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CEREAL PRODUCTION STABILITY IN TERRITORIAL PROFILE

ABSTRACT

Romania's agricultural production has been fluctuating, the instability being mainly generated by the climate factors and the production technologies, deficient in counteracting the effects of climate factors.

In Romania, cereals are the most widely grown crop, the average of the last 25 years showing that over 65% of total arable area has been cultivated with cereals. Romania's total cereal production largely depends on the weather conditions, featuring strong instability at national level, with variations from year to year, under the background of changes in the cultivated areas and average yields; in this paper we investigate the variation of these factors, i.e. areas and productivity, which determine production stability.

Cereals have a significant share in both animal and human consumption, and in these conditions the research on cereal production stability is important because a stable production can meet the domestic consumption needs, attenuating price volatility.

In order to study how the agricultural production values for wheat and maize are dispersed, in the paper we used the production variation coefficient at county level. Calculating the variability for the average wheat and grain maize yields per hectare, in territorial profile, we could notice that the counties with the greatest productions also have the greatest variations.

Key words: agriculture, production, cereals, stability, Romania.

JEL Classification: Q01, Q10, Q12, Q13.

1. INTRODUCTION

The paper investigates the cereal production stability and the main factors determining the stability or instability of cereal production. Starting from Romania's state of facts as regards the cereal crops, we made an analysis of the production, areas and average yields as compared to the main European cereal producing countries, next detailing our analysis at national, regional and county level. The factors that determine the agricultural production stability are the following: common factors, namely natural, structural, technological, economic, external, demographic factors, and specific, particular factors, which affect certain crops.

In Romania, the area cultivated with cereals (5464 thousand ha) represent about 10% of the area cultivated with cereals of the EU-28, our country ranking 4th after France, Germany and Spain. The average yield of 3449 kg/ha ranks us on the 25th place in EU-28, the first 3 positions being occupied by Belgium (9653 kg/ha), Ireland (9032) and the Netherlands (8724). The total production (19286 thousand tons) represents 6% of the EU-28 production, with Romania ranking 6th after France, Germany and Poland. The cereal export increased from year to year, reaching 1,998 million euro in 2014, with a positive trade balance of 1,691 million euro. As regards the storage capacity, Romania has a surplus of 21% (23423 thousand tons) nationwide. Cereals represent the group with the highest self-sufficiency, namely over 150%, wheat with 213% and maize with 135% (cereals – the group with the highest volatility).

2. STATE OF KNOWLEDGE

The specialty literature investigates the factors determining production stability, the areas and yields as the main determinants of production stability, as well as the natural factors (rain, wind, soil and climate); the structural factors such as farm structure, agricultural production structure, the technological and economic factors: inputs as prices and infrastructure. Production stability is also influenced by external factors, such as agricultural policy or economic policy in general or the demographic factors. A characteristic of the specialty literature as regards the cereal crops is that the wheat and maize varieties are often mentioned as contributing to production stability.

Conceptually, the performance of a stable agricultural production is affected by common factors, but there are also specific, particular factors that affect certain crops. The crop production is generally more unstable. The regional distribution of different crops represents an issue worth taking into consideration. The practice of traditional, non-performant technologies leads to production instability, generated by low and fluctuating average yields per hectare. Romania's cereal production largely depends on the weather conditions. Last but not least, cereal storage can represent another determinant of cereal production.

3. MATERIAL AND METHOD

In the paper we investigated the evolution of cereal production stability and the main factors that determine the stability or instability of cereal production. Data series for 11 years (2005–2015) were used and the variation coefficient for cereal production (wheat and maize) was calculated at county level; the results were filtered by extracting the county with the highest and lowest production volatility. The correlation of production and productivity with each of the above factors was

made, in order to establish the relevance of each. Comparisons were made with some cereal producing countries of the European Union: countries with low volatility (France, Germany etc) and countries with economic policies similar to Romania's (Poland).

We used the variation coefficient in order to investigate the way in which the production values are dispersed. Having in view that this is expressed on percentage basis and not in the unit of measure of the measured size, this provides a clearer picture of dispersion than, for instance, the mean square deviation.

The calculation formula used for the variation coefficient is:

$$CV(x) = \frac{\sigma_x}{\bar{x}}$$

Where:

σ_x is the mean square deviation;

\bar{x} is the data series average.

The mean square deviation has the following formula:

$$\sigma_x = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$

The data on the evolution of areas under cereals and cereal production in Romania, across regions and counties were taken from NIS and MARD. For the international comparisons and those linked to the production value we used data from EUROSTAT, USDA, DG AGRI and FAO. The source of data on cereal storage was MARD.

4. RESULTS AND DISCUSSIONS

4.1. COMPARISONS WITH THE MAIN CEREAL PRODUCERS FROM THE EUROPEAN UNION

Compared to the main cereals producers in Europe, in Romania we can notice high variations of cereal production, which are firstly caused by the low yields. We included Germany, France and Italy in our study, as the first three great cereal producers in Europe, as well as Poland, due to the comparable size and socio-political evolution, relatively similar to those from Romania. For all the categories of data used in this study, we used the variation coefficient. For a more accurate picture of the data series variation, we also used chain-base growth indices in the analysis, these ones removing the trend from the data series, trend that could give altered results.

In Table 1 we can see that Italy has the lowest variation of cereal production, the variation coefficient being 7.8%, while Romania has the highest variation coefficient, i.e. 24.4%. France and Poland have relatively low variation coefficients, 8.3% and 9.3% respectively.

Table 1

Cereal production in the main producing countries of the EU-28

	Germany	France	Italy	Poland	Romania
2006	43475	61613	18787	21776	15741
2007	40632	59382	18812	27143	7787
2008	50105	70142	20459	27664	16778
2009	49748	69862	15892	29827	14801
2010	44039	65444	17036	27512	16651
2011	41921	63695	17955	26767	20777
2012	45396	68335	17169	28544	12773
2013	47757	67242	16872	29702	20842
2014	52011	72632	18047	31945	22026
2015e	48867	72085	16148	28003	18623
2016p	45496	55325	16426	30241	18571
Variation coefficient	7.9%	8.3%	7.8%	9.3%	24.4%

Note: e – estimated, p – foreseen.

Source: author's processing of DG AGRI 2016 data.

However, if we calculate the chain-base growth indices for the data series in Table 1 we shall see that the variations from year to year are even more significant (Table 2).

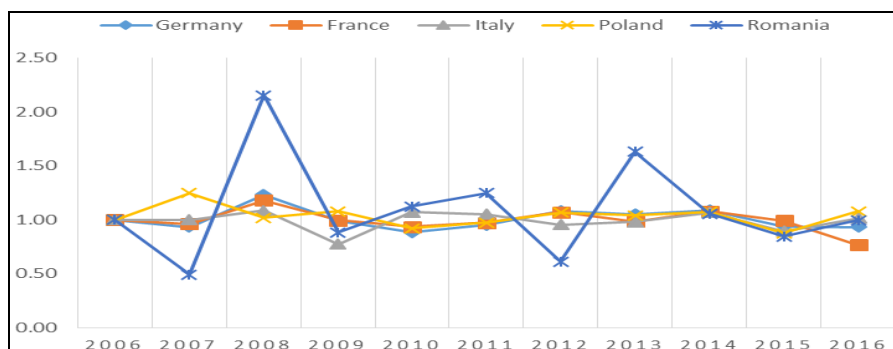
Table 2

The variations of chain-base growth indices for the cereal production

	Germany	France	Italy	Poland	Romania
2006	1	1	1	1	1
2007	0.9346	0.9638	1.0013	1.2465	0.4947
2008	1.2331	1.1812	1.0876	1.0192	2.1545
2009	0.9929	0.9960	0.7767	1.0782	0.8822
2010	0.8852	0.9368	1.0720	0.9224	1.1250
2011	0.9519	0.9733	1.0539	0.9729	1.2478
2012	1.0829	1.0728	0.9562	1.0664	0.6148
2013	1.0520	0.9840	0.9827	1.0406	1.6317
2014	1.0891	1.0801	1.0697	1.0755	1.0568
2015	0.9396	0.9925	0.8947	0.8766	0.8455
2016	0.9310	0.7675	1.0172	1.0799	0.9972
Variation coefficient	9.9%	10.3%	9.2%	9.4%	42.4%

Source: author's processing of DG AGRI 2016 data.

Taking as reference the year 2006, we can see important variations between the cereal productions in the years 2006/2007, when, due to the drought in the year 2007, the cereal production in Romania decreased to half as against the previous year, as well as in 2012, when production was significantly down under the background of drought that affected the agricultural production nationwide. We can also see that among the analyzed countries, the lowest variation coefficient was noticed in Italy (9.2%), followed closely by Poland (9.4%). Figure 1 represents the data obtained after the utilization of the chain-base indices for cereal production.



Source: Processing after data: DG AGRI 2016, http://ec.europa.eu/agriculture/markets-and-prices/short-term-outlook/index_en.htm

Figure 1. Variation of chain-base growth indices for cereal production

We can see that Romania has the highest variation of cereal production, much above that of the other analyzed European countries.

In order to get a clearer picture of the causes of cereal production variation, we also took into consideration the influence exercised by the cultivated areas and average yields.

Thus, (in Table 3) we can see that the areas cultivated with cereals varied very little, being around 5278 thousand hectares. The variation coefficient is 2.9%, among the lowest in Europe.

France has a variation coefficient close to that of Romania, i.e. 2.3%, while Italy has higher variations of the areas cultivated with cereals, namely 7.1%.

Table 3

Variation of areas cultivated with cereals

	Germany	France	Italy	Poland	Romania
2006	6702	9031	3575	8381	5109
2007	6572	9072	3701	8353	5121
2008	7038	9646	3814	8599	5201
2009	6909	9357	3215	8583	5270
2010	6595	9219	3225	7638	5028
2011	6501	9178	3173	7803	5212
2012	6527	9371	3361	7704	5430
2013	6534	9453	3306	7480	5410
2014	6469	9575	3207	7485	5431
2015	6526	9519	3082	7512	5452
2016	6355	9592	3194	7785	5397
Variation coefficient	3.0%	2.3%	7.1%	5.6%	2.9%

Source: author's processing of DG AGRI 2016 data.

We can conclude that the variation of areas cultivated with cereals does not determine to a great extent the high variation of cereal production.

It can be noticed that the average grain yields in Romania are much lower than those obtained by the great cereal producing countries from Europe (Table 4).

Thus, the average yield in Romania, 3.18 tons per hectare, represents only 45% of the average yields obtained by Germany (7.01 t/ha) and France (7.04 t/ha), yet comparable to those of Poland, with an average yield of 3.56 tons/ha.

However, from the point of view of average yield instability, Romania is on the last place among the investigated countries. Thus, while Germany ranks second as regards the stability of average yields per hectare, with a variation coefficient of 7.6%, after Italy, which has an average yield in the investigated period (2006–2016) of 5.26 tons/ha and a variation coefficient of 4.3% (the lowest), Romania has the highest value of average yield instability among the investigated countries, i.e. 23.5%. By comparison, Poland, although having values of the average cereal yields close to those of Romania, 5.56 tons per hectare, has a variation coefficient significantly lower than that of Romania, i.e. 12.5%.

We can notice from Figure 2 that the highest variations in the evolution of cereal yields were noticed in the years 2007 and 2012, characterized by prolonged drought.

Table 4

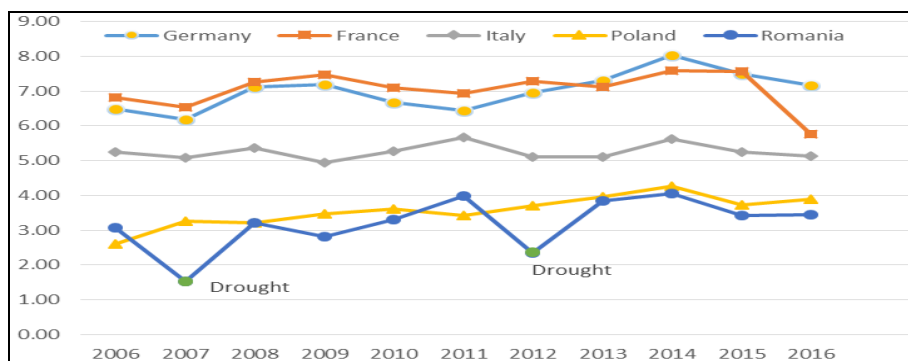
Average yields per hectare in cereals

	Germany	France	Italy	Poland	Romania
2006	6.49	6.82	5.26	2.60	3.08
2007	6.18	6.55	5.08	3.25	1.52
2008	7.12	7.27	5.36	3.22	3.23
2009	7.20	7.47	4.94	3.48	2.81
2010	6.68	7.10	5.28	3.60	3.31
2011	6.45	6.94	5.66	3.43	3.99
2012	6.95	7.29	5.11	3.70	2.35
2013	7.31	7.11	5.10	3.97	3.85
2014	8.04	7.59	5.63	4.27	4.06
2015	7.49	7.57	5.24	3.73	3.42
2016	7.16	5.77	5.14	3.88	3.44
Variation coefficient	7.6%	7.5%	4.3%	12.5%	23.5%

Source: author's processing of DG AGRI 2016 data.

In Romania, the areas cultivated with wheat (38%) and maize (46%) accounted for 84% of the total area cultivated with cereals. Romania ranks 5th in EU-28 as regards the area cultivated with cereals (Table 5), after France, Poland, Germany and Spain. The average cereal yields are low, by comparison with the other European countries, due to the high dependency of production on the weather conditions, the absence of a functional irrigation system, the concentration of cultivated areas (about 50%) into small farms, which have few and limited financial resources to practice performant technologies, with limited access to agricultural bank loans. As regards the average yields, Romania ranked 25th in EU-28 in the year 2015. Romania's total production accounted for only 6.08% of the

EU-28 cereal production, in 2015; with 18623 thousand tons of cereals, Romania ranks 6th in the EU.



Source: author's processing of DG AGRI 2016 data, http://ec.europa.eu/agriculture/markets-and-prices/short-term-outlook/index_en.htm

Figure 2. Evolution of average cereal yields

Table 5

Cultivated areas, production and average yields for cereal crops, in Romania and in the main EU Member States, in the year 2015

Country	Cultivated area (thousand ha)	Production (thousand tons)	Yield (kg/ha)
France	9519	72085	7573
Poland	7512	28003	3727
Germany	6526	48867	7488
Spain	6061	18693	3084
Romania	5452	18623	3529

Source: Tempo-online data, NIS 2016 and DG AGRI 2016 data.

By the cultivated area in the year 2015, Romania's wheat crop ranks 4th in EU-28 (Table 6), and 5th in Europe by total production, while by average yields it is on the 23rd place.

Table 6

Cultivated areas, production and average yields for wheat, in Romania and in the main EU Member States, in the year 2015

Country	Cultivated area (thousand ha)	Production (thousand tons)	Yield (kg/ha)
France	5179	41029	7920
Poland	2396	10958	4574
Germany	3264	26462	8106
Spain	1817	5427	2986
Romania	2043	7851	3842

Source: Tempo-online data, NIS 2016 and DG AGRI 2016 data.

By the area cultivated with maize in the year 2015, Romania ranks 2nd in EU-28 (Table 7), by total maize production it ranks 5th and by average maize yields it ranks 22nd.

Table 7

Cultivated areas, production and average yields for maize, in Romania and in the main EU Member States, in the year 2015

Country	Cultivated area (thousand ha)	Production (thousand tons)	Yield (kg/ha)
France	1622	13552	8355
Poland	670	3156	4709
Germany	456	3973	8722
Spain	382	4315	11298
Romania	2528	8871	3509

Source: Tempo-online data, NIS 2016 and DG AGRI 2016 data.

At national level, in the year 2015, the average wheat yield increased by 7.02% as against the previous year; as regards the cultivated areas, we can say that they remained the same in 2015 as compared to 2014 (Table 8), while the area cultivated with wheat slightly decreased by 3.3% as against the previous year and the area cultivated with maize increased by 0.60%.

Table 8

Data on the evolution of wheat areas and production in Romania

Item	MU	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Area	Thousand ha	2476	2013	1975	2110.3	2149	2162.4	1947	1998	2104	2113	2043
Average yield	Kg/ha	2965	2746	1541	3403	2421	2688	3663	2652	3468	3590	3842
Total production	Thousand tons	7341	5526	3045	7181	5203	5819	7132	5298	7296	7585	7851

Source: NIS data 2016 – Tempo online and MARD 2016 data.

The total wheat production slightly increased by only 3.51% (in 2015 as against 2014), while maize production (Table 9) significantly decreased by 26%. Nevertheless, as compared to the year 2005, the average wheat yield increased by 29.58%, while the average maize yield decreased by 11.21%. Overall, the areas cultivated with wheat and maize decreased in 2015 as compared to 2005, by 17.49% in wheat and by 3.84% in maize. The total wheat production increased by 6.95% and maize production decreased by 14.61%.

Table 9

Data on the evolution of maize areas and production in Romania

Item	MU	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Area	Thousand ha	2629	2520	2525	2442	2339	2098	2589	2730	2518	2513	2528
Average yield	Kg/ha	3952	3565	1526	3215	3409	4309	4525	2180	4488	4770	3509
Total production	Thousand tones	10389	8985	3854	7849	7973	9042	11718	5953	11305	11989	8871

Source: NIS data 2016 – Tempo online and MARD 2016 data.

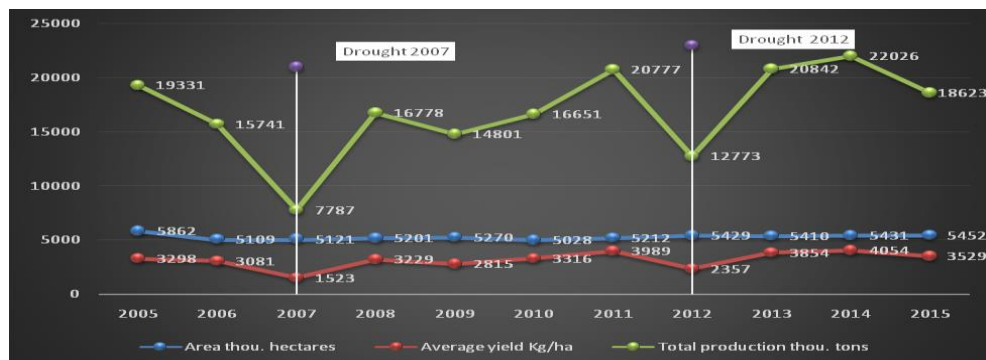
Table 10

Evolution of cereal areas, production and average yields in Romania

Item	Area	Total production	Average yield
UM	Thousand ha	Thousand tons	Kg/ha
2005	5862	19331	3298
2006	5109	15741	3081
2007	5121	7787	1523
2008	5201	16778	3229
2009	5270	14801	2815
2010	5028	16651	3316
2011	5212	20777	3989
2012	5429	12773	2357
2013	5410	20842	3854
2014	5431	22026	4054
2015	5452	18623	3529
Variation coefficient	4.4%	24.5%	23.5%

Source: author's processing of DG AGRI 2016 data.

As regards the cereal production stability, we can notice that there is a good stability as regards the areas cultivated with cereals, at national level, the variation coefficient being 4.4%; at the same time, in the investigated period, a relatively high instability can be noticed in the average yields, i.e. 23.5%, which leads to a production variation coefficient of 24.5%.

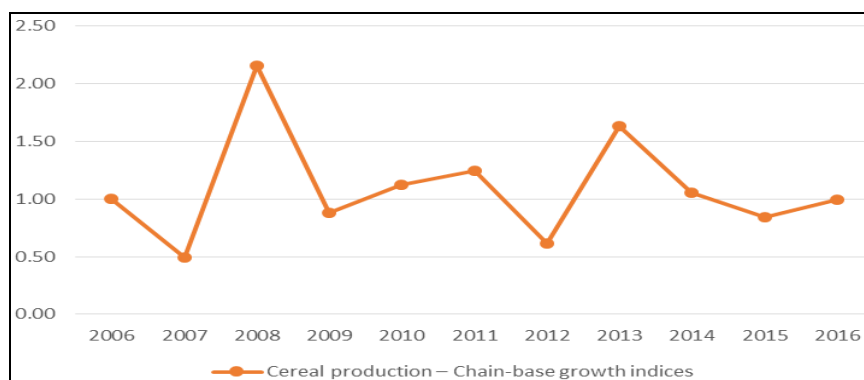


Source: Tempo-online data, NIS 2016 and DG AGRI 2016 data

Figure 3. Evolution of cereal areas, production and average yields in Romania.

In Figure 3 we can notice the decrease of the average yield per hectare in cereals, which had minimum values in the years 2007 and 2012 due to the severe drought, which significantly influenced the total cereal production level. Thus, in the year 2007, cereal production had the lowest level in the investigated period, i.e. 7,787 thousand tons, accounting for 35% of the maximum production level in the investigated period, which reached 22,026 thousand tons in the year 2014. The production of the year 2012 totalled 12,772 thousand tons, representing 58% of the maximum level of the production reached in 2014. The high instability can be

better noticed if we graphically represent the chain base growth indices for the total cereal production.



Source: author's processing of DG AGRI 2016 data, http://ec.europa.eu/agriculture/markets-and-prices/short-term-outlook/index_en.htm

Figure 4. Evolution of cereal production in Romania, using chain base growth indices.

In Figure 4 we can notice important variations of indices from year to year, with values ranging from 0.5 to 2.2.

Analyzing the cereal, wheat and maize productions across regions, in the year 2015, it can be noticed (Table 11) that the region South-Muntenia ranks 1st with a total cereal production of 5,035 thousand tons representing 26.1% of the total cereal production at national level, followed by the region South-East, with a production of 4,016 thousand tons, i.e. 20.8% of total production. The two regions together represent about 53% of the wheat production at national level. On the third place is the West Region, with 13.3% of total cereal production.

Table 11

Production of cereals, wheat and maize by development regions, in the year 2015

Regions	Cereal production			Wheat production			Maize production		
	Thousand tons	%	Classification	Thousand tons	%	Ranking	Thousand tons	%	Ranking
Romania	19286	100	–	7962	100	–	8985	100	–
North-West	1702	8.8	6	570	7.2	5	873	9.7	6
Center	1142	5.9	7	334	4.2	7	647	7.2	7
North-East	2159	11.2	5	509	6.4	6	1497	16.7	3
South-East	4016	20.8	2	1850	23.2	2	1566	17.4	2
South-Muntenia	5035	26.1	1	2364	29.7	1	2033	22.6	1
Bucharest – Ilfov	147	0.8	8	78	1.0	8	47	0.5	8
South-West Oltenia	2524	13.1	4	1210	15.2	3	1066	11.9	5
West	2558	13.3	3	1044	13.1	4	1254	14.0	4

Source: Tempo-online data, NIS 2016.

At national level, the storage capacity sums up 23,423 thousand tons, out of which 48.3% in silos (11,305 thousand tons) and 51.7% in grain sheds. At regional level, the regions South-East and South-Muntenia sum up 12,519 thousand tons, i.e. 53.45% of total storage capacities. The region South-Muntenia is on the first place as regards the storage capacity in silos, totalling 3,398 thousand tons (Table 12), while in the region South-East 3,399 thousand tons (21.4% of total cereals) can be stored in sheds.

Table 12

The storage capacity in the year 2016

No.	Regions	Storage capacity – thousand tons –	Silos – thousand tons –	Sheds – thousand tons –
1	Romania	23423	11305	12118
2	North-West	1520	610	909
3	Center	682	349	333
4	North-East	2144	815	1329
5	South –East	6524	3125	3399
6	South-Muntenia	5995	3398	2597
7	Bucharest–Ilfov	201	119	82
8	South-West Oltenia	2020	993	1027
9	West	4326	1892	2434

Source: MARD data, 2016.

Analyzing the storage capacity surplus or deficit in relation to cereal production across regions (Table 13), we can notice that the region with the highest storage capacity deficit is the region Center, with 40% deficit, also with the lowest production nationwide.

Table 13

The storage capacity in relation to total cereal production

No.	Regions	Total cereal production – thou tons –	Ranking	Total storage capacity – thou tons –	Ranking	Storage / production %
1	Romania	19286		23423		21
2	North-West	1702	6	1520	6	-10
3	Center	1142	7	682	7	-40
4	North-East	2159	5	2144	4	-1
5	South-East	4016	2	6524	1	62
6	South-Muntenia	5035	1	5995	2	19
7	Bucharest–Ilfov	147	8	201	8	37
8	South-West Oltenia	2524	4	2020	5	-20
9	West	2558	3	4326	3	69

Source: Tempo-online data, NIS 2016 and MARD, 2016.

The region South-West Oltenia has a deficit of 20%. At the opposite pole, the region West ranks 1st with a surplus of 69% due to the investments in storage facilities, while the region South-East comes next with 62%.

4.2. THE ANALYSIS OF CEREAL PRODUCTION INSTABILITY IN TERRITORIAL PROFILE BASED ON THE CALCULATION OF THE VARIATION COEFFICIENT

Calculating the variation coefficient of average wheat and maize yields per hectare, at county level, we can notice that the counties with high productions also have the greatest variations. Thus, the counties from the South region have high variation coefficients of wheat average yield per hectare: Tulcea (41.35%), Ialomița (37.05%), Călărași (36.26%), Olt (30.44%). These values are very high compared to the country's average, which is 23.67%. At the same time, counties like Suceava (9.22%), Caraș-Severin (11.67%), Brașov (16.78%), Timiș (18.51%), Argeș (18.66%) have average wheat yields per hectare under the national average.

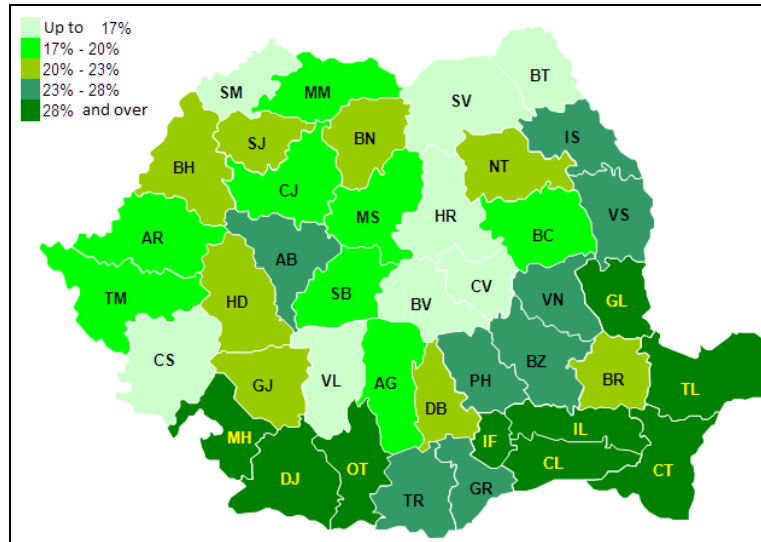
Similar results can be noticed in the case of maize yields, where the variation coefficients are even higher. Thus, the counties Buzău (52.86%), Constanța (47.96%), Ialomița (44.12%), Dolj (41.46%), Olt (43.82%) have variation coefficients much over the national average (29.76%). The counties Suceava (15.98%), Mureș (16.81%), Bistrița-Năsăud (17.02%) and Timiș (18.31%) have some of the smallest fluctuations in the average maize yields.

Analyzing the variations of average yields in correlation with the areas cultivated with wheat and maize, we cannot draw the conclusion that these production variations are caused by the variations of the cultivated areas, the Pearson correlation coefficient indicating low values. Thus, in the counties Galați (0.11), Tulcea (0.17), Olt (-0.24) these values are not significant for the confirmation of the hypothesis that such a correlation exists.

From Figure 5 we can notice that at national level the greatest wheat producing counties are also the most exposed to high variations of average yields. Thus, the counties from the entire southern zone of the country, and also the eastern part, are mostly exposed to important yield variations (Iași, Vaslui, Galați, Vrancea). At the same time, we can notice that regions Center and West (except for the county Alba), as well as the counties Suceava and Botoșani have lower variations than the national average.

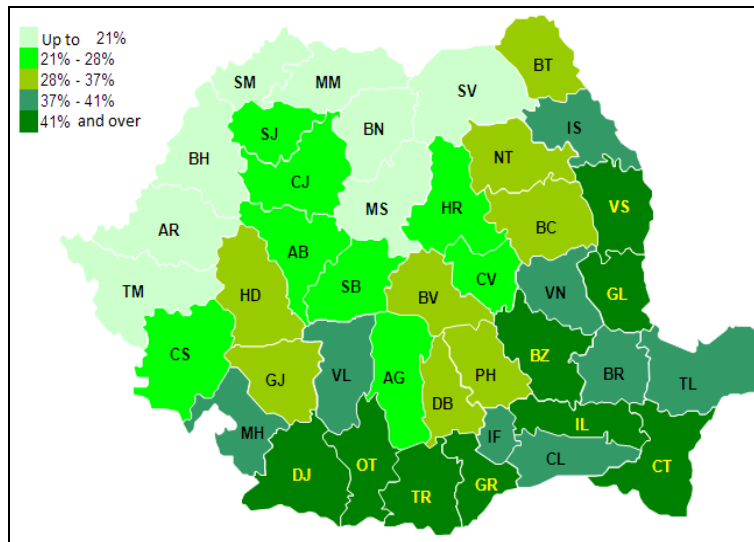
As regards the average maize yields (Figure 6), we can notice the same phenomenon. In the southern and eastern zones of the country we can notice significant variations of average yields, much above the national average, while the counties from the western and northern part of the country have the lowest variations of average yields. These significant variations have a negative effect upon agricultural production stability, largely due to the unfavourable weather conditions. That is why it is necessary to identify in detail the causes that are likely

to endanger the stability and sustainability of the agricultural production and to find efficient methods to attenuate the disturbing factors.



Source: author's processing of NIS data, 2016

Figure 5. Distribution of the variation coefficient of average wheat yields at national level.



Source: author's processing of NIS data

Figure 6. Distribution of the variation coefficient of average grain maize yields at national level.

5. CONCLUSIONS

Production instability in the wheat and maize crops is much higher in Romania than at EU level. This derives from the high instability of one of the investigated determinant factors, i.e. the average yields per hectare. The main causes of these significant variations that have a negative effect upon the cereal production stability are the great dependence on the weather conditions, and also the inadequate measures for attenuating these effects.

- The highest average cereal yields are found in the regions South-Muntenia (counties: Calarasi, Ialomita and Teleorman), South-East (counties: Constanta, Buzau, Braila), West (counties Timiș and Arad) and South-West Oltenia (counties Dolj and Ilt)
- The counties with high cereal production also have high production variability, except for the counties Timiș (20.5%) and Arad (19.7%), which have variation coefficients of production relatively low compared to the country average.
- The counties Buzau (38.2%), Dolj (32.7%), Ialomita (31.4%), Călărași (31.3%), Constanța (29.6%), Teleorman (26.8%) and Brăila (26.5%) have high variation coefficients of the cereal production.
- As regards the storage of cereals, there is a surplus of storage space nationwide (21%) as compared to the cereal production, the largest storage facilities being found in the zones West (+69%), South-East (+62%) and South-Muntenia (+19%), while the storage deficits are found in the regions Center (−40%), South-West Oltenia (−20%) and North-East (−10%).
- After the analysis of the correlation between the average wheat and maize yields and the areas cultivated with these crops, we cannot conclude that these production variations are caused by the variations of the cultivated areas, the Pearson correlation coefficient indicating low values.
- The main determinant in cereal production stability is represented by the dependence on the weather conditions, which can be manifested under severe forms, with a significant effect upon production.

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