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ANALYSIS OF THE EVOLUTION AND DISTRIBUTION OF MAIZE CULTIVATED AREA AND PRODUCTION IN ROMANIA

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Abstract

The paper goal was to analyze the dynamics and distribution of maize cultivated area and production in Romania and in its regions of development, using empirical data provided by the National Institute of Statistics for the period 2007-2013. The statistical parameters: mean, deviation standard and coefficient of variation were determined in order to characterize each indicator. With 2.5 million ha cultivated with maize Romania came on the top position in the EU-28.For maize production, it is on the 2nd position after France. Romania's production increased more 2.7 times in the analyzed period, and the contribution of the development regions to it was the following one in 2013: 22.29 % South Muntenia, 18.18 % South East, 18.19 % North East, 13.06 % South West Oltenia, 12.47 % West, 9.68 % North West, 5.69 % Central part and 0.44 % Bucharest-Ilfov. The means, standard deviations and the variation coefficients proved that both the cultivated area and maize production registered a high variation from a region to another. The discrepancies among the regions concerning soil and climate conditions, farm size, technical endowment, applied technologies, maize varieties, farm management resulted in a high variability of production performance. For Romania, maize is a strategic crop which could cover both the internal market, and become a good product for export on the foreign market. As a result, the Romanian farmers should be aware that the yield growth must be their main objective which should be reached using high potential hybrids resistant to drought and diseases, and extending irrigation systems.

Key words**:** *cultivated area, dynamics, distribution, maize, production, Romania*

INTRODUCTION

Maize and wheat are among the most important cereals in the world. In 2013, the world maize production accounted for 1,058,948 thousand Metric Tons, to which the top five producers contributed by 74.5 % as follows: USA 32.1 %, China 24.4 %, Brazil 8.3 %, the EU-28 6.4 % and Argentina 3.3 % [8].

In 2013, maize was cultivated on 181.55 million ha at world level, which produced 991.45 million Metric Tons grains.

The most important countries cultivating maize on the largest surfaces are China (36.32 million ha), USA (35.39 million ha), Brazil (15.80 million ha), India (9.43 million ha) and Mexico (7.05 million ha). [9] (Table 1).

The EU-28 comes on the 4th position in the world. It cultivated 9,660 million ha with maize in 2013, and having an average production of 6.69 Metric Tons/ha, it produced 64.62 million Metric Tons grains.

Romania is among the most important producers of maize grains in the EU and also among the top 10 producers at world level. In 2014, it was situated on the 1st position in the EU-28 for the cultivated area with maize for grains and on the 2nd position after France, regarding the maize production. In Romania, maize is cultivated on 47.1 % of the agricultural land cultivated with cereals. [4, 8]

Eurostat confirmed the paradox between the top position of Romania for the cultivated area with maize and the smallest level of yield.

In 2013, the EU-28 average was 6,690 kg/ha, while Romania carried out only 4,408 kg/ha by 35 % less.

Other countries registered a higher performance: Germany 8,214 kg/ha, France 8,139 kg/ha, Austria 8,118 kg/ha, Czech Rep., 6,726 kg/ha, Croatia 6,600 kg/ha, and Bulgaria 5,476 kg/ha. [3]

Table 1. The top five maize producers in the world, 2013

COUNTRY	MAIZE CULTIVATED AREA MILLION HA		MAIZE YIELD METRIC TONS/HA		MAIZE PRODUCTION MILLION METRIC TONS	
	VALUE	SHARE IN THE WORLD (%)	VALUE	SHARE IN THE WORLD (%)	VALUE	SHARE IN THE WORLD (%)
WORLD	181.55	100.00	5.46	100.00	991.45	100.00
1.USA	35.39	19.49	9.93	181.86	351.27	35.42
2.CHINA	36.32	20.00	6.02	110.25	218.49	22.03
3.BRAZIL	15.80	8.70	5.60	92.67	80.00	8.06
4.INDIA	9,43	5.19	2.57	47.06	24.66	2.48
5.MEXICO	7.05	3.88	3.24	59.34	22.88	2.30

Source: World Agricultural Production, Circular Series, Sept 2015[9] Own calculations.

In this context, the purpose of the paper was to analyze the dynamics of the surface cultivated with maize for grains and production in the period 2007-2013 in Romania, both at national level and in the territory by regions of development and to identify the variation from a year to another and among different areas.

MATERIALS AND METHODS

In order to achieve the objective of the research, the empirical data were collected from the data basis of the National Institute of Statistics for the period 2007-2013.
The main indicators were the maize cultivated surface at the national level and in the territory by region of development, the share of the regions in the cultivated area, the statistical parameters for the cultivated area and maize production: mean, standard deviation and the variation coefficient, the share of maize production in the cereals production, Romania's position in the EU-28 for the cultivated area and maize production, the contribution of various development regions to maize production, the weight of development regions in the maize production, the maize production/consumption ratio per inhabitant.
The results were presented in Tables, illustrated in graphics and interpreted as presented below.

RESULTS AND DISCUSSIONS

The maize cultivated area was 2,524,706 ha in 2007, and then it recorded a decline to 2,098,394 ha in 2010, but after that it increased again to 2,730,157 ha in 2012, and in 2013 it decreased again to 2,518,268 ha. In 2013, of the total agricultural land cultivated with cereals in Romania, accounting for 5,475 thousand ha, maize was cultivated on 2,528 thousand ha, representing 46.17 % (Fig.1.).

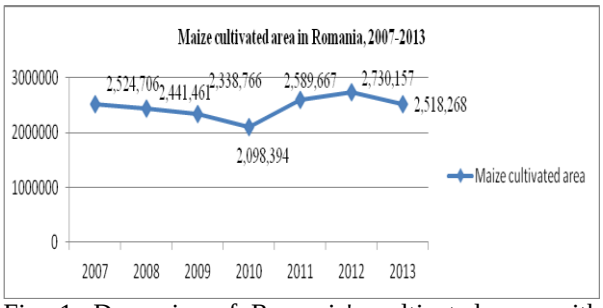

Fig. 1. Dynamics of Romania's cultivated area with maize, 2007-2013 (ha). Source: [6] Own design.

The most important regions producing maize grains. In Romania in all the development regions it is possible to produce maize, but there are zones more suitable for this crop, it is about the South Muntenia, South Eastern and North Eastern Romania, but also the South West Oltenia, West and North West. (Fig.2, Table 2).

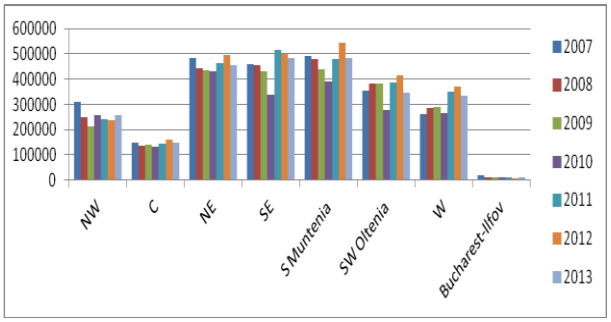

Fig. 2. Romania's maize cultivated area by development region, 2007-2013. [7] Own design.

The share of development regions in the cultivated area. In 2013, the relative distribution of the cultivated area with maize by region was the following one: 19.24 % South Muntenia, 19.12 % South East, 17.99 % North East, 13.77 % South West Oltenia, 13.33 % West, 10.18 % North West, 5.95 % Central part and 0.42 % Bucharest-Ilfov(Table 3).

Table 2. The share of each development region in the cultivated area with maize, Romania, 2007-2013 (%)

	2007	2008	2009	2010	2011	2012	2013
NW	12.20	10.23	9.17	12.22	9.25	8.69	10.18
C	5.84	5.55	5.89	6.27	5.59	5.86	5.95
NE	19.09	18.13	18.56	20.43	17.91	18.11	17.99
SE	18.22	18.65	18.36	16.00	19.91	18.31	19.12
S MUNTENIA	19.42	19.61	18.84	18.67	18.53	19.94	19.24
SW OLTENIA	14.07	15.66	16.35	13.17	14.93	15.18	13.77
W	10.37	11.70	12.35	12.64	13.54	13.64	13.33
BUCHAREST ILFOV	0.79	0.47	0.48	0.60	0.34	0.27	0.42

Source: Own calculations.

The statistical parameters of the maize cultivated area. The average cultivated area per year in the analyzed period varied between the minimum value 262,299.25 ha in the year 2010 and the maximum value 341,262.62 ha in 2012. The variation coefficient was very high every year, reflecting that there are discrepancies in time. The highest variation coefficient, V%=55.52 % in 2012 and the lowest coefficient of variation was 51.87 % in 2010.(Table 4).

Table 3. Statistical parameters of maize cultivated area by years, 2007-2013

	MEAN	STANDARD DEVIATION	VARIATION COEFFICIENT (%)
2007	315,588.25	168,765.1	53.47
2008	305,182.62	167,349.96	54.83
2009	292,470.75	159,496.49	54.53
2010	262,299.25	136,078.75	51.87
2011	323,708.37	178,858.61	55.25
2012	341,262.62	189,476.99	55.52
2013	314,783.50	169,250.33	53.76

Source: Own calculations.

By region, the mean of the cultivated area varied between the maximum level 472,819.85 ha in the South Muntenia and the minimum level 11,621.85 ha in Bucharest-Ilfov area. The coefficient of variation reflects in this case much better the disparities exiting among regions. Thus, Bucharest-Ilfov recorded the highest variation coefficient, 34.79 %, South Muntenia registered 9.94 ||% and the Central part 6.76 5 and North Eat area 5.37 % reflecting a low variation. The regions with moderate variation were North West 11.40 %, South East 13.12 %, South West Oltenia 12.17 % and West 14.22 %.(Table 5).

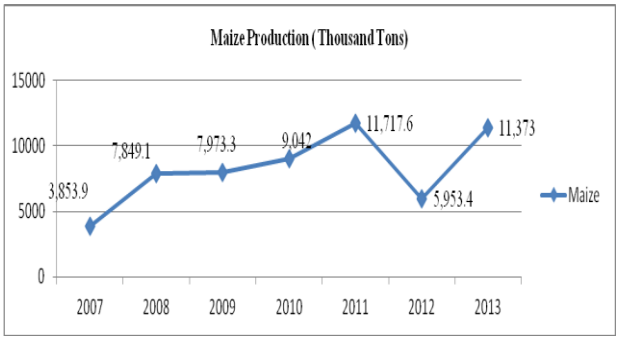

Fig. 3. Dynamics of Romania's maize production, 2007-2013 (ha). Source: Source: Romania's Statistical Yearbook, 2014 [7]. Own design.

The maize production increased 2.95 times in the analyzed period from 3,853.9 thousand tons in 2007 to 11,373 thousand tons in 2013. The general trend is an increasing one, however in 2012, the production declined due to the drought (Fig. 3).

Table 4. Statistical parameters of maize cultivated are by development region, 2007-2013

	MEAN	STANDARD DEVIATION	VARIATION COEFFICIENT (%)
NW	251,824.71	28,732.38	11.40
C	143,890.28	9,738.08	6.76
NE	457,073.14	24,579.03	5.37
SE	454,057.28	59,589.16	13.12
S MUNTENIA	472,819.85	47,000.18	9.94
SW OLTENIA	363,328.71	44,247.88	12.17
W	308,443.43	43,888.56	14.22
BUCHAREST ILFOV	11,621.85	4,044.07	34.79

Source: Own calculations.

The statistical parameters of the maize production. The production mean varied between 481,739.79 tons, the lowest level, in the year 2007 and the highest level in 2011. The variation coefficient was very high every year, reflecting that there are discrepancies during the analyzed period. The highest variation coefficient, V%= 57.41% in 2013 and the lowest coefficient of variation was 50.84% in 2010.(Table 6).

Table 5. Statistical parameters of maize production by years, 2007-2013

	MEAN	STANDARD DEVIATION	VARIATION COEFFICIENT (%)
2007	481,739.79	262,195.42	54.42
2008	981,135.37	503,157.52	51.28
2009	996,657.25	551,735.07	55.35
2010	1,130,254	574,671.91	50.84
2011	1,464,698.87	837,777.65	57.19
2012	744,169	425,364.88	57.15
2013	1,413,136.87	811,365.18	57.41

Source: Own calculations.

The share of maize production in cereals production increased from 49.31 % in 2007 to 54.11 % in 2013, with a peak of 56.22 % in 2011 and the lowest value 46.42 % in 2012. Compared to other cereals, maize has the highest share in the cereals production. (Table 7).

Romania's position in the EU-28 regarding maize production and cultivated area. Romania is among the top producers of maize in the EU-28. Romania, France, Germany, Bulgaria, Croatia, Czech Rep. and Austria.

In 2013, Romania cultivated 2,580 thousand ha with maize, representing 26.70 % of the EU-28 cultivated area with this crop, a reason to be placed on the top. For maize production achieved in 2013, which accounted for 11,373 thousand tons, representing 17.60 % of the EU-28 maize production, Romania came on the 2nd position after France (Table 8).

In 2014, Romania carried out 11,734 thousand tons maize grains, the highest production, meaning 4,600 kg/ha maize grains yield. [6]

The contribution of various development regions to maize production. The regions with the highest maize production are South Muntenia, South East and North East, followed in the decreasing order, by West and North West part of Romania (Table 9, Fig.4).

The share of development regions in the maize production. In 2013, the relative distribution of the maize production by region was the following one: 22.29 % South Muntenia, 18.18 % South East, 18.19 % North East, 13.06 % South West Oltenia, 12.47 % West, 9.68 % North West, 5.69 % Central part and 0.44 % Bucharest-Ilfov (Table 10).

The ratio maize production/consumption per inhabitant. Taking into account the demographical evolution and maize production, the maize production/inhabitant increase 2.81 times in the analyzed period from 179 kg/capita in the year 2007 to 504 kg/capita in 2013.

And considering average annual consumption

of maize in terms of maize grains equivalent, the production/consumption ratio is higher than 1. (Table 11)

Taking into account 2007 as a reference term, the self sufficiency registered an increasing trend from 96 % in 2008 to 112 % in 2013. [1]

The maize yield. Maize production was determined by the cultivated area and the maize yield, which in its turn depended on the soil type, technologies applied, weather conditions and many other factors.

Farm size is an important factor closed related to the applied technologies (technical endowment, maize varieties, fertilization level, irrigation etc) and all this resulting in the production performance, productivity and efficiency.

Romania's maize yield is the smallest in the EU-28, because maize is cultivated in about 2.5 agricultural holdings of various dimensions, only 0.38 % of the total number of farms have over 100 ha.

The yield varied between 1.526 kg/ha in 2007 to 4,490 kg/ha in 2013, reflecting a 2.94 times higher performance. [2, 5]

Table 6. The weight of maize production in the cereals production, Romania, 2007-2013 (%)

	2007	2008	2009	2010	2011	2012	2013
CEREALS PRODUCTION (THOUSAND TONS)	7,814.8	16,826.4	14,873	16,712.9	20,842.2	12,824.1	21,016
SHARE OF MAIZE PROD.(%)	49.31	49.64	53.60	54.10	56.22	46.42	54.11

Source: Romania's Statistical Yearbook, 2014. [7]Own calculations.

Table 7. Romania's position in the EU-28, regarding the maize cultivated area, production and yield, 2007-2013

	MAIZE CULTIVATED AREA (THOUSAND HA)		MAIZE GRAINS PRODUCTION (THOUSAND TONS)		MAIZE GRAINS YIELDS (KG/HA)	
EU-28	9,660,000	100.00	64,620	100.00	6,690	100.00
ROMANIA	2,580	26.70	11,373	17.60	4,408	65.88
FRANCE	1,849.6	19.14	15,053	23.29	8,139	121.66
GERMANY	495.8	5.13	4,072.4	6.30	8,214	122.78
BULGARIA	420.0	4.34	2,300.0	3.55	5,476	81.85
CROATIA	290.0	3.00	1,914	2.96	6,600	98.65
AUSTRIA	201.9	2.09	1,639	2.53	6,726	100.53
CZECH REP.	11.9	1.15	752.6	1.16	8,118	121.34
TOTAL	-	61.55	-	57.39	-	-

Source: Eurostat, 2014. [3] Own calculations.

Table 8. Romania's maize production by development region, 2007-2013 (Tons)

	2007	2008	2009	2010	2011	2012	2013
NW	858,027	1,009,247	1,009,247	735,923	1,096,326	1,060,818	648,234
C	434,821	521,490	521,490	527,681	582,564	675,837	406,965
NE	680,504	1,627,542	1,627,542	1,475,914	1,664,395	1,966,518	977,220
SE	396,874	1,097,187	1,097,187	1,053,286	1,456,742	2,454,524	839,806
S MUNTENIA	463,617	1,448,641	1,448,641	1,684,462	1,794,856	2,381,534	1,388,692
SW OLTENIA	315,235	1,086,449	1,453,235	1,189,394	1,569,294	604,181	1,475,745
W	690,963	1,024,627	1,009,614	1,208,001	1,570,345	1,075,699	1,409,572
BUCHAREST ILFOV	13,877	33,900	33,143	49,754	38,721	12,555	48,989

Source: Romania's Statistical Yearbook, 2014, [7]

Dividing the cultivated area in the year 2007, 2,524,706 ha by the number of agricultural holdings cultivating maize, 2,390,933, it resulted an average farm size of 1.05 ha, which very small specific to subsistence farms.

In the year 2010, the cultivated area was 2,098,394 ha and divided by the number of farms, accounting for 1,899,054, it is obvious that the farms size increased a little to 1.10 ha/holding.

The situation regarding the share of the farms by surface interval was the following one in the year 2007: under 0.1 ha 0.39 %, 0.1-0.3 ha 6.37 %, 0.3-0.5 6.66 %, 0.5-1 ha 17.19 %, 1-2 ha 24.59 %, 2-5 ha 31.87 %, 5-10 ha 9.85 %, 10-20 ha 2.21 %, 20-30 ha 0.30 %, 30-50 ha 0.20 %, 50-100 ha 0.14 % and over 100 ha 0.23 %.

In the year 2010, the farm weight by size interval was: under 0.1 ha 1.06 %, 0.1-0.3 ha 10.48 %, 0.3-0.5 ha 9.60 %, 0.5-1 ha 18.43 %, 1-2 ha 24.18 %, 2-5 ha 26.85 %, 5-10 ha 6.59 %, 10-20 ha 1.48 %, 20-30 ha 0.27 %, 30-50 ha 0.28 %, 50-100 ha 0.24 % and over 100 ha 0.38 %.(Romania's Statistical Yearbook, 2014).

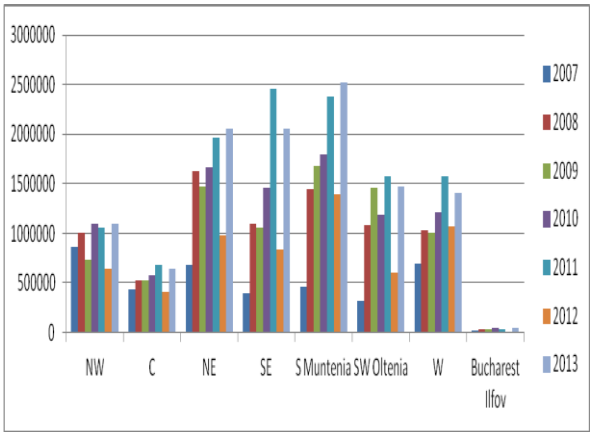

Fig. 4. Romania's maize production by development region, 2007-2013. Own design

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Table 9. The share of each development region in the cultivated area with maize, Romania, 2007-2013 (%)

	2007	2008	2009	2010	2011	2012	2013
NW	22.26	12.85	9.20	12.12	9.05	10.88	9.68
C	11.28	6.64	6.51	6.44	5.76	6.83	5.69
NE	17.65	20.73	18.50	18.40	16.78	16.41	18.19
SE	10.39	13.97	13.46	15.11	20.94	14.11	18.18
S MUNTENIA	12.04	18.46	21.10	19.85	20.32	23.33	22.29
SW OLTENIA	8.18	13.85	18.21	13.16	13.40	10.15	13.06
W	17.93	13.06	12.61	13.36	13.41	18.07	12.47
BUCHAREST ILFOV	0.36	0.44	0.41	0.56	0.34	0.22	0.44

Source: Own calculations.

Table 10. Maize Production/Consumption ratio per inhabitant

	2007	2008	2009	2010	2011	2012	2013	2013/2007
MAIZE PRODUCTION KG/CAPITA	170	347	353	401	521	265	504	281.56
MAIZE CONSUMPTION IN GRAINS EQUIVALENT KG/CAPITA	36.5	34.9	34.8	36.7	37.7	38.3	42.3	115.89
MAIZE PRODUCTION/ CONSUMPTION RATIO	4.65	9.94	10.14	10.92	13.81	6.91	11.91	256.13

Source: National Institute of Statistics, 2015[6]. Own calculations.

CONCLUSIONS

This study emphasized that Romania had a relatively constant surface cultivated with maize, about 2.5 million ha, representing about 47 % of the cultivated area with cereals. Due to this reason, Romania is in the top cultivators of maize in the EU-28.

The maize production registered an increasing trend from 3,853.9 thousand tons in 2007 to 11,373 thousand tons in 2013. The growth was due to the producers' continuous efforts directed to increase the maize yield.

The distribution of the cultivated area and production of maize in the territory varies from a year to another and from a region of development to another. In the decreasing order, the share of the development regions in the maize production in 2013 was the following one: 22.29 % South Muntenia, 18.18 % South East, 18.19 % North East, 13.06 % South West Oltenia, 12.47 % West, 9.68 % North West, 5.69 % Central part and 0.44 % Bucharest-Ilfov.

The means, standard deviations and the variation coefficients proved that both the cultivated area and maize production registered a high variation from a region to another. The explanations consist of the discrepancies exiting among regions regarding the soil and climate conditions, farm size, technical endowment, applied technologies, maize varieties, farm management.

The farm size is a critical one, in average about 1.10 ha/agricultural holding.

Just a number of 23,302 farms cultivating maize have over 20 ha and all together represent 1.17 % of the whole number of farms dealing with this crop.

Therefore, the farm size is very important to be improved, and this is possible only by joining land, endowment and labour, the main production factors which could be more efficiently used by producer's associations.

The high maize production situated Romania on the 2nd position in the EU-28, after France. Despite of the production performance on such a large surface cultivated with maize, Romania has still a low maize yield compared to France and other countries, in fact, it has the smallest performance level from this point of view.

As a conclusion, the surplus resulting from the difference between production and consumption is an encouragement for the Romania to produce more and to export in the international market. Therefore, the Romanian farmers should pay attention especially to the yield growth, using high potential hybrids resistant to drought and diseases, and extending irrigation systems to assure protection against the global warmth.

REFERENCES

[1]Constantin Florentina, Cereals Market in Romania under the Impact of the Common Agricultural Policy, Economia.Seria Management, Vol.16(2)2013:333-345

[2]El-Jubouri, M., D., Y., Draghici, M., 2014, The main statistic indicators analysis that characterize maize crop in Romania, Irak and worldwide. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 14 ISSUE 3, PRINT ISSN 2284-7995, 69-74.

[3]Eurostat, 2014.

[4]Marinescu Andreea, 2014, Romania on the 1st position in the EU, for the cultivated surface with maize and on the 2nd place for production in 2014.Agerpress, 29.Oct.2014, www.agerpress.ro/economie/2015

[5]Meita, N.L., 2015, The evolution of agriculture in Romania after the integration into the EU, Annals of the „Constantin Brâncuşi" University of Târgu Jiu, Economy Series, Issue 1, volume I/2015:287-293

[6]NIS, 2015, Press Release No. 75 of March 31, 2015

[7]Romania's Statistical Yearbook, 2014, National Institute of Statistics

[8]USDA, Grains World, Markets and Trade, 2013

[9]World Agricultural Production, Circular Series, Sept.2015, Foreign Agricultural Service USDA, Office of Global Analysis.