

THE EVOLUTION OF MAIZE CULTIVATED AREA AND PRODUCTION IN ROMANIA (2011-2021)

Ionel Alin GHIORGHE^{1,2}, Adrian TUREK-RAHOVEANU¹

¹University of Agronomic Sciences and Veterinary Medicine Bucharest of Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest, Romania, Phone: +40213182564, Fax:+40213182888, Emails: alin_ionel93@yahoo.com, turek.adrian@managusamv.ro

²Agricultural Research and Development Station of Braila, KM9, Viziru Street, Brăila. Romania, Email: alin_ionel93@yahoo.com

Corresponding author: turek.adrian@managusamv.ro

Abstract

Using empirical data provided by the National Institute of Statistics for the years 2011 through 2021, the paper's objective was to study the dynamics and distribution of maize cultivation area and production in Romania and its development regions. With 2.5 million ha of maize cultivation, Romania ranked first among the EU-27 in 2021. It is the second-largest producer of maize after France. Compared to 2011, the area planted with maize decreased by 1.6% in 2021. In the studied period, Romania's production climbed by 26.5%, and in 2021, the developing regions contributed as follows: 20.6% of South Muntenia, 17.7% of the South, 17.1% of the East, 14.5% of the North, 12.0% of the West, 11.9% of the North, 6.8% of the Central area, and 0.013% of Bucharest-Ilfov make up Romania. The yield of maize in 2021 was 5082 kg/ha, which was 22% more than in 2011.

Key words: cultivated area, maize, production, Romania

INTRODUCTION

Maize is a widely consumed and versatile crop. It is a rich source of carbohydrates and fibre, with moderate content of total protein and some micronutrients. Genetics, growing conditions, processing procedures, and preparation and storage environments influence nutrient amounts and bioavailability. It contains about 72% starch, 10% protein and 4% fat, providing an energy value of 365 Kcal/100 grams, comparable to rice and wheat, but has a lower protein content [6].

The maize grain is mainly composed of fibre, ranging from 61 to 86%, depending on the variety. Approximately 99% of the fibre is found in the endosperm and consists of starch (about 73% of the total weight). It also contains polysaccharides such as cellulose, hemicellulose and lignin to a lesser extent [1]. Maize is the most geographically widespread crop and the third largest crop in the world occupying 13% of the world's cultivated land [9] and reaches its highest cropping intensity in the U.S. maize belt, but it is also a major

commodity in northeastern China (Manchuria), along the Rift Valley in Africa, and in eastern Europe [4].

Maize can be grown on very different soils and under very different climatic conditions, is not demanding on the pre-seedling plant and tolerates monoculture better than other cereals. Maize has a high multiplication rate, which is why it requires a small amount of seed per hectare, and its cultivation is highly mechanizable, from sowing to harvesting [12, 11].

Romania, along with France, is consistently among the two largest producers of corn in the European Union (EU) [8, 10].

However, with limited irrigation and frequently hot and dry summer, Romania's corn harvest fluctuates significantly.

Recently, the national production reached a record level of 14.3mn tonnes in 2019/20, in almost ideal weather conditions, but this was followed by a minimum of the last few years of 10.8 million tonnes in 2020/21 [3].

MATERIALS AND METHODS

The study consisted of the research, analysis and interpretation of the statistical data provided by the National Institute of Statistics

in Romania for the period 2011-2021.

The following indicators have been used and analyzed: total cultivated area, cereal cultivated area, maize cultivated area, distribution of maize cultivated area in the territory by macroregions (Macroregion 1, Macroregion 2, Macroregion 3, Macroregion 4) and microregions (North-West, Centre, NorthEast, South-east, South Muntenia, Bucharesti for, South-West Oltenia and West).

At the national level and in macro and microregions, production was examined using yield and total production.

The methodology consisted of descriptive analysis of data and comparative analysis, the results being presented in tabular and graphical form.

RESULTS AND DISCUSSIONS

The maize cultivated area: Romania ranked top among EU nations in terms of cultivated area in 2021, according to statistics from the National Institute of Statistics and Eurostat.

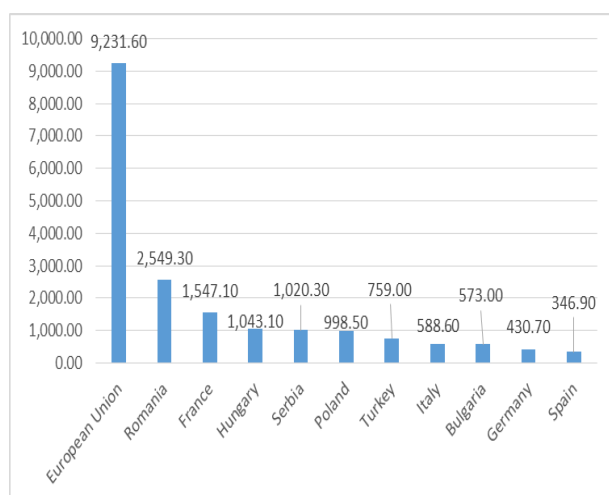


Fig. 1. The top 10 producers of maize in the EU, in 2021, in terms of cultivated area (thousand hectares)

Source: statistical data processing EUROSTAT, Accessed on 19.07.2022 [2].

Cereals occupied 64.75 percent of Romania's total cultivated land in 2021, which was 8,263.8 thousand hectares. About 30.8% of the total cultivated land and 47.6% of the cereal-cultivated area is made up of maize. (Table 1).

The area used for maize cultivation changed between 2011 and 2021. A reduction in the area used for maize cultivation to 2,402.1 thousand hectares in 2017 was followed by a rise such that in 2021 the area used for maize cultivation rose to 2,549.3 thousand hectares from 2,730.2 thousand hectares (Figure 2).

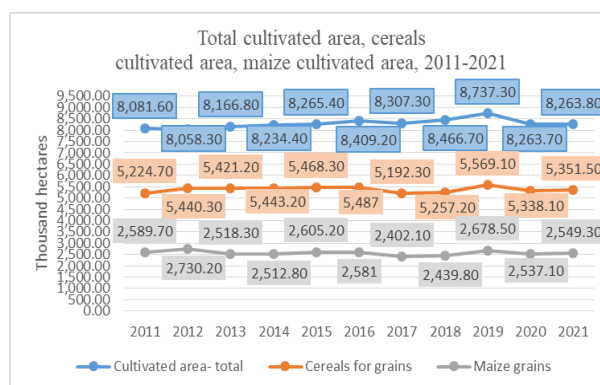


Fig. 2. Dynamics of Romania's total cultivated area, cereals cultivated area and maize cultivated area, 2011-2021 (ha)

Source: statistical data processing National Institute of Statistics, Accessed 24.07.2022 [7].

The most important macroregions producing maize grains:

In terms of development macroregions it is found that Macroregion 2 owns the first place for maize acreages.

On average, during the 10 years analysed, Macroregion 2 occupied 37.3% of the total area under maize cultivation.

The largest area cultivated with maize was recorded in 2021 (1,042.15 thousand hectares). At the opposite pole, the lowest maize acreage was Macroregion 1 (Table 2).

Regarding the total area under maize cultivation, in the period 2011-2021, the largest areas of 2,730.16 thousand hectares and 2,678.84 thousand hectares were recorded in 2012 and 2019 respectively.

At the level of Macroregion 1, the largest area under maize, 451.61 thousand hectares, was recorded in 2021 and the smallest area, 384.45 thousand hectares, was recorded in 2011.

Macroregion 2 recorded the highest area under maize cultivation of 1,042.15 thousand hectares in 2021 and the lowest area of 876.57 thousand hectares in 2017 (Table 2).

Table 2. Distribution of maize cultivated area by Romania's macroregion, thousand hectare

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average 2011-2021
TOTAL MAIZE CULTIVATED AREA	2,589.67	2,730.16	2,518.27	2,512.81	2,605.17	2,580.98	2,402.08	2,439.84	2,678.50	2,537.10	2,549.28	2,558.53
M 1	384.45	397.56	406.35	418.70	437.61	438.27	416.76	426.64	427.72	431.75	451.61	421.58
% of the area that is cultivated for maize	14.8	14.6	16.1	16.7	16.8	17.0	17.3	17.5	16.0	17.0	17.7	16.5
M 2	979.72	994.70	934.71	924.96	947.48	954.99	876.57	907.03	966.73	956.95	1042.15	953.27
% of the area that is cultivated for maize	37.8	36.4	37.1	36.8	36.4	37.0	36.5	37.2	36.1	37.7	40.9	37.3
M 3	488.54	551.45	495.02	472.35	510.98	482.00	465.18	474.60	546.44	559.88	528.99	506.86
% of the area that is cultivated for maize	18.9	20.2	19.7	18.8	19.6	18.7	19.4	19.5	20.4	22.1	20.8	19.8
M 4	736.97	786.45	682.19	696.81	709.10	705.72	643.57	631.58	737.62	588.51	526.53	676.82
% of the area that is cultivated for maize	28.5	28.8	27.1	27.7	27.2	27.3	26.8	25.9	27.5	23.2	20.7	26.4

Source: statistical data processing National Institute of Statistics, Accessed on 24.07.2022 [7].

Macroregion 3 recorded the highest area under maize cultivation of 559.88 thousand hectares in 2020 and the lowest area of 465.18 thousand hectares in 2017. Macroregion 4 recorded the highest area under maize cultivation of 737.62 thousand hectares in 2019 and the lowest area of 526.53 thousand hectares in 2021 (Table 2).

All microregions of development offer ideal circumstances for maize growth. The South-Muntenia Region grows maize on an average of 19.4% of the country's land from 2011 to 2021, followed by the South East Region at 19%, the North East Region at 18.3%, the South West Oltenia Region at 13.5%, the West Region at 12.9%, the North West Region at 10.3%, the Center Region at 6.2%, and Bucharest-Ilfov Region at 0.4%. (Figure 3).

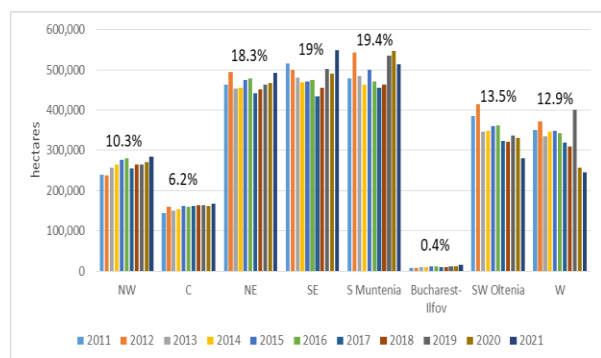


Fig. 3. Average share of maize cultivated area by development region of Romania, 2011-2021.

Source: statistical data processing National Institute of Statistics, Accessed on 24.07.2022 [7].

Compared to 2011, the area planted with maize decreased by 1.6% in 2021. The area farmed with maize increased in each of the macro-regions of development, compared to 2011, by the following percentages: 17.5% in Macro-region 1, 6.4% in Macro-region 2, and 8.3% in Macro-region 3. In Macro-region 4, the area planted with maize decreased significantly by 28.6%.

The Bucharest-Ilfov region, where maize cultivation increased by 78.9%, and the South West Oltenia region, where it decreased by 27.5% and the West region, where it decreased by 29.7%, showed the most obvious variations in the level of development of micro-regions compared to 2011 (Table 3).

Table 3. Evolution of the area under maize in 2021 compared to 2011

Macro/micro-region	Maize cultivated area (thousands ha)	Maize cultivated area (thousands ha)	Maize cultivated area (thousands ha)
	2011	2021	2021/2011 %
TOTAL	2,589.7	2,549.3	98.4
Macroregion 1	384.4	451.6	117.5
NW	239.7	284.7	118.8
C	144.8	166.9	115.3
Macroregion 2	979.7	1042.2	106.4
NE	463.9	492.4	106.1
SE	515.8	549.8	106.6
Macroregion 3	488.5	529	108.3
S Muntenia	479.9	513.5	107.0
Bucharest-Ilfov	8.7	15.5	178.9
Macroregion 4	737	526.5	71.4
SW Oltenia	386.5	280.2	72.5
W	350.5	246.3	70.3

Source: statistical data processing National Institute of Statistics, Accessed on 24.07.2022 [7].

The area cultivated with maize is expected to decrease in the next five years, by almost 5%, a forecast because during the analyzed period 2014-2019 it showed a downward trend [11]. The maize production increased in the analyzed period (2011-2021) by 26.5 % from 11,717.16 thousand tons in 2011 to 14,820.7 thousand tons in 2021. Analyzing Table 4, the year 2012 recorded the lowest maize

production (5,953.4 thousand tons), while in the year 2018 Romania registered the highest maize production (18,663.9 thousand tons). The variations were determined by the changes in cultivated surface and average production per surface unit, which in turn depended on the soil type, technologies applied, and weather conditions.

Table 4. The proportion of maize output in the production of cereals, Romania, 2011-2021 (%)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2021/2011 %
Cereals production (Thousand tons)	20,842.2	12,824.1	20,897.1	22,070.7	19,332.8	21,764.8	27,138.9	31,553.3	30,412.4	18,153.7	27,791.3	133.3
Maize production	11,717.6	5,953.4	11,305.1	11,988.6	9,021.4	10,746.4	14,326.1	18,663.9	17,432.2	10,096.7	14,820.7	126.5
Share of maize prod (%)	56.2	46.4	54.1	54.3	46.7	49.4	52.8	59.2	57.3	55.6	53.3	Average 2011-2021 53.8%

Source: statistical data processing National Institute of Statistics, Accessed on 30.07.2022 [7].

The share of maize production in cereal production decreased by 2.9 % from 56.2% in 2011 to 53.3 % in 2021. In this case, too there were variations, from 46.4% in 2012 to 59.2% in 2018, but on average, the share of maize in cereal production between 2011 and 2021 was 53.8%. At the EU-27 level, in terms of maize production, France together with Romania ranked first among the top ten maize producers, with similar productions of 15,285.7 thousand tonnes and 15,186.1 thousand tonnes respectively (Figure 4).

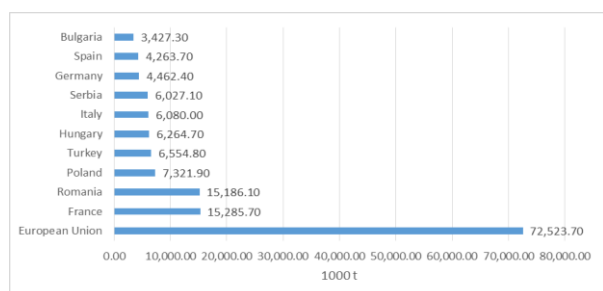


Fig. 4. Position of Romania in the EU-27 in terms of tons of maize produced in 2021

Source: statistical data processing EUROSTAT, Accessed 19.07.2022 [2].

With a total production of 4,372.6 thousand tonnes from the years 2011 to 2021, macroregion 2 produced the most maize. The production minimum was attained in 2012 (1,814 thousand tonnes), and the production peak was reached in 2018 (6,856.5 thousand tonnes). Also, Macroregion 4 recorded a significant average production of 3,520.2

thousand tonnes from 2011-2021. Macroregion 1, had a smaller contribution to the total maize production, averaging 2,159.7 thousand tonnes.

In 2021, an increase in maize production compared to 2011 of 59% is observed for Macroregion 1, 45% for Macroregion 2 and 30.9% for Macroregion 3. At the opposite pole, Macroregion 4 registers a decrease in production compared to 2011 by 21.9%. Regarding the production realized by micro-regions, it is found that South Muntenia obtained the highest production of maize during 2011-2021, 2,532.8 thousand tons. It got a maximum of production in 2018 (3,674.4 thousand tons).

Table 5. Share in maize production by development region, 2011 vs 2021 (%)

TOTAL	2011	2021	Average 2011-2021	2021/2011 %
M1	14.8	18.6	17.7	125.7
NW	9.1	11.7	10.9	129.1
C	5.8	6.9	6.8	120.4
M2	37.7	43.4	34.8	115.1
NE	16.8	19.1	17.1	113.8
SE	20.9	24.3	17.7	116.2
M3	20.7	21.4	21.1	103.5
S Muntenia	20.3	20.8	20.6	102.3
Bucharest Ilfov	0.012	0.013	0.013	106.9
M4	26.8	16.5	26.5	61.8
SW Oltenia	13.4	7.5	12.0	56.2
W	13.4	9.0	14.5	67.3

Source: statistical data processing National Institute of Statistics, Accessed on 30.07.2022 [7].

In this region, in 2018, it was achieved 19.6 % of the total production of maize in Romania. The lowest production was achieved in 2012 (1,388.7 thousand tons).

Another micro-region that contributes significantly to the total maize production is the South East micro-region. Here, 2,254.1 thousand tons were obtained on average in the period 2011-2021, and the year with the highest production recorded was 2018, with 3,648.5 thousand tons. Low production in this micro-region was recorded in 2012 and 2020, years are known to be very dry (Table 6).

Macroregions 1, 2, and 3 saw increases in their proportions of the overall output of

maize when compared to 2011 in the following ways: Macroregion 1 (+25.7%), Macroregion 2 (+15.1%), and Macroregion 3 (+3.5%). There was a decline in Macroregion 4's contribution to global maize output (-38.2%). At the level of microregions, the North West region recorded an increase compared to 2011 by 29.1% and the Centre region by 20.4%. The South West Oltenia region, which experienced a reduction of 43.8%, was at the other pole. In 2021 Macroregion 2 held 43.4% of the total maize production and at the micro-region level the South Muntenia region stood out with 20.8% (Table 5).

Table 6. Romania's maize production by development region, thousand tons, 2011-2021

Total	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average 2011-2021	2021/2011 %
	11,717.6	5,953.4	11,305.1	11,988.6	9,021.4	10,746.4	14,326	18,663.9	17,432.2	10,096.7	14,820.7	12,370.2	126.5
M1	1,736.7	1,055.2	1,739.1	2,015.5	1,520.8	1,945.4	2,440.4	3,100.8	2,793.3	2,647.8	2,761.7	2,159.7	159.0
NW	1,060.8	648.2	1,095.0	1,226.3	873.4	1,191.6	1,504.0	1,953.6	1,769.6	1,643.7	1,732.2	1,336.2	163.3
C	675.8	407.0	644.1	789.3	647.4	753.8	936.4	1,147.2	1,023.7	1,004.1	1,029.5	823.5	152.3
M2	4,421.0	1,817.0	4,112.3	4,389.1	3,062.9	3,595.5	5,029.8	6,856.5	5,722.0	2,654.1	6,438.7	4,372.6	145.6
NE	1,966.5	977.2	2,057.1	2,261.3	1,497.4	1,712.0	2,473.5	3,208.0	2,683.2	1,637.3	2,830.3	2,118.5	143.9
SE	2,454.5	839.8	2,055.2	2,127.8	1,565.6	1,883.4	2,556.3	3,648.5	3,038.8	1,016.8	3,608.4	2,254.1	147.0
M3	2,420.3	1,401.2	2,568.4	2,501.7	2,080.3	2,007.8	3,085.1	3,756.3	3,655.0	1,820.3	3,167.8	2,587.7	130.9
S Muntenia	2,381.5	1,388.7	2,519.4	2,449.3	2,032.9	1,959.4	3,020.0	3,674.4	3,579.5	1,775.3	3,080.2	2,532.8	129.3
Bucharest-Ilfov	38.7	12.6	49.0	52.5	47.3	48.5	65.2	81.9	75.5	45.0	87.6	54.9	226.1
M4	3,139.6	1,679.9	2,885.3	3,082.2	2,357.4	3,197.7	3,770.8	4,950.3	5,262.0	2,974.5	2,452.5	3,250.2	78.1
SW Oltenia	1,569.3	604.2	1,475.7	1,445.0	1,066.3	1,243.4	2,076.8	2,362.3	1,924.1	1,456.1	1,116.0	1,485.4	71.1
W	1,570.3	1,075.7	1,409.6	1,637.3	1,291.1	1,954.3	1,694.0	2,588.0	3,337.8	1,518.5	1,336.5	1,764.8	85.1

Source: statistical data processing National Institute of Statistics, Accessed on 30.07.2022 [7].

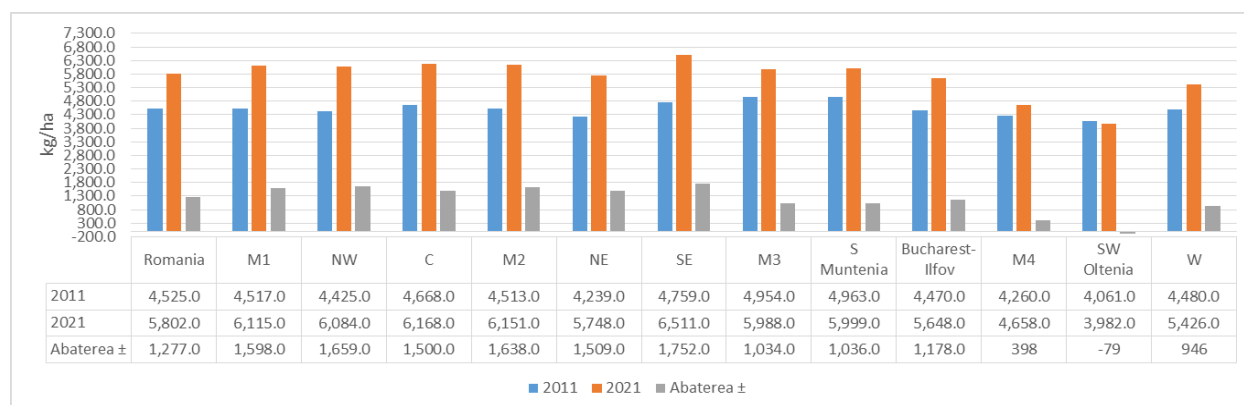


Fig. 5. National and development-related regions' average maize production per hectare, 2011 and 2021 (kg/hectare)

Source: statistical data processing National Institute of Statistics, Accessed on 30.07.2022 [7].

Figure 5 depicts the evolution of national average maize production per hectare and by region of regions.

The average amount of maize produced nationally in 2021 was 5,802 kg/ha, an increase of 1,277 kg/ha over the amount produced on average in 2011.

Except for the South West Oltenia region, which reported a negative deviation of -79 kg/ha, there were positive deviations in the emerging regions compared to 2011.

With a positive deviation of 1,752 kg/ha and a 6,511 kg/ha yield, the South East region had the highest yield.

CONCLUSIONS

Following are the findings of an examination of the growth of maize production and area in Romania:

- About 2.5 million ha of the surface were cultivated in Romania for maize, which continued to be the most significant crop with a share of 47.6% in the area cultivated for cereals and 30.8% in the total area cultivated.
- The following regions made up the majority of the area used to cultivate maize, in decreasing order: 19.4% South Muntenia, 19% South East, 18.3% North East, 13.5% South West Oltenia, 12.9% West, 10.3% North West, 6.2% Central, and 0.4% Bucharest-Ilfov.
- In 2021 there was a decrease of 1.6% in the area cultivated with maize compared to 2011
- At the level of macro-regions of development, compared to 2011 there was an increase in the area cultivated with maize as follows: 17.5% in Macro-region 1, 6.4% in Macro-region 2 and 8.3% in Macro-region 3. There was a significant decrease in the area cultivated with maize in Macro-region 4, by 28.6%.
- Between 2011 and 2021, the production of maize increased by 26.5%, from 11,717.9 thousand tons to 14,820.7 thousand tons.
- Maize production was 5,802 kg/ha with a positive deviation from the average production recorded in 2011 of +1,277 kg/ha.
- Changes in the cultivated surface and average production per surface unit, which in

turn are dependent on the soil type, technologies used, and meteorological conditions, have an impact on maize productivity.

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