

COMPARATIVE ANALYSIS OF THE IMPORT AND EXPORT OF SORGHUM AND BARLEY MADE IN THE LIGHT OF PRE-ACCESSION AND POST-ACCESSION TO THE EUROPEAN UNION

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Abstract

Increasing climate change as well as the evolution of agricultural prices have led to important changes in the structure of crops cultivated predominantly in Romanian farms. If in the past the Romanian agricultural producer does not have a great deal of openness to the new technologies, as well as to new crops like sorghum and rapeseed ten years ago, it is noticed that, with Romania joining the EU, 2007, things they changed. By increasingly contacting European farmers with a much better yield per hectare, but also opening up to new technologies and the attractive price of oil crops, Romanian farmers have begun to focus their attention on far more attractive crops than in terms of sales prices and the application of new technologies to help them achieve high output to cope with European competition. By interpreting the statistical data provided by the National Institute of Statistics and Eurostat, a comparative analysis of the import and export of sorghum and barley was carried out in the light of the pre-accession and post-accession EU production to observe whether these crops provide a high level of profitability and if it is justified to cultivate them on extended surfaces. Although there is still much to be done in this area, we see that investing in high performance technologies and equipment, in quality inputs and hybrids, is a way of generating production levels comparable to those recorded at European level.

Key words: sorghum, barley, rapeseed, production, area, sale price

INTRODUCTION

Regarding the evolution of the agricultural production context and taking into account the increasingly important environmental challenges, sorghum culture has important advantages over the cultivation of maize, especially in those farms where droughts and heat show their presence every year. The sorghum can be harvested either as a whole plant or in the form of beans with the most diverse uses. [1, 2]

Sorghum culture is not so widespread in Romania despite its many uses, being used in both human and animal food, but also for the production of energy biomass.

With a low input of inputs, sorghum provides for both quantitative and qualitative feed supplies, especially in difficult pedoclimatic conditions, when water resources are difficult. In view of these considerations, sorghum can be a variant of corn crop replacement, especially in those areas where there is no possibility of crop irrigation, where the level

of maize production is relatively low. [3,5]

The research has enabled over time the development of a wide range of feed sorghum hybrids allowing for several classifications that have been made to make it easier to choose the most adapted hybrids for each situation and for each type of recovery. We meet one-harvested sorghum hybrids that need 100 to 140 days of vegetation and multiple harvest hybrids that are used either for mowing or for grazing, where the first harvest takes place approximately 45-60 days after Sown and under the category of multiple harvest hybrids such as Sudan grass or sorg x Sudan hybrids.

Over time, the development of fodder sorghum hybrids has made it possible, in the case of different pedoclimatic situations, to find a feed to adapt to pedoclimatic constraints and to meet the animal feed utilization goals. The feed sorghum is rich in digestible vegetable fibers and can be an excellent supplement to corn silos in the food ration, maintaining a high level of production

without significant changes.

Compared to sorghum culture, due to the increased exploitation price, rapeseed has rapidly expanded in Romania, where farmers have reduced the areas for maize or sunflower crops. Due to insufficient information, the prices for the three crops analyzed were not fully presented. Neither barley culture is negligible in Romania, where until recently grain and barley were the only cultures established in the autumn. However, the disappearance of the beer factories, as well as the diminution of the livestock, resulted in the reduction of barley-bearing areas, especially after Romania's accession to the European Union. [4]

Barley has remained a crop that occupies extensive areas only on those farms located in the immediate vicinity of a brewery, a venue offering the highest level of price.

In this paper we will carry out a comparative analysis of the three crops of barley, rapeseed and sorghum on production, cultivated area and the recovery price in order to identify whether these three crops provide a high level of profitability at farm level and whether it is justified. Their cultivation on extended surfaces.

MATERIALS AND METHODS

The statistical data provided by the National Institute of Statistics in Romania, as well as

the Eurostat international data base, on the surfaces cultivated with barley, sorghum and rapeseed, the recorded productions, as well as the value of the imports and exports to the crops are also used. Barley in the pre-accession and post-accession period (of Romania to the European Union), at the level of Romania and at the level of the big producing countries, thus determining the evolution trends of these indicators. These, combined with theoretical aspects extracted and learned from the literature, allowed to determine trends of evolution of these indicators. The methodology consisted of descriptive analysis of data and comparative analysis, the results being tabulated.

RESULTS AND DISCUSSIONS

The comparative analysis carried out on barley, sorghum and rapeseed crops will allow to formulate assumptions that will lead to important changes in the structure of crops found at farm level in Romania.

As we can see, until the moment of Romania's accession to the European Union, barley culture was very extensive in our country, while rapeseed occupies an area almost four times smaller in 2001. In 2007, The area planted with rapeseed has increased substantially, from 110,110 hectares in 2006 to 364,919 hectares in 2007, exceeding the barley area.

Table 1. Comparative analysis of the area planted with barley, sorghum and rape in the pre-accession and post-accession periods of Romania to the European Union (hectares)

Specification	2000	2001	2006	2007	2008	2013	2014	2015	2015/2000 (%)	2015/2007 (%)
Barley	214,623	316,648	131,528	130,895	161,952	269,637	303,969	266,658	24.24	103.72
Sorghum	1,602	6,213	740	1,058	8,014	21,668	18,845	13,486	741.82	1,174.67
Rape	68,412	82,395	110,110	364,978	364,978	276,596	406,705	367,885	437.75	0.81

Source: Data processed National Institute of Statistics, date of access: 25.02.2017; [6]

After Romania's accession to the European Union, the surface cultivated with rape has constantly evolved, far exceeding the area allocated to barley crops. At the level of 2015, 266,658 hectares of barley and 367,885 hectares of rape were cultivated in Romania, with 37.96% more. According to the data provided by the National Institute of Statistics, the largest area planted with

rapeseed was in 2014, when it reached an area of over 400,000 hectares, while in the year 2000 the rape crop occupied an area of only 68,412 hectares, while the area occupied by barley was three times higher.

Analyzing comparatively the area planted with rape in 2015 compared to the year 2000, there is an increase of 5.37 times, whereas for barley the cultivated area registered an

increase of 24.24%. In 2015 compared to 2007, the area cultivated with barley recorded an increase of 103.72%, while the surface cultivated with rapeseed registered an insignificant increase (0.81%).

In terms of sorghum culture, the area cultivated in Romania is still at a low level. As it can be noticed, in 2006 in our country there was cultivated an area of only 740 hectares, and in 2007 it reached just over 1,000 hectares cultivated with sorghum. The most significant area cultivated with sorghum was recorded in 2013, when just over 20,000 hectares of sorghum were cultivated. In 2015,

the area cultivated with sorghum was 13,486 hectares, eight times larger than the area cultivated in the year 2000 and 12.74 times higher than the area cultivated in 2007.

Analyzing the three cultures, rape is the one that occupies the largest surface, followed by barley and then sorghum. The evolutions recorded by the three crops are significant, especially when it comes to sorghum, but also rape. This demonstrates that Romanian farms are beginning to adapt to market requirements and choose cultures that provide a high level of profitability and significant production.

Table 2. Analysis of areas cultivated with sorghum at European level in the main producing countries of the European Union (1,000 hectares)

Specification	2008	2009	2010	2011	2012	2013	2014	2015	2016
European Union (28 countries)	-	-	114.19	117.03	-	-	158.08	138.51	127.73
%	100	100	100	100	100	100	100	100	100
Bulgaria	1.8	0.7	3.54	2.84	5.3	4.34	6.71	6.82	5
%	-	-	3.10	2.43	-	-	4.24	4.92	3.91
Greece	0.12	0.3	0.04	0.22	0.14	0.2	1.83	2.86	2.86
%	-	-	0.035	0.188	-	-	1.158	2.065	2.239
Spain	6.8	7.5	7.14	8.48	7.73	8.97	7.29	8.38	8.96
%	-	-	6.25	7.25	-	-	4.61	6.05	7.01
France	37	58	47.65	43.44	42.15	51.25	62.97	53.7	45.67
%	-	-	41.73	37.12	-	-	39.83	38.77	35.76
Italy	38.6	39.9	40.73	41.73	37.1	51.07	51.91	43.37	43.46
%	-	-	35.67	35.66	-	-	32.84	31.31	34.02
Hungary	3.9	2.8	3.16	5.33	4.43	5.33	4.58	4.58	4.91
%	-	-	2.77	4.55	-	-	2.90	3.31	3.84
Austria	-	-	1.17	1.11	1.19	1.94	2.8	2.92	2.26
%	-	-	1.02	0.95	-	-	1.77	2.11	1.77
Romania	8.01	6.12	10.28	13.08	19.99	21.67	18.85	13.49	13.12
%	-	-	9.0	11.2	-	-	11.9	9.7	10.3

Source: Eurostat database processing, date hits: 25.02.2017; [6]

In 2016, at a European Union level of 28 states, sorghum culture occupies an area of 127,730 hectares, and the main cultivation countries of sorghum are: France (45,670 hectares), Italy (43,460 hectares) and Romania (13,120 hectares). Smaller areas of sorghum are grown in Spain – 8,960 ha, Bulgaria – 5,000 ha, Hungary – 4,910 hectares, but also Greece and Austria.

The first three countries of sorghum cultivation in the European Union - France, Italy and Romania cover an area of 102,250 ha, representing 80.05% of the total area cultivated with sorghum at European level.

Bulgaria and Hungary are also sorghum cultivators, but they are not an important player on the European market because both countries fail to bring together the area cultivated by our country.

In relation to the total area cultivated with sorghum, Romania, by hectare, covers between 9 and 10% of the total area. That is, while France cultivates 35.76% of the total area cultivated with sorghum at European level and Italy cultivates 34.02% of the total European area.

Table 3. Comparative analysis of the production of barley, sorghum and rape during the pre- and post-accession periods of Romania to the European Union (tonnes)

Specification	2000	2001	2006	2007	2008	2013	2014	2015	2015/2000 (%)	2015/2007 (%)
Barley	560,618	1,056,032	337,070	231,918	577,178	930,515	1,085,573	1,071,960	91.21	362.22
Sorghum	1,479	5,584	1,331	1,193	20,899	49,829	51,543	31,728	2,045.23	2,559.51
Rape	76,126	101,789	175,050	361,500	673,033	666,097	1,059,121	919,473	1,107.83	154.35

Source: Data processed National Institute of Statistics, date of access: 25.02.2017; [6]

Production data reveals that yields per hectare have increased steadily with Romania's accession to the European Union, largely due to the farmers' access to modern technologies, but also because they have had access to favorable varieties and hybrids, through the production level to the specific pedoclimatic conditions in a permanent change.

At 2015, the total barley production amounted to 1.07 million tonnes, while the production of sorghum was 31,728 tonnes, 33 times less than that of wheat. Rape production in 2015 was just under 1 million tonnes, 16.58% less

than barley production.

Analyzing comparatively the data provided by the National Institute of Statistics in 2015 it is observed that compared to 2000 the production of barley grew by 91.21%, while the production of sorghum and rape had significant evolutions, the production being of 21 Times larger for sorghum and 12 times higher for rape. This reflects the fact that farmers have invested in technology to record increases in yields for the three crops, but also that the areas allocated for barley, rape and sorghum have increased quite a bit over 2000.

Table 4. Average yield on barley, sorghum and rape during the pre-accession and post-accession periods of Romania to the European Union

Average production	2000	2001	2006	2007	2008	2013	2014	2015
Barley	2.61	3.34	2.56	1.77	3.56	3.45	3.57	4.02
Sorghum	0.92	0.90	1.80	1.13	2.61	2.30	2.74	2.35
Rape	1.11	1.24	1.59	0.99	1.84	2.41	2.60	2.50

Source: Data processed National Institute of Statistics, date of access: 25.02.2017; [6]

Regarding the average production recorded at country level, this trend has been steady since 2000 and so far. As can be seen, if at the 2000 barley crop there was an average production of 2.61 tons / ha, in 2015 the average production almost doubled, reaching 4.02 tons / ha. And in the sorghum crop there was an important evolution, so that if in 2000 the average production did not exceed one tonne per hectare, in 2015 the average sorghum production reached 2.35 tons / ha. Also, rapeseed has experienced a significant increase in yield per hectare, so that if in 2000 the average yield was 1.11 tonnes / ha, in 2015 it was twice as high, reaching 2.50 tons / ha.

As regards the level of production recorded at European level for sorghum crops, it can be seen that at 2016 the production of sorghum in France was 232.200 tonnes, while Italy, which cultivated a smaller sorghum area with 5.08% achieved the largest production at

European level – 315,680 tonnes. At European level, total sorghum production was 689,860 tonnes.

If, from the point of view of the surface cultivated with sorghum, Romania ranks third in terms of production, our country ranks fourth, being downgraded by Spain, which although cultivated an area of 8,960 hectares in 2016 with 46.42 %

Less than the area cultivated in Romania, the yield per hectare was much better. With a total production of 53,100 tons of sorghum, Spain surpassed our country, which managed to harvest a production of 28,870 tons in the year 2016, two times less than the production of Spain.

Reporting the production of sorghum registered in the main producer countries in total European Union production, it is noted that in France the total harvested production represents 33.66% of the total European sorghum production, while the Italian

production represents 45.76%. Regarding the situation in Romania, the production of sorghum registered in 2016 covers 4.18% of the sorghum production registered in the

European Union with 28 member countries. In terms of yield per hectare, it can be seen that Italy, Spain and France have the most significant average yields per hectare.

Table 5. Analyze European sorghum production in the main producing countries of the European Union (1,000 tonnes)

Specification	2008	2009	2010	2011	2012	2013	2014	2015	2016
European Union (28 countries)	-	-	608.86	673.9	-	-	940.09	728.68	689.86
%	-	-	100	100	-	-	100	100	100
Bulgaria	3.4	1.8	8.61	5.55	10.8	11.63	18.35	17.04	10.7
%	-	-	1.41	0.82	-	-	1.95	2.34	1.55
Greece	0.15	0.17	0.12	0.84	0.76	0.66	6.22	10.27	10.2
%	-	-	0.02	0.12	-	-	0.66	1.41	1.48
Spain	22.4	32.3	36.56	38.64	27.38	44.85	47.66	50.34	53.1
%	-	-	6.00	5.73	-	-	5.07	6.91	7.70
France	230.6	309.9	262.61	280.74	239.19	278.54	395.62	277.8	232.2
%	-	-	43.13	41.66	-	-	42.08	38.12	33.66
Italy	224.6	243.4	271.44	287.82	157.81	316.92	368.78	294.22	315.68
%	-	-	44.58	42.71	-	-	39.23	40.38	45.76
Hungary	13.6	7.6	7.85	16.62	12.44	14.45	19.47	15.53	9.23
%	-	-	1.29	2.47	-	-	2.07	2.13	1.34
Romania	20.9	14.44	18.68	39.7	37.48	49.83	51.54	31.73	28.87
%	-	-	3.07	5.89	-	-	5.48	4.35	4.18

Source: Eurostat database processing, date of access: 25.02.2017; [6]

Table 6. Average yield on sorghum crops registered at European level in the main producer countries of the European Union (100 kg / ha)

Specification	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bulgaria	-	-	24.32	-	20.20	26.65	27.36	24.98	21.30
Greece	12.43	5.67	32.49	38.66	53.01	32.76	33.90	35.91	35.63
Spain	-	-	40.79	46.59	53.41	55.29	68.32	60.10	59.26
France	-	-	55.11	64.56	57.00	54.37	63.00	51.65	50.84
Italy	-	-	66.65	68.98	42.81	60.98	71.06	69.20	67.58
Hungary	-	-	10.09	29.56	18.60	-	42.51	33.94	18.80
Romania	26.08	23.59	18.16	30.35	18.75	23.00	27.35	23.53	22.00

Source: Eurostat database, hits date: 25.02.2017; [6]

Thus, at the level of 2016 Italy recorded an average production of 6.7 tonnes / ha, Spain recorded a production of 5.9 tonnes / ha, and France had an average yield of 5.08 tonnes / ha. In Romania, the average sorghum production recorded in 2016 was 2.2 tons / ha, three times lower than the average production recorded in Italy.

Analyzing the value of barley and sorghum imports from Romania during the period 2005-2015, the share of these two crops is of little importance. Thus, as far as barley is concerned, the value share of this crop in total imports is more important from 2011, reaching a peak in 2015 when it represents 1.32% of the total value of Romania's import. As regards sorghum, the imported quantity is

not significant, as it can be seen, at the level of 2015 it represented 0.02% of the total import value.

As far as the export value of barley and sorghum is concerned, neither is the weight of these crops extremely important.

Thus, during the analyzed period, the two cultures did not undergo significant changes, a sign that neither the surface nor the production had changed in the analyzed period.

At 2015, the value of grain exports to the European Union accounted for 1.27% of the total export value.

Table 7. Analysis of the import of barley and sorghum from Romania in the period 2005-2015 (million euro)

Import value	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total import value	32,568	40,746	51,322	57,240	38,953	46,869	54,952	54,703	55,317	58,522	62,962
%	100	100	100	100	100	100	100	100	100	100	100
Barley	2.65	30.72	105.21	339.26	56.67	144.78	350.75	325.63	451.45	199.46	837.12
%	0.0081	0.0754	0.2050	0.5927	0.1455	0.3089	0.6383	0.5953	0.8161	0.3408	1.3296
Sorghum grains			14.91	0.798	0.377	0.531	11.93	20.47	17.01	0.986	10.63
%			0.03	0.00	0.00	0.00	0.02	0.04	0.03	0.002	0.02

Source: Data processed National Institute of Statistics; [6]

Table 8. Analysis of the export of barley and sorghum from Romania in the period 2005-2015 (million euro)

The value of the export	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Value of total export (million euro)	22,255	25,850	29,549	33,725	29,084	37,360	45,292	45,069	49,562	52,466	54,596
%	100	100	100	100	100	100	100	100	100	100	100
The amount of grain exports out of the total EU	67.124	83.35	93.66	143.726	365.231	434.195	505.613	574.012	501.26	674.891	691.192
%	0.30	0.32	0.32	0.43	1.26	1.16	1.12	1.27	1.01	1.29	1.27
Barley	30.205	12.07	26.743	110.537	60.579	95.512	146.537	155.569	224.058	228.485	299.2
%	0.14	0.05	0.09	0.33	0.21	0.26	0.32	0.35	0.45	0.44	0.55
Sorghum grains	:	:	:	:	1.434	0.709	1.269	4.297	1.494	4.313	3.758
%	:	:	:	:	0.0049	0.0019	0.0028	0.0095	0.0030	0.0082	0.0069

Source: Data processed National Institute of Statistics; [6]

As it can be noticed, prior to Romania's accession to the EU, the grain trade in the intra-Community countries was at a low level. Only after 2009 grain trade begins to increase, oscillating between 1.27-1.29%.

CONCLUSIONS

As can be seen from the analysis of barley, rape and sorghum crops in terms of areas and productions recorded in the pre-accession and post-accession periods to the European Union, there are significant changes between the two analyzed periods.

If during the pre-accession period of Romania to the European Union the area cultivated with barley was much larger, the yield per hectare was quite low, with Romania's accession to the European Union the area cultivated with barley decreased, but there was an increase in the evolution yield

In terms of rapeseed crops, the cultivated area recorded a significant increase immediately after 2007. This development, both of the areas planted with rape and the yield per hectare, can be explained by the fact that in recent years the Rape has recorded significant

developments, which has led to the increase in the area planted for rapeseed.

As far as the sorghum crop is concerned, it is scarcely spread at European level, totalizing 127,730 hectares, and the main three producer countries are France, Italy and Romania, cultivating an area of 102,250 ha, representing 80,05% of the total cultivated area With sorghum at European level.

Despite the fact that Romania ranks third in the European Union as regards the area cultivated with sorghum, the average production per hectare places our country in fifth place, with an average production of 2.2 tons / ha, at the level of the year 2016.

The average yield per hectare should be improved both for sorghum and barley or rape crops, because despite the fact that these crops occupy significant areas at European level, the non-performing farms determine Romania's quaint position on the level of production.

Investing in cutting-edge technologies, high-quality inputs and hybrids, as well as high performing machines are a way to achieve production levels comparable to those recorded at European level.

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