007 registering a profit of 6.3 lei / ha or even negative, in 2017 reaching -50.6 lei / ha, considering that this culture is a non-profit, registering a profit rate of -1.4% in the last year taken into study (2017). Exports of maize from a value point of view were more than 3 times higher than the imports, so that at the level of 2015, the value of corn maize exports was over 961 million euros, reaching the maximum value of the period analyzed (figure no.3)

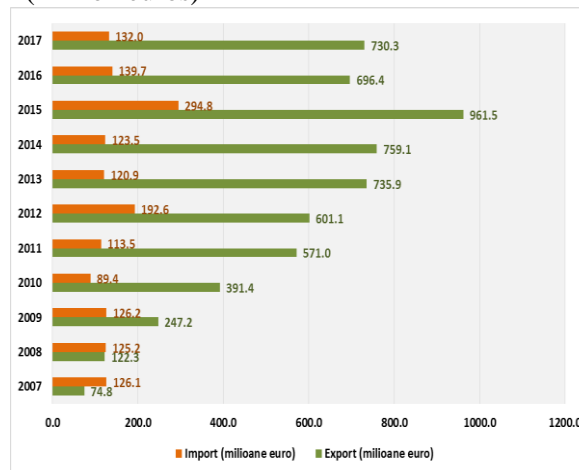
Spain (10.3 million euros), Italy (9.5 million euros), as well as Turkey (6.2 million), exports growing in the year, are among the top importing countries of Romanian corn in Romania. 2017, reported in 2007.

Figure no. 2. Import and export of corn maize to Romania between 2012-2017 (thousand tons)



Source: Trade statistics for international business development –Trade map

Figure no.3.Import and export of grain maize to Romania in the period 2012-2017 (million euros)



Source: Trade statistics for international business development –Trade map

From a quantitative point of view, grain maize imports are very low compared to exports, so that in 2017, the total quantity of maize imported was 475.2 thousand tons, compared to 3.75 million tons of maize exported. Among the corn exporting countries in Romania are Hungary, Slovakia and Bulgaria.

Analyzing from the point of view of the commercial corn grain balance, it is noted that it has an upward trend, but Romania exports double quantitatively, especially raw materials, and the deficit appears as a result of the import of value-added products.

Following the analysis of the import and export of grain maize, we can say that this crop is of great importance at national level, due to the quantities exported annually.

## CONCLUSIONS

Within the study carried out, the technical indicators of the grain maize culture, the surfaces and the productions obtained at national level were highlighted, thus indicating their evolution during the analyzed period 2007-2017 with the help of absolute, relative and average statistical indicators.

With the help of the average dynamics indicators, it was observed that the maize corn surfaces underwent annual changes on average of 1.7%, and the total maize yields increased year by

year at a rate of 14%. All these evolving trends can be due both to the funds allocated from the U.E. as well as the resurgence of the agricultural sector through investments in the mechanization of the sector but also of the development of research in the field.

Taking into consideration the economic indicators such as: the average purchase price, the production cost, the subsidies, the income obtained per hectare with subsidies and without, the profit of the crop, it could be shown that the grain corn crop is a profitable one only if the farmers benefit from the subsidies granted.

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