

## MAIZE AND WHEAT - TOP AGRICULTURAL PRODUCTS PRODUCED, EXPORTED AND IMPORTED BY ROMANIA

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### Abstract

*The paper analyzed wheat and maize production, export and import in Romania in the period 2007-2016 in order to point out the main trends and factors which sustain the position of the country in the international trade. Index method, comparison method, export/production ratio, export/import ratio, gross exchange index have been determined to characterize efficiency of external trade. Maize and wheat production increased 2.8 times during the last decade, representing 50 % and respectively 38.5 % in cereal production. Romania comes on the 2nd position for maize and on the 5th position for wheat in the EU production. The production growth is due mainly to the large cultivated surface, 4.7 million ha, for these two cereals which represent 85 % of the cultivated area in Romania. But, with 4.1 tonnes maize and 3.9 tonnes wheat per ha, yield is by 42.39 % and respectively 26.22 % lower than the EU average. Romania exported 11 times more maize and 34 times more wheat during the last decade. Also, it imported less maize but more wheat mainly for re-export. Export/Production ratio increased from reached 0.32 for maize and 0.82 for wheat, and Export/Import ratio reached 7.78 for maize and 5.83 for wheat. Export and import value also had a high growth rate, while import had a decline, resulting a positive balance, and this under the decline of export price and increase of import price. As a conclusion, the production growth contributed to the development of export with a benefic effect on the trade balance and Romania's prestige and position as a cereal producer and exporter. To increase yield level, investments are required in new technologies ( machinery, irrigations, high production value hybrids and varieties, fertilization and plant protection). Also, farm size should be increased by joining in associative forms for a more efficient use of capital and human resources and increase economic efficiency.*

**Key words:** maize, wheat, production, export, import, trade balance, Romania

### INTRODUCTION

Even thou its existence dates back in the early 7,000 and even in the pre-historic era, till nowadays wheat cropping has been developed very much [21]. Today, wheat is cultivated on the largest surface than any other crop in the world and it is the most traded grain worldwide [5]. Wheat is "the king of cereals" because it is a great grain deal being easy to cultivate, store and process [7].

Wheat has a high content in protein (12-16%), gluten, carbohydrates, lysine, minerals (Ca, P, Fe etc), A and D vitamins, lipids etc. For this reason, it is the most used cereal for human nutrition but also for as animal feed especially in the years with rains when harvest is unsuitable for bakery. For human consumption the most important wheat species are *Triticum Durum or Turgidum* (L)

and *Triticum Aestivum* (L). The both species are cultivated in many countries in the world from Asia, Europe, Middle East, Africa and America [9].

In Romania, wheat was cultivated 3000 years ago and Getae-Dacians had a flourishing trade in the Black Sea area. Across the centuries, wheat cropping has been rapidly developed in the Romanian Countries, and at the beginning of the 19th century, Romania was considered "the granary of Europe". Wheat crop was affected by the two world wars, but after that it has recovered and increased due to the technical endowment, the extend of high potential varieties and good cropping technologies [14].

Maize (*Zea mays*) has its origin in the Latin America, more exactly in Mexico, dating from 10,000 years back. From there, its cropping was spread in all the Americas, Europe, Asia

and Africa. It is considered the most productive crop, and together with wheat it accounts for 80 % of world cereal production [17].

In Romania, maize was brought about 300 years ago to replace the old plantations of millet which was an important crop till that time. Maize has been the most important cereal for Romanians for about 200 years, but from the beginning of the 20th century, they have been more oriented to wheat, as bread has become an important food. Maize is also successfully used in animal feeding, for producing ethanol and for other purposes [2, 3, 15].

Maize grains contain 13.3 % water, 10 % protein, 4.7 % lipids, 59 % starch, sugars 2.2 %, dextrin 2.4 %, pentosan 4.3 %, 1.4 % minerals ( K, Ca, Si etc), (A, B, E and PP vitamins), cellulose 2.2 % and pigments [23].

About 77 kg maize flour, 44 l alcohol, 71 kg glucose, 1.8-2.7 l oil and 3.6 kg cakes could be obtained from 100 kg maize grains as mentioned by Zamfirescu *et al* (1963), as cited in "Cultura porumbului-Maize crop". [5].

In 2017, the world grains production accounted for 2,460.41 million metric tonnes, of which maize 1,033.74 million metric tonnes (42.01 %) and wheat 757.92 Million metric tonnes (30.8 %), the difference belonging to rice, barley, oats and rye [30].

The main wheat producers are EU, China, India, Russia, USA, Canada, France, Ukraine, Pakistan and Germany [13], while the main maize producers are USA, China, Brazil, Argentina, Ukraine, Mexico, Indonesia, France and South Africa [20].

The EU-28 is an important "player" in the cereals market. In 2016, it achieved 301.3 million tonnes cereals, of which wheat 134.5 million tonnes (44.6%) and 62.7 million tonnes maize (20.8 %) [10,11].

Romania is one of the most important producers of maize and wheat in Europe and in the world. Its performance in maize and wheat cropping is based on the use of high potential varieties and hybrids, plant resistance to diseases and pests and grain quality required for processing [17, 25, 27, 28].

In this context, the purpose of the paper was to comparatively analyze the situation of production, export and import for maize and wheat, the main cereals cultivated in Romania and top agricultural products in production performance and international trade. The period of reference was 2007-2016 for which available official empirical data were updated at the date of the present study.

## MATERIALS AND METHODS

The study was focused on the following indicators in order to characterize the competition between maize and wheat in production, export and import. In this purpose, there were analyzed: production of maize and wheat, cultivated area, yield, exported and imported quantities of maize and wheat, export and import value, trade balance, the share of export and import values of maize and wheat in the agro-food export and import value, average export FOB price and average import CIF price for maize and wheat, the ratio between the average export and import price, and gross exchange index.

Also, in this study was presented Romania's position in terms of market share regarding maize and wheat production, export and import among the EU countries and also at the world level.

The data were collected for the period 2007-2016 from FAOSTAT Data base, 2018 and Tempo online Data Base, 2018 of the National Institute of Statistics [12, 19].

The following methods have been used in order to process the data:

*Index Method*, in its variant of the Index with fixed basis whose formula is:  $I_{FB} = (X_n / X_1) * 100$ ,

*Graphical Method* used to illustrate the dynamics of each indicators and to allow comparisons between maize and wheat.

*Gross Exchange Index (GEI)* was used to reflect the purchasing power of maize compared to wheat. GEI was determined as the ratio between the average export price and the average import price, according to the mathematical formula:

$$GEI = \frac{I_{p0}^E}{I_{p0}^I} \times 100 = \frac{\sum q_{1p0} xE}{\sum q_{0p0} xE} \times \frac{\sum q_{0p0} xI}{\sum q_{1p0} xI} \times 100$$

where:

GEI= Gross Exchange Index

$I_{p0}^E$ = the index of the average export price in the basic period  $p_0$

$I_{p0}^I$ = the index of the average import price in the basic period  $p_0$

$q_1$ = the quantity of exported goods, and respectively, the quantity of imported goods in the current period

$q_0$ = the quantity of exported goods, and respectively, the quantity of imported goods in the basic period

$p_0$ = export price and, respectively import price in the basic period.

If  $GEI > 1$ , the both goods have a higher purchasing power as when we export them we get a higher price than the price at which these goods are bought. This is a favorable exchange index.

If  $GEI < 1$ , the goods have a low purchasing power, as they are sold at a price smaller than the price at which they are imported. This index reflects an unfavorable exchange

between export and import with a negative consequence on the trade balance [24].

The results were presented in tables and the necessary comments and interpretations were made.

## RESULTS AND DISCUSSIONS

**Productions.** Romania's cereal production has known a fast dynamics after 2007, so that in 2016, it accounted for 21.8 million tonnes, being by 2.79 times higher than in the 1st year of study.

Maize and wheat are the main cereal crops cultivated in Romania. *Maize production* increased from 3.9 million tonnes in 2007 to 10.7 million tonnes, so that in 2016 it was 2.74 times higher than in the 1st year of study. *Wheat production* accounted for 8.4 million tonnes in 2016 compared to 3 million tonnes in 2007. Therefore, in the analyzed period, it increased 2.8 times.

In the analyzed period, the weight of maize and wheat in the cereal production remained relatively constant at about 50 % in case of maize and at about 38.5 % in case of wheat (Fig.1.)

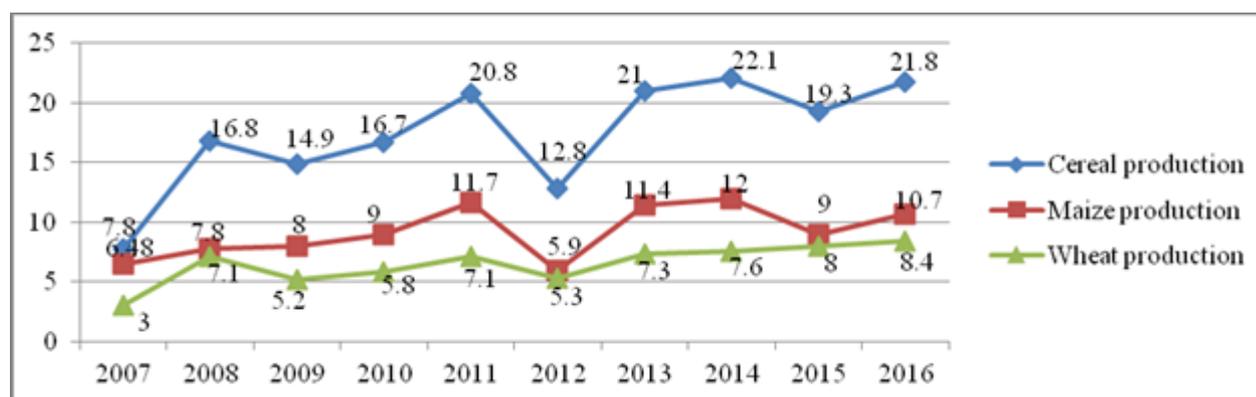


Fig.1.Evolution of cereals, maize and wheat production in Romania, 2007-2016 (Million tonnes)

Source: Own design based on the data of [12, 19].

The average, standard deviation and the variation coefficient for cereal, maize and wheat productions are presented in Table 1. The variation coefficient varied between 20 % and 30 % reflecting that production levels were relatively heterogeneous.

Table 1. The average, standard deviation and variation coefficient of the production of cereals, maize and wheat in the period 2007-2016

	Mean	Std. Dev.	Variation Coeff. (%)
Cereal production	17.4	4.59	26.37
Maize production	8.94	2.18	24.38
Wheat production	6.18	1.68	27.18

Source: Own calculation based on the data of [12, 19].

Romania is among the first top producers of cereals in the EU [18]. In 2016, it achieved 10,746 thousand tonnes grain maize and 8,406 thousand tonnes wheat. For this performance, Romania came on the 2nd position for grain maize and corn-cob mix ( 6.9 %) after France (19 %) and on the 5th position for wheat and spelt production ( 6.2 %) after France (20.5 %), Germany (18 %), United Kingdom (10.7 %), and Poland (8 %) [10].

At the world level, Romania is situated on the 18th position for wheat production and on the 12th position for maize production.

During the last decade, maize and wheat are in competition to occupy the 1st position among the top agricultural products produced, exported and imported by Romania (Table 2). These two products are followed by cow fresh milk, potatoes, sunflower seeds, barley, rapeseed, sugar beet, cabbage and grapes in a different order depending on the year [12].

Table 2. Position occupied by maize and wheat in production, export and import quantity, Romania, 2007-2016

	Position for production		Position in exported quantity		Position for imported quantity	
	Maize	Wheat	Maize	Wheat	Maize	Wheat
2007	2	4 (after milk, maize and potatoes)	2 (after sunflower seeds)	4 (after sunflower seeds, maize and rapeseed)	1	2 (after maize)
2008	1	2	2 (after wheat)	1	1	2 (after maize)
2009	1	2	2 (after wheat)	2 ( after maize)	1	2 (after maize)
2010	1	2	2 (after wheat)	1	3 (after wheat and soybeans cake)	1
2011	1	2	1	2 ( after maize)	4 (after wheat, soybeans cake and raw sugar)	1
2012	1	2	2 (after wheat)	1	1	1
2013	1	2	2 (after wheat)	1	4 (after wheat, soybeans cake and raw sugar)	1
2014	1	2	2 (after wheat)	2 ( after maize)	2 (after wheat)	1
2015	1	2	1	2 ( after maize)	1	1
2016	1	2	2 (after wheat)	1	2 (after wheat)	1

Source: Own determination based on the data from [12].

**Cultivated area** with cereals, mainly with maize and wheat is the first important factor with a deep influence on production. The empirical data reflect that the surface cultivated with cereals has slightly increased from 5.1 million ha in 2007 to 5.5 million ha

in 2016 (+7.8%). The cultivated area with maize accounted for 2.6 million ha in 2016, being by 4 % larger than in 2007. The surface cultivated with wheat increased by 5 % from 2 million ha in 2007 to 2.1 million ha in 2016 (Fig.2).

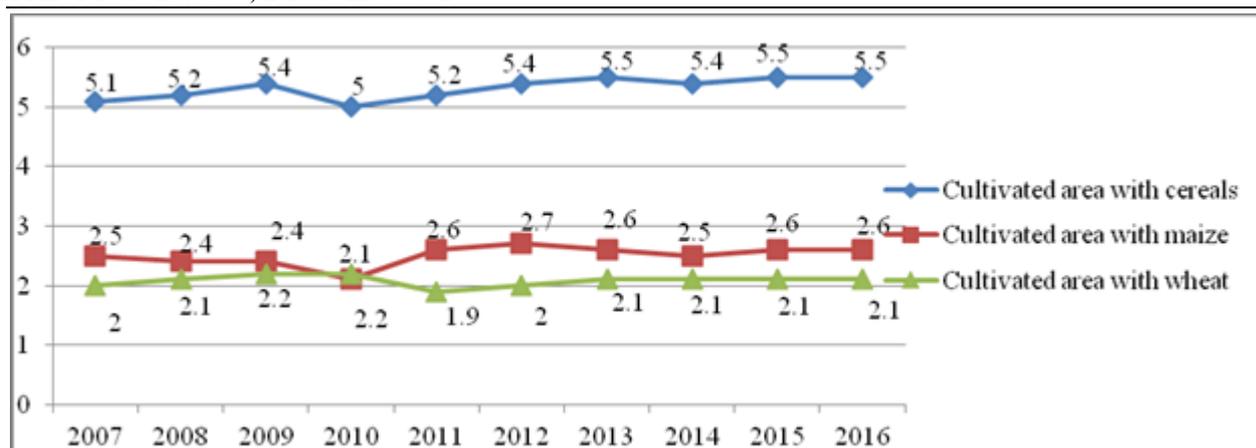


Fig.2.Evolution of the cultivated area with cereals, maize and wheat in Romania, 2007-2016 (Million ha)  
 Source: Own design based on the data from [12, 19].

The average, standard deviation and the variation coefficient for cereal, maize and wheat cultivated areas are shown in Table 3. The values of the coefficient of variation were lower than 10% showing that cultivated area did not varied too much and remained relatively homogeneous.

Table 3. The average, standard deviation and variation coefficient of the cultivated area with cereals, maize and wheat in the period 2007-2016

	Mean	Std. Dev.	Variation Coeff. (%)
Cultivated area with cereals	5.32	0.18	3.38
Cultivated area with maize	2.5	0.16	6.4
Cultivated area with wheat	2.08	0.09	4.3

Source: Own calculation based on the data from [12, 19].

In 2016, of the 14.4 million ha utilized agricultural surface in Romania, the cultivated area with cereals represented 38.19 %, the cultivated area with maize 18.05 % and the surface cultivated with wheat 14.5 %. Therefore, maize and wheat all together have a share of 85.45 % in the cultivated area with cereals and 32.6 % in the utilized agricultural land.

In the same year, Romania's weight in the EU cultivated area with cereals was 9.08 %, bringing the country on the 5th position after France (16.3 %), Poland (13.3 %), Germany (11%) and Spain (10.5%). All these 5 countries together cultivate cereals on 60.18

% of the EU cultivated agricultural land [10, 29].

**Yields.** Besides the cultivated area, which is an extensive factor of development, the growth of production is also influenced by yield or the obtained amount of grain per surface unit, which is an intensive factor of production.

In the studied period, the average production of cereals increased from 1,524 kg/ha in 2007 to 3,971 kg/ha in 2017.

Maize yield increased 2.72 times from 1,526 kg/ha in 2007 to 4,163 kg/ha in 2016, while wheat yield increased from 1,541 kg/ha in the 1st year of the analysis to 3,944 kg/ha in the last year (Fig.3).

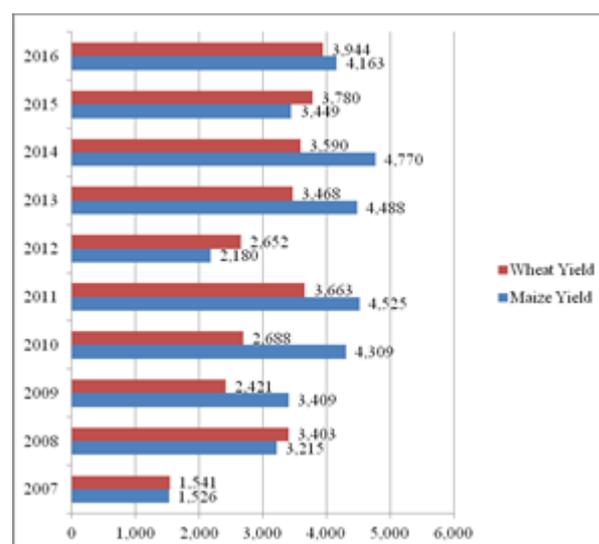


Fig.3.Evolution of maize and wheat yields in Romania, 2007-2016 (kg/ha)

Source: Own design based on the data from [19]

The average, standard deviation and the variation coefficient for maize and wheat yield are presented in Table 4. The figures for the coefficient of variation are over 20%, but lower than 30%, meaning maize and wheat yield values are relatively heterogeneous.

Table 4. The average, standard deviation and variation coefficient for maize and wheat yield in the period 2007-2016

	Mean	Std. Dev.	Variation Coeff. (%)
Maize yield	3,603.4	1,072.79	29.77
Wheat yield	3,115	761.48	24.44

Source: Own calculation based on the data from [19].

The average production is influenced by a large range of factors such as: farm size, crop variety, soil conditions, fertilization level, climate (rainfalls, drought, extreme phenomena), irrigation, plant protection, moment and quality of agricultural works, farmer training level and experience etc.

Farm size in Romania is a restraining factor for production level. The average surface of a farm is about 3.7 ha, far away from 17 ha/holding in the EU. About 75 % farms have less than 2 ha, 18.8 % between 5 and 10 ha and 4.7 % between 10 and 50 ha. Only 1.5 % of farms are larger than 50 ha. And, just 0.5 % of the number of holdings have over 100 ha and utilize 49 % of the agricultural land.

Therefore, in Romania, the smallest farms are dominant, representing 98 % of the total number of holdings and they utilize about 40 % of the agricultural surface. This is a real impediment in the application of the modern technologies in cereal cropping and not only. In addition, the lack of co-operatives or other associative forms does not allow the existing subsistence and semi subsistence farms to perform better due to the distribution of agricultural land in small plots. More than this the lack of material and financial resources and the low training level of the farmers are other restraining factors in the development of cereal cropping in Romania.

During the last decade, the effects of climate change are more and more visible. In the years 2007 and 2012, the production per surface unit have been very much affected by drought. The non sufficient irrigation systems

in Romania are also a cause of the low yield level.

The lack of financial resources and the lack of attractiveness of the credit system are other factors which do not allow production growth. However, the highest maize yield was 4,770 kg/ha carried out in the year 2014 and the highest wheat yield was 3,944 kg/ha recorded in the year 2016.

Unfortunately, cereal yield in Romania is still very low compared to the records in other EU countries [16].

In 2016, for 3,971 kg/ha cereal grains, Romania came on the 17th position in the EU-28. This performance was similar to the world yield (3,967 kg/ha). But, in the EU, higher cereal yields were achieved by the Netherlands, Germany, France, Austria, United Kingdom, Belgium, Croatia, Slovenia, Czech Republic, Denmark, Sweden, Hungary, Bulgaria, Malta, Norway and Poland.

As many Romanian farmers are mainly oriented to cereal cropping, in the year when production is high, cereal price at the harvest moment is very low on the domestic market, obliging the farmers to sell their grains on the external market to get a higher price and cover the production cost. The lack of stores is also a cause of this decision, because farmers have not the possibility to keep their grain production and sell it when the demand is higher and price is more attractive.

**Romania's share in the EU and in the world maize and wheat production, cultivated area and yield.**

In 2016, Romania carried out 1.1 % of the world wheat production and 0.99 % of the world maize production. In the same year, its contribution to the EU-28 production was 5.77 % for wheat and 17.28 % for maize.

Romania's cultivated area with wheat and the one cultivated with maize represented 0.94 % and respectively 1.39 % in the world cultivated area with these two cereals. In the EU-28 cultivated area, Romania's share is 7.7 % for wheat and 30.33 % for maize.

Wheat yield achieved by Romania is by 16.56 % higher than the average yield in the world, but by 26.22 % lower compared to the EU average.

Maize yield carried out by Romania is by 28 % lower than the EU average (Table 5). % lower than the world average and by 42.39

Table 5. Romania's share in the EU and in the world for wheat and maize production, cultivated area and yield in 2016

	Production (Million Metric Tonnes)		Cultivated area (Million ha)		Yield (Metric Tonnes/ha)	
	Wheat	Maize	Wheat	Maize	Wheat	Maize
World	752.08	1,078.31	222.21	186.91	3.38	5.77
EU-28	145.37	61.89	27.23	8.57	5.34	7.22
Romania	8.4	10.7	2.1	2.6	3.94	4.16
-Share of Romania in the World (%)	1.1	0.99	0.94	1.39	116.56	72.09
-Share of Romania in the EU (%)	5.77	17.28	7.7	30.33	73.78	57.61

Source: Own calculation based on the data from [31]

**Exported quantity.** As mentioned above in Table 2, maize and wheat are competitors for the top position, not only regarding production, but also exported and imported amounts.

*The exported quantity of maize* increased in a very fast manner from 312.3 thousand tonnes

in 2007 to 1,101.2 thousand tonnes in 2016. Therefore, it was 11 times higher in the last year of the analysis. *Wheat export* accounted for 206.6 thousand tonnes in 2007, but in 2016 it was 6,994 thousand tonnes, 33.8 times higher than in the first year of the analysis (Fig.4).

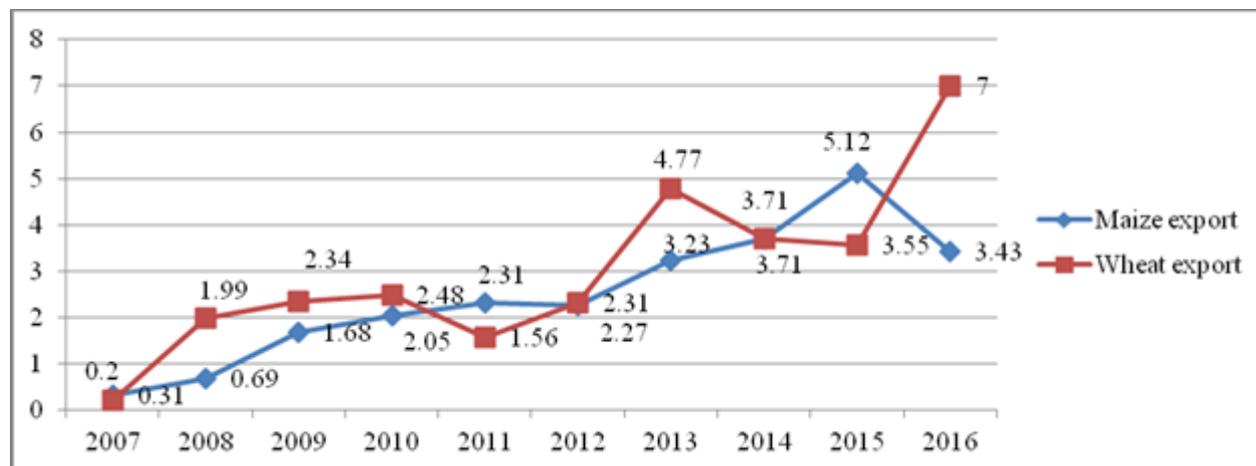


Fig.4.Evolution of maize and wheat exported quantities by Romania, 2007-2016 (Million tonnes)

Source: Own design based on the data from [12]

Table 6. The average, standard deviation and variation coefficient for maize and what exported amounts in the period 2007-2016

	Mean	Std. Deviation	Coefficient of variation (%)
Maize export	2.48	1.44	58.06
Wheat export	2.99	1.88	62.87

Source: Own calculation based on the data from [12].

The average, standard deviation and variation coefficient for maize and what exported quantities are shown in Table 6. The variation coefficient was very high in this case, over 30 %, reflecting that the amount of exported maize and wheat was heterogeneous.

The main partners for wheat export are: Egypt, Spain, Jordan, Libya, Italy, Turkey, Tunisia, Israel, Bangladesh, and the principal beneficiaries for maize export are: Spain, the

Netherlands, South Korea, Turkey, Egypt, Italy, Portugal, Iran, Israel, Lebanon, Syria, Lybia, Algeria [8].

**Imported quantity.** Maize and wheat are also subject of import, despite that Romania is a large producer and exporter. The imported amount of maize varied from a year to another depending on the obtained production, but mainly due to commercial a commercial reason- re-export.

In 2016, Romania imported 583.4 thousand tonnes maize, by 11.7 % less than in 2007. The year with the highest imported amount, 813.2 thousand tonnes, was 2015. In case of wheat, it was registered a general ascending trend of imports, from 587.5 thousand tonnes in 2007 to 1,200 thousand tonnes in 2016. Therefore, wheat import was double in the last year of the study (Fig.5).

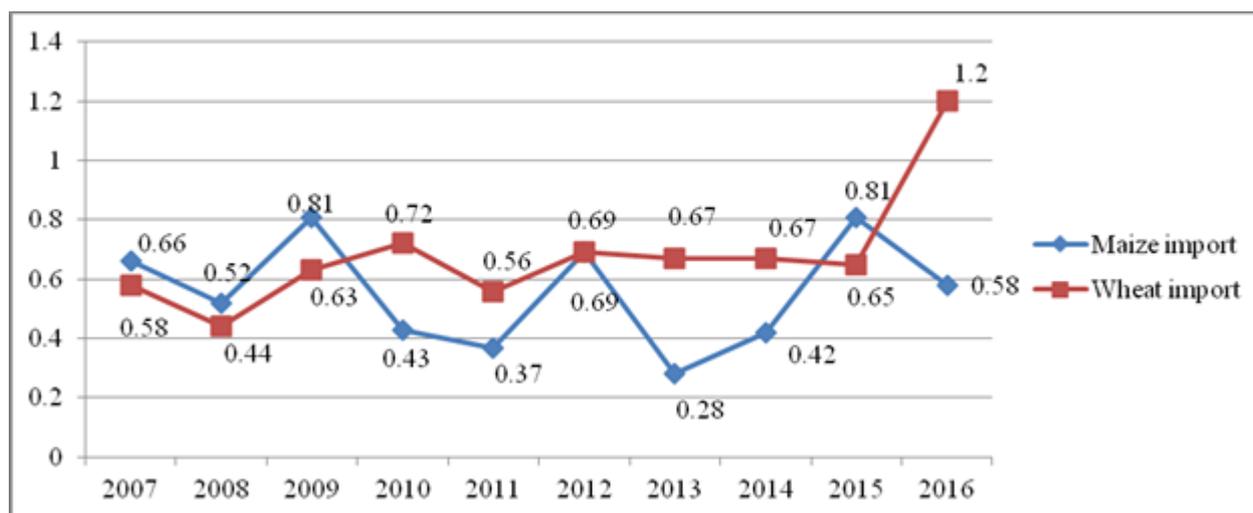


Fig.5. Dynamics of maize and wheat imported amounts by Romania, 2007-2016 (Million tonnes)  
 Source: Own design based on the data from [12]

In Table 7 are shown the values for average, standard deviation and variation coefficient for maize and what imported quantities. In case of maize import, the variation coefficient was very high, over 30 %, reflecting heterogeneous data in the analyzed period. But, in case of wheat, the variation coefficient was lower than 30%, reflecting relatively heterogeneous data.

Table 7. The average, standard deviation and variation coefficient for maize and what imported amounts in the period 2007-2016

	Mean	Std. Deviation	Coefficient of variation (%)
Maize import	0.55	0.18	32.72
Wheat import	0.68	0.20	29.41

Source: Own calculation based on the data from [12].

The main commercial partners for cereal import are Hungary, Bulgaria and Slovakia.

However, the imported cereals, especially of wheat, are not used in most of cases in Romania, but reoriented to other markets [26]. **Export/Production Ratio.** In the analyzed period, due to the increased production, but also due to the development of export, the export/production ratio registered an increasing trend. In 2016, in case of maize, export/production ratio accounted for 0.32, being 4 times higher than in 2007. In case of wheat, export/production ratio was 6.42 times higher in 2016, accounting for 0.82 compared to 0.07 in the year 2007 (Fig.6).

In 2011, this ratio was almost similar meaning that both export and import had the same weight in total production of maize and, respectively of wheat as shown in Fig.6.

However, in 2016, the share of wheat in wheat production was 2.5 times higher than the share of corn in corn production.

**Export/Import ratio** has recorded the highest dynamics. In 2016, its level was 7.78 in case

of maize and 5.82 in case of wheat, being over 1.6 times higher than in 2007.

This was due to the expand of export in a larger proportion than the import growth rate (Fig.7.)

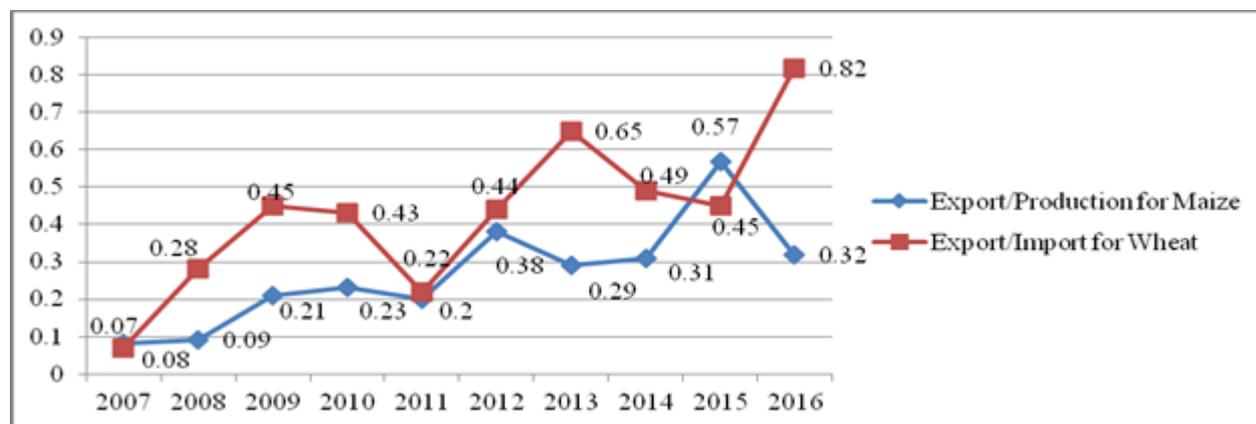


Fig.6.Dynamics of maize and wheat export/production ratio, Romania, 2007-2016

Source: Own design based on the data provided by FAOSTAT, 2018 [12]

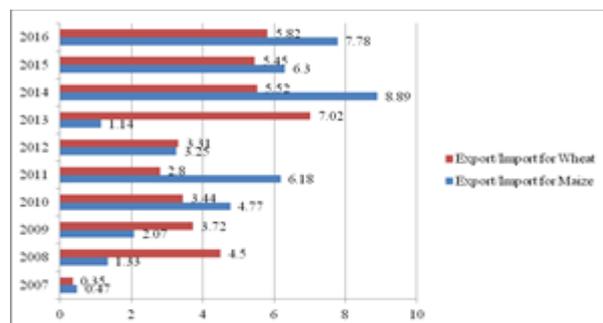


Fig.7.Dynamics of maize and wheat export/import ratio, Romania, 2007-2016

Source: Own design based on the data from [12]

**Export and import value and trade balance.** In the analyzed period, the maize export value increased 9.48 times, while the wheat export value raised 24.9 times. In 2006,

maize export accounted for Euro Million 722.1 compared to import value which was Euro Million 147.8. As export value had a higher growth rate compared to import value, the maize trade balance has become positive after 2009. In 2016, it accounted for Euro Million 574.3.

The export value of wheat was much higher compared to maize export value. In 2016, the value of exported wheat accounted for Euro Million 1,160.7, being 24.9 times higher than in 2007.

The wheat import value reached Euro Million 337.3 in the year 2016, being 3.03 times higher than the level of the first analyzed year (Table 8, Fig.8).

Table 8.Maize and wheat export value, Romania, 2007-2016 (Euro Million)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2016/2007 %
<b>MAIZE</b>											
Export value	76.1	138.5	254.7	396.2	606.7	608.2	744.3	772.9	982.6	722.1	948.88
Import value	130.2	138.9	133.6	92.9	127.6	193.6	126.4	126.6	298.7	147.8	113.5
Trade balance	-54.1	-0.4	121.1	303.3	479.1	414.6	617.9	646.3	683.9	574.3	-
<b>WHEAT</b>											
Export value	46.5	385.2	304.7	378.0	313.0	548.5	989.6	963.2	700.5	1,160.7	2,496.12
Import value	111.1	99.3	80.9	115.9	117.0	121.9	127.6	120.0	120.7	337.3	303.6
Trade balance	-64.6	285.9	223.8	262.1	196	426.6	862	843.2	579.8	823.4	-

Source: Own calculations based on the data from [19].

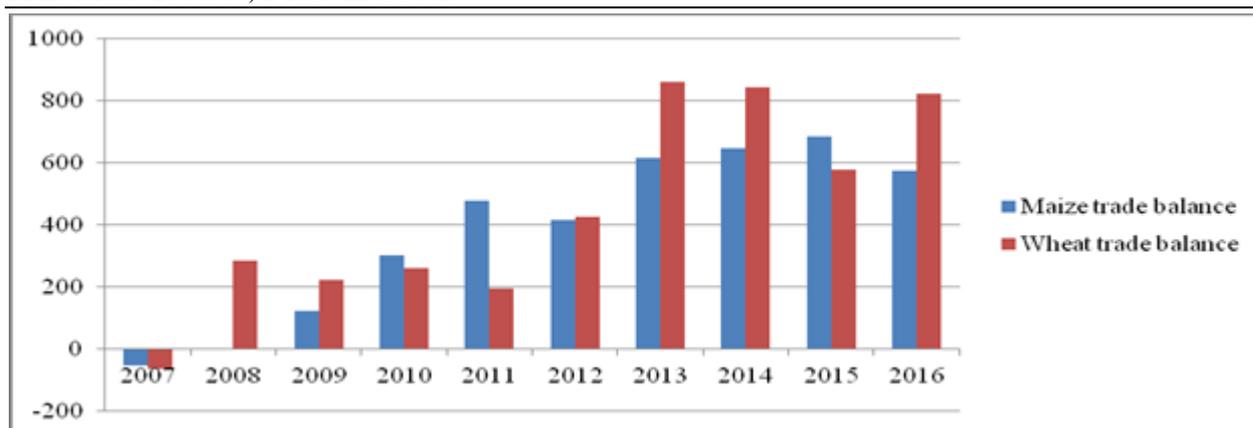


Fig.8.Dynamics of maize and wheat trade balance, Romania, 2007-2016

Source: Own design based on the data from [19]

The trade balance was deeply influenced not only by the exported and imported amounts, but also by export and import price.

**The share of export value for maize and wheat in the agro-food export value.** The weight of maize export value in agro-food export value ranged between 4.15 % in 2007 and 19.1 % in the year 2016, reflecting how important is this cereal in Romania's export of agro-food products.

The share of wheat export value varied between 6.7 % in 2007 and 11.7 % in 2016, with a peak of 16.6 % in the year 2015. Therefore, wheat is a main item in Romania's agro-food export.

All together, maize and wheat, represented 30.8 % of agro-food export value, compared to only 10.85 % in the year 2007 (Table 9).

Table 9. The share of maize and wheat export values in Romania's agro-food export value, 2007-2016 (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maize	6.7	6.4	11.3	12.7	15.0	15.0	14.0	13.8	16.6	11.7
Wheat	4.15	17.8	13.6	12.1	7.7	13.5	18.7	17.2	11.8	19.1
All together	10.85	24.2	24.9	24.8	22.7	28.5	32.7	31.0	28.4	30.8

Source: Own calculations based on the data from [19]

Also, in the cereals export value, wheat export value represented 30.7 % in 2007 and 55.3 % in 2016, while maize export value accounted for 50.2 % in 2007 and 34.4 % in 2016.

**The share of import value for maize and wheat in the agro-food import value.** The weight of maize import value in Romania's agro-food import value had different levels during the analyzed period, varying between 3.8% in 2007 and 2.2 % in 2016. However,

the highest level was 4.9 % registered in the year 2015. Regarding wheat, its export value represented 3.2 % in 2007 and 4.9 % in 2016 in Romania's import value of agro-food products. Taking into consideration the both cereals, their share in agro-food import value accounted for 7 % in 2007 and 7.1 % in 2016, but in the other years their weight was a little lower, with the minimum value 4.8 % in the year 2014. (Table 10).

Table 10. The share of maize and wheat import values in Romania's agro-food import value, 2007-2016 (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maize	3.8	3.2	3.5	2.4	2.4	4.0	2.5	2.5	4.9	2.2
Wheat	3.2	2.3	2.1	2.9	2.6	2.5	2.6	2.3	2.0	4.9
All together	7.0	5.5	5.6	5.3	5.5	6.5	5.1	4.8	6.9	7.1

Source: Own calculations based on the data from [19]

The figures show the contribution of maize and wheat to the value of agro-food import in Romania.

In the import value of cereals, wheat represented 41 % in 2007 and higher weight, 56.9 % in the last year of the analysis, while the share of maize declined from 48 % in 2007 to 24.9 % in 2016.

**Average export price.** The both prices had various levels in the external market

depending on offer/demand ratio, grains quality and other factors. Maize price varied between Euro 243.7 per tonne in 2007 and Euro 209.9 in the year 2016. The highest FOB price for maize was Euro 267.5 per tonne registered in the year 2012. Wheat price ranged between Euro 225.4 in 2007 and 165.9 per tonne in 2016, with the highest level Euro 259.7 carried out in 2014.(Table 11).

Table 11. Average export and import price of maize and wheat, Romania, 2007-2016 (Euro/tonne)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Average export price										
Maize	243.7	199.4	151.0	192.8	262.5	267.5	230.2	208.3	191.7	209.9
Wheat	225.4	193.6	130.1	152.4	199.5	236.9	207.3	259.7	197.0	165.9
Average import price										
Maize	197.1	266.6	164.3	215.8	341.4	277.2	444.9	303.4	367.4	253.3
Wheat	189.2	224.9	128.6	161.0	209.4	174.5	187.8	178.8	185.0	281.1

Source: Own calculation using the data from [12, 19]

The export price reflects the major trends in the world cereal market, regarding demand/offer ratio and quotations on the stock exchange. the major problems in Romania's export with cereals is linked to climate change and Romanian agriculture is highly dependent on the meteorological conditions as long irrigation systems are operating on a small surface. The nonsufficient storage capacity is also a problem which determine farmers to sell their grains immediately after harvesting and to get a low price [1].

**Average import price.** In case of maize, it varied between Euro 197.1 in the year 2007 and Euro 253.3 per tonne in 2016. The highest maize import price accounted for Euro 444.9 in the year 2013.

In case of wheat, its average import price varied from Euro 189.2 in 2007 and Euro

281.1 per tonne in 2016. The lowest import price was noticed in 2009, accounting for Euro 128.6 for wheat and for Euro 164.3 per tonne for maize (Table 11).

**The ratio between the average export price and the average import price.** In case of wheat, this ratio registered higher levels than 1 in many years, except 2008, 2010, 2011 and 2016. In these four years, this ratio reflects that wheat was imported at a higher price than the export price, and this had a negative influence on the wheat trade balance. In case of maize, the export/import price ratio was unfavorable in most of the years, except 2007. Therefore, maize was sold at a lower average price than the import average price, resulting a negative impact of maize trade balance (Table 12).

Table 12. The ratio between export price/import price for maize and wheat, Romania, 2007-2018

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maize	1.23	0.74	0.91	0.89	0.76	0.96	0.51	0.68	0.50	0.82
Wheat	1.19	0.86	1.01	0.94	0.95	1.35	1.10	1.45	1.06	0.59

Source: Own calculations based on the data from [12, 19]

**Gross Exchange Index (GEI) between average export price and average import price** had the value 1.03 for 2016/2015. This value shows that for maize and wheat, the ratio between the average export price and the

average import price was over unity,  $GEI > 1$ , reflecting that the two agricultural products have a high purchasing power.

## CONCLUSIONS

Maize and wheat productions increased 2.8 times in the analyzed period, accounting for 10.7 million tonnes and, respectively, 8.4 million tonnes in 2016. Maize represent 50 % and wheat 38.5 % of cereal production of Romania.

Based on production level, Romania occupies the 2nd position for grain maize and the 5th position for wheat in the EU, while at the world level, it is situated on the 18th position for wheat and on the 12th position for maize.

The production performance is due mainly to the large surfaces cultivated with these cereals, in 2016, accounting for 2.6 million ha maize and 2.1 million ha wheat, representing 18.5 % and, respectively, 14.5 % of the cultivated area in Romania. The both crops totalize 85.45 % of the cereals cultivated area.

In 2016, maize yield and wheat yield reached 4,163 kg/ha and, respectively 3,944 kg/ha, much more than in 2007. Despite that these yields are higher than in 2007, yield performance in Romania is still very low. In case of wheat, yield level is by 16.56 % higher than the world average and by 26.22 % smaller compared to the EU average. In case of maize, yield carried out by Romania is by 28 % smaller than the world average and by 42.39 % smaller than the average in the EU.

An important growth was noticed regarding export of maize and wheat. In 2016, Romania exported 1,101.2 thousand tonnes maize, 11 times more than in 2007 and 6,994 thousand tonnes wheat, 34 times more. Export increase is justified first by the effort to assure a good grain quality for covering the EU market needs and, secondly, by the need to satisfy the demand in some countries from the Middle East and Africa.

In 2016, Romania imported 583.4 thousand tonnes maize and 1,200 thousand tonnes wheat. While maize import is lower, wheat import is much higher than 10 years ago.

In country like Romania, an important producer of cereals, import of wheat and maize is justified only in the years affected by meteorological phenomena when production is low. But, during the last years, it was noticed a practice among traders to import

these cereals especially from Hungary and Bulgaria in order to re-export them to other destinations.

Export/Production ratio in terms of quantity registered an ascending trend mainly in case of wheat. In 2016, it accounted for 0.32 in case of maize and 0.82 in case of wheat.

Export/Import ratio in terms of quantity also registered a positive evolution reaching 7.78 in case of maize and 5.82 in case of wheat in the year 2016.

Export value increased 9.48 times in case of maize and 24.9 times in case of wheat. Import value registered a lower increase in the both cases, which resulted in a positive trade balance. This reflect an intensified effort of Romania in the international trade with wheat and maize, as a consequence of the increased production performance.

As a result, in 2016, the share of maize and wheat all together in Romania's agro-food export value accounted for 30.8 % of agro-food export value, being 3 times higher than in 2007.

Average export price varied between Euro 243.7 and Euro 209.9 for maize and between Euro 225.4 and Euro 165.9 for wheat. Therefore, it is a descending trend in export price for these cereals.

The import price varied between Euro 197.1 and Euro 253.3 per tonne for maize, and between

Euro 189.2 and Euro 281.1 per tonne for wheat.

This increase of the import price had a negative influence on the ratio between export and import price. While wheat has a better situation with many years when export/import price ration was over 1, in case of maize in most of the years, this ratio was lower than 1.

As a final conclusion, the obtained results confirmed Romania's efforts to produce and export more maize and wheat. This has a benefic effect on the trade balance and for the country promotion among the most important producers and exporters of the EU. These two agricultural products are in a permanent competition for production performance and to conquer new markets. To reach this purpose, new efforts are needed to increase yield using high breeding value hybrids and

modern technologies. Investments are required in machinery and irrigations, and also fertilization and plant protection should be assured in a corresponding level. Joining in associative forms is compulsory to increase farm size, capital and human resources to better work the land and benefit of a higher productivity and economic efficiency.

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