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EVOLUTION OF THE ECONOMIC AND TECHNICAL INDICATORS FOR HOPS CULTURE IN ROMANIA. A RETROSPECTIVE OF THE LAST DECADE, 2006-2016

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Abstract

Hops is an increasingly rare crop on the territory of Romania, but this culture deserves attention due to its use. It is worth mentioning that the Romanian farmers are encouraged to cultivate this plant by increasing subsidies from one year to the next. For the analysis of evolution of this crop for the studied period, the technical indicators represented by the areas and production environments as well as the economic indicators represented by the prices, subsidies granted / ha and commercial trade will be taken into account. This paper seeks to highlight the technical and economic aspects presented above, their dynamics and the importance of this culture that will reflect on the demand for the national market for this product. The outcome of the study will highlight the support of the domestic hop market through domestic or imported production.

Key words**:** *consumption, hops, areas, average yields*

INTRODUCTION

Humulus lupulus [10], known as hops, has instead of flowers some light green seed cones, often used as a stabilizer and flavour agent in beer [8] but with utility in other beverages such as beans tea or even soft drinks, this plant can also be used in natural medicine having the same effect as valerian, used to treat anxiety, insomnia, etc. [5]. The history of hops is quite extensive and there is evidence that this plant has been used in beer production since the 9th century [7], and since then hops have not been replaced with another plant.

Worldwide, hops areas have been steadily rising, for example for the period under review, respectively 2006-2016, it has grown on average by 1.41% per year. Analysing the year 2016 compared to 2015, we see an increase in the global area of 5.57% (from 85,870 hectares to 90,653 hectares) and an increase of 13.9% compared to 2006, representing an increase of 11,057 hectares.

In terms of world production, they rose by an average of 2.79% per year, thus analysing the year 2016 compared to the previous year we see an increase in total production of 7.32% (from 131,872 tonnes to 141,528 tonnes) and an increase of 26.78% compared to 2006, representing an increase of 29,900 tons.[4]

Worldwide for the year 2016, according to FAO statistics, the state with the largest areas and implicitly productions with this crop is Ethiopia with an area of 31,367 hectares, followed by the US (20,581 hectares), Germany (17,210 hectares), and Czech Republic (4,775 hectares), with Romania ranked 20th overall in terms of areas and productions with this culture [1].

The main objective of the paper is to highlight, as the title says, the dynamics/evolution of the economic and technical indicators for the hop culture in Romania, importing and exporting with this product, thus emphasizing the importance of hops on the national market.

MATERIALS AND METHODS

Taking into account the importance of this culture in different sectors, a quantitative and qualitative analysis of the statistical data provided by the institutions in the field, such as the National Statistics Institute of Romania, Eurostat and Faostat, will be carried out as

well as the analysis of other documents specialized.

Also, the comparative method will be used, considering that this culture is taken in the analysis for a period of 10 years, it will concretize the evolution of area and production (for hops culture) using the processing series which are chronological and involving different indicators, as absolute, relative and average indicators.

In order to highlight the potential and necessity of the hop culture in Romania, a quantitative analysis of the national consumption data of this plant will be carried out, thus highlighting the trade balance aspects.

With the analysis of the above, we will also analyze the prices for this crop together with the subsidies granted for the period considered.

The work is carried out under the ADER 13.1.2 project, "Technical and economic costing of production costs and estimates of the prices for wheat, maize, sunflower, rape, soybean, sugar beet, rice, hemp, hop, tobacco, potato for conventional agriculture and organic farming" and has a synthetic methodological character, so that the research was based on descriptive research. The aim of the work should emphasize technical indicators and economic development indicators and to highlight the feasibility of this culture

RESULTS AND DISCUSSIONS

Given that the study goes through a longer period of time, it is advisable to analyze surfaces and total productions by processing chronological series using absolute, relative and average indicators.

A chronological series is a parallel between two strings of data, one of which is necessarily defined by the variable "time", the other being defined by the magnitudes recorded for the studied phenomenon.

Thus, the chronological series have been processed using absolute indicators starting from individual values denoted by "y" as well as from the total values "Σyt".

Absolute indicators show absolute changes (increase or decrease) over time.

Therefore, absolute changes with fixed and mobile / chain base have the following formulas: $\Delta t/t\text{-}1=yt\text{-}y1$; $\Delta t/t\text{-}1=yt\text{-}yt\text{-}1$.

With the help of relative indicators, we will identify the dynamic index that shows us how many times the variable has increased or decreased, in our case the surface or the production, from time to time, this index can also be calculated with a fixed base ($It/1=yt1/y1$) and with chain base ($It/t\text{-}1=yt1/yt\text{-}1$).

Within the same category of indicators is also the dynamics that measure the percentage changes from time to time, it can be calculated as the other indicators both with fixed base ($Rt=It1*100\text{-}100$) and with base in string ($Rt/t\text{-}1=It/t\text{-}1*100\text{-}100$); the absolute value of a percentage of the rate of change is expressed in the unit of the variable Y and the absolute measure of the change indicates a unit (1 percent of the rate of change) can also be calculated with a fixed base ($At/1=y1/100$) and in the chain ($At/t\text{-}1=yt\text{-}1/100$).

The average indicators will indicate the average level $\overline{Y} = \Sigma yt/n$ as well as the absolute changes, they show us how many units the average occurrence has been adjusted between two successive moments or intervals $\overline{\Delta} = (\sum \Delta t/t\text{-}1)/n\text{-}1=yn\text{-}y1/n\text{-}1$. The average dynamics index shows how many times or as many as the average phenomenon analyzed within the time horizon of the chronological series is averaged and is calculated according to the formula $\overline{I} = \sqrt{(\Pi It/t\text{-}1)} = \sqrt[n-1]{yn/y1}$. The average rhythm of dynamics expresses with how many percent the phenomenon analyzed from time to time is changed and is given by the formula $\overline{R}=\overline{I}*100\text{-}100$. [2]

In order to apply the calculation methods mentioned above it is necessary to know the surfaces and the products for the hop culture in the period 2006-2016, so we can see in Table 1 surface evolution and the productions of this culture.

Table 1. Evolution of hops surfaces and production in Romania

Year	Surface (hectares)	Total production (tons)	Average yield (kg / ha)
2006	652	435	667
2007	440	374	850
2008	501	257	513
2009	456	245	537
2010	215	232	1079
2011	177	117	661
2012	226	173	765
2013	239	172	720
2014	243	268	1,103
2015	225	224	996
2016	257	208	809

Source: Faostat [3]; INS [6]; Accessed 25.05.2018

Table 2. Absolute surface changes

Year	Surface (hectares)	Absolute changes (hectares)	
		With fixed base Δt/t-1=yt-y1	With chain base Δt/t-1=yt-y_{t-1}
2006	652	-	-
2007	440	**-212**	**-212**
2008	501	**-151**	**61**
2009	456	**-196**	**-45**
2010	215	**-437**	**-241**
2011	177	**-475**	**-38**
2012	226	**-426**	**49**
2013	239	**-413**	**13**
2014	243	**-409**	**4**
2015	225	**-427**	**-18**
2016	257	**-395**	**32**

Source: own processing based on statistical data

Table 3. Absolute changes in production

Year	Total production (tons)	Absolute changes (ton)	
		With fixed base Δt/t-1=yt-y1	With chain base Δt/t-1=yt-y_{t-1}
2006	435	-	-
2007	374	**-61**	**-61**
2008	257	**-117**	**-178**
2009	245	**-12**	**-190**
2010	232	**-13**	**-203**
2011	117	**-115**	**-318**
2012	173	**56**	**-262**
2013	172	**-1**	**-263**
2014	268	**96**	**-167**
2015	224	**-44**	**-211**
2016	208	**-16**	**-227**

Source: own processing based on statistical data

The largest areas for this crop were recorded in 2006, 652 hectares, in the same year, of course, the highest yields of 435 tons with a yield of 667 kilograms per hectare. Table 2 and Figure 3 show changes in both surface and production from year to year and compared to base year 2006.

It should be noted that although the yields were in constant decline compared to 2006, the yield per hectare hasn`t remained the same, we estimate that for 2010 and 2014 it was 1,079 kg/ha and 1,103 kg/ha and increased average by 8.92% (Figure 1).

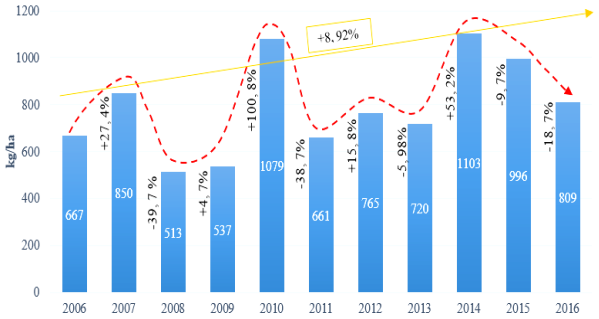

Fig.1. Average hops production in Romania
Source: data processing FAOSTAT, INS, 2018

Table 4. Relative surface changes

Year	Surface (hectares)	Dynamics index		Dynamic rhythm (%)		The absolute value of a percentage of the dynamics rhythm (hectares)	
		With fixed base It/1=yt 1/y1	With chain base It/t-1=yt1/yt -1	With fixed base Rt=It1* 100-100	With chain base Rt/t-1=It/t-1*100-100	With fixed base At/1=y1 /100	With chain base At/t-1=yt-1/100
2006	652	-	-	-	-	6,52	6.52
2007	440	0.6748	0.6748	-32.52	-32.52		4.4
2008	501	0.7684	1.1386	-23.16	13.86		5.01
2009	456	0.6994	0.9102	-30.06	-8.98		4.56
2010	215	0.3298	0.4715	-67.02	-52.85		2.15
2011	177	0.2715	0.8233	-72.85	-17.67		1.77
2012	226	0.3466	1.2768	-65.34	27.68		2.26
2013	239	0.3666	1.0575	-63.34	5.75		2.39
2014	243	0.3727	1.0167	-62.73	1.67		2.43
2015	225	0.3451	0.9259	-65.49	-7.41		2.25
2016	257	0.3942	1.1422	-60.58	14.22		2.57

Source: own processing based on statistical data

Table 5. Relative production changes

Year	Total production (tons)	Dynamics index		Dynamic rhythm (%)		The absolute value of a percentage of the dynamics rhythm (hectares)	
		With fixed base It/1=yt 1/y1	With chain base It/t-1=yt1/yt -1	With fixed base Rt=It1 *100-100	With chain base Rt/t-1=It/t-1*100-100	With fixed base At/1=y1 /100	With chain base At/t-1=yt-1/100
2006	435	-	-	-	-	4,35	4.35
2007	374	0.8598	0.8598	-14.02	-14.02		3.74
2008	257	0.5908	0.6872	-40.92	-31.28		2.57
2009	245	0.5632	0.9533	-43.68	-4.67		2.45
2010	232	0.5333	0.9469	-46.67	-5.31		2.32
2011	117	0.2690	0.5043	-73.10	-49.57		1.17
2012	173	0.3977	1.4786	-60.23	47.86		1.73
2013	172	0.3954	0.9942	-60.46	-0.58		1.72
2014	268	0.6161	1.5581	-38.39	55.81		2.68
2015	224	0.5149	0.8358	-48.51	-16.42		2.24
2016	208	0.4782	0.9286	-52.18	-7.14		2.08

Source: own processing based on statistical data

According to the average dynamics, which measures the percentage changes from time to

time, we can see that the most significant change of the surface (Table 2 and 4) was recorded in 2010 compared to 2009 when the area decreases by -52.85%. As for the absolute value of a percentage of dynamics this indicates that for the fixed base analysis the size of one percent (1%) of the hops in any year compared to the base year 2006 is equivalent to an absolute 6.52 hectares. Whilst the absolute value of a percentage of the mobile / chain base rhythm is variable.

According to the average dynamics, we can see (Table 3 and 5) that the most significant negative change in production is recorded in 2011 compared to 2010 when it drops by 49.57%. As for the absolute value of a percentage of dynamics this indicates that for the fixed base analysis the size of one percent (1%) of hops production in any year compared to the base year 2006 is equivalent to an absolute increase of 4.35 tons. Whilst the absolute value of a percentage of the mobile or chain base rhythm is variable.

The average surface area for the period 2006-2016 was 330.1 hectares and the hops area decreased for the analysed period by 39.5 hectares per year.

On average, the areas decreased during the period 2006-2016 by 0.911 times, and the average dynamic rhythm indicate that the areas have changed on average by -8.89% annually.

The average production level for the period 2006-2016 was 245.9 tons and the production of hops decreased annually for the analysed period by 22.7 tons.

On average, yields increased 3.1308 times.

Concerning economic indicators of hops culture, according to the study "Impact on Financing of the Agricultural Sector through Support Schemes Established on the Basis of European Regulations on the CAP and Funding of Support Schemes from the National Budget"[12], carried out by ICEADR, average purchase prices increased by 3% on average for the analysed period from 20 lei / kg in 2007 to 25 lei per kilogram in 2016.

The highest prices were recorded in 2011-2012 of 31.7 lei per kilogram, 18.72% higher than in 2010, while the average purchase price registered in 2016 is 21% lower than in the years in which this maximum was recorded.

Subsidies granted per hectare, according to the same work, increased gradually from year to year, thus from a subsidy of 570.3 lei / ha granted in 2007 a subsidy of 3,041.7 lei/ hectare was reached in 2016, more than about 4 times that of 2007.

Table 6. Economic indicators for hop culture (production, price, income, production cost)

Specification	Average production	Average purchase price	Income / ha without subsidies	Income / ha + subsidies	Production cost / ha
1	2	3	4	5	6
AN/UM	Kg/ha	lei/kg	lei/ha	lei/ha	lei/ha
2007	850	20	17,000	17,570.3	16,000
2008	513	21.2	108,75.6	11,551.8	10,500
2009	537	21.2	11,384.4	12,190.5	11,000
2010	1,079	26.7	28,809.3	29,665.2	25,000
2011	621	31.7	19,685.7	20,647.2	18,000
2012	473	31.7	14,994.1	17,057.5	14,600
2013	720	28.6	20,592	22,707.8	19,500
2014	951	27	25,677	27,846.3	24,000
2015	996	26.2	26,095.2	29,024.1	25,300
2016	809	25	20,225	23,266.7	20,000

Source: ICEADR ("Impact on Financing of the Agricultural Sector through Support Schemes established on the basis of European Regulations on CAP and Funding of Support Schemes from the National Budget") [12]

Table 7. Other economic indicators for hop culture (profit and subsidies)

Specification	Profit without subsidies	Profit + Subsidies	Profit rate without subsidies	Profit rate + subsidies	Subsidies
1	7	8	9	10	11
AN/UM	lei/ha	lei/ha	%	%	lei
2007	1,000	1,570.3	6.3	9.8	570.3
2008	375.6	1,051.8	3.6	10	676.2
2009	384.4	1,190.5	3.5	10.8	806.1
2010	3,809.3	4,665.2	15.2	18.7	855.9
2011	1,685.7	2,647.2	9.4	14.7	961.5
2012	394.1	2,457.5	2.7	16.8	2,063.4
2013	1,092	3,207.8	5.6	16.5	2,115.8
2014	1,677	3,846.3	7	16	2,169.3
2015	795.2	3,724.1	3.1	14.7	2,928.9
2016	225	3,266.7	1.1	16.3	3,041.7

Source: ICEADR ("Impact on Financing of the Agricultural Sector through Support Schemes established on the basis of European Regulations on CAP and Funding of Support Schemes from the National Budget") [12]

Thus, from Table 6, we can see that by capitalizing the productions at a farm price, a profit is achieved even without subsidies, which are oscillating from one year to

another, with net annual profits ranging between 225 lei / ha (year 2016 - year with the lowest non-subsidized profit) and 3,809.3 lei / ha (2010 with the highest non-subsidized profit). The rate of non-subsidized profit was between 1.1% (2016) and 15.2% (2010), which was directly proportional to the production levels.

These values change as the direct payment schemes are taken into account, coupled with the coupled support, therefore, following the application of the subsidies granted per hectare for this crop for the analyzed period, we notice that there is a higher profit (Table 6, columns 8) so the rate of subsidized profit is higher (Table 7, column 10).

Under these conditions, a higher rate of return is achieved, ranging from 9.8% (2007) to 18.7% (2010).

The revenue growth rate is higher than the growth rate of costs, so the average non-subsidized and costing revenue ratio is 1.0531: 1, while the average revenue-to-grant ratio is 1.1256: 1. [11]

Since hops cannot be consumed fresh but only after processing, we cannot take into account the consumption of this product per capita. So we can determine the importance of this culture at national level by highlighting the quantities imported and exported with hops by Romania.

As can be seen from the two tables below (Table 8 and Table 9), Romania has imported hops more than they exported for the entire analyzed period.

In terms of hops imports, we can see that the largest quantity was imported in 2008 of 1,257 tonnes of hops, the main supplier of hops on the Romanian market being Germany, this country being found throughout the analysis period, However, Romania has imported this product from other European Union countries and not only (Table 7). The quantity of hops impregnated in 2016 increases by + 15.05% in 2016 as compared to the previous year, but it is by some -31.5% less than in 2006. For the whole analyzed period we can say that hops imports have increased with an average of 8.65%.

The hop quantities that Romania exported during the analyzed period are insignificant and present data only for the years 2007, 2008, 2010 and 2011, the main importers being Germany, Czech Republic, Italy and Bulgaria.

Table 8. List of hop cones supplying the market, fresh or dried, even ground, powdered or in the form of pellets in Romania

Exporters	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Imported quantity, Tons										
World	**625**	**629**	**1,257**	**358**	**280**	**329**	**233**	**216**	**421**	**372**	**428**
Germany	**311**	**396**	**1,103**	**348**	**272**	**304**	**215**	**177**	**411**	**359**	**394**
Belgium	0	**197**	**7**	0	**5**	**17**	**13**	0	0	**1**	0
United States of America	**211**	0	0	0	0	0	0	0	0	0	0
Slovenia	**61**	0	**63**	0	0	0	0	0	0	0	0
Czech Republic	**34**	**29**	**16**	**6**	**4**	**8**	**4**	**5**	**9**	**12**	**5**
United Kingdom	0	**6**	**4**	0	0	0	0	**10**	0	0	0
Austria	0	0	0	0	0	0	**1**	0	0	0	0
Bulgaria	0	0	0	**3**		0	0	0	0	0	0
France	0	0	**4**	0	0	0	0	0	0	0	0
Hungary	0	0	**2**	0	0	0	0	**24**	0	0	0
Poland	**4**	0	**59**	0	0	0	0	0	0	0	**29**
Slovakia	**5**	0	0	0	0	0	0	0	0	0	0

Source: Trade statistics for international business development -Trade map [9]

Table 9. List of import markets for hop cones, fresh or dried, whether or not ground, powdered or in the form of pellets by Romania

Importers	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Exported quantity,										
World	0	**18**	**22**	0	**25**	**1**	0	0	0	0	0
Czech Republic	0	**6**	0	0	0	0	0	0	0	0	0
Germany	0	**12**	**21**	0	**25**	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	**1**	0	0	0	0	0
Italy	0	0	**1**	0	0	0	0	0	0	0	0

Source: Trade statistics for international business development -Trade map [9]

Thus, in terms of the quantities imported and exported by Romania to Romania, we can state that this culture is important at national level due to the quantities of hops imported annually.

Imported quantities of hops are proof that domestic demand cannot be sustained by our own production, having to resort to imports to meet demand for hop in different industries.

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CONCLUSIONS

The first part of this paper presents the technical indicators of this culture, representing both the areas and the productions obtained in the cultivation of hops in Romania for the last decade, 2006-2016, showing their evolution in terms of absolute, relative and average statistical indicators. With the help of the average dynamics indicators, it is noticed that the hops areas have changed on average by -8.89% annually, while the production has grown on an average of 3.1308 times.

In the second part of the study were presented economic indicators for the cultures represented by the average purchase price, subsidies, cost of production, income per hectare with and without subsidies and profit and rate of return. Through all these economic indicators it has been demonstrated that this culture is profitable even without subsidies, and the average of the revenue to cost ratio is 1.0531: 1 (without subsidies) and 1.1256: 1 (when grants are granted).

With all aspects listed and discussed above in order to determine technical and economic importance of this culture, we can say that although demand for hops at national level is quite high, growers Romanians do not consider the possibility of creating such a culture, evidence being areas that are continually decreasing.

Romanian farmers are encouraged to produce hops through subsidies increasing from year to year, although this culture is one profitable even without subsidies.

In conclusion, this crop could bring significant gains per hectare and the yields obtained can easily be capitalized on the national market.

So, it is imperiously needed to support this plant, this culture, on the national territory and awareness of the Romanian producer regarding the hop culture and the importance it holds at national level and not only.

REFERENCES

[1]Compare data - Faostat, http://www.fao.org/faostat/en/#compare, Accessed 20.05.2018.

[2]Enache, C., 2015, Rural Statistics Course, Faculty of Management, Economic Engineering in Agriculture and Rural Development.

[3]Faostat-database, http://www.fao.org/faostat/en/#home, Accessed 25.05.2018.

[4]Food Outlook, Bianual report on global food market, released by FAO, http://www.fao.org/3/a-i7343e.pdf, Accessed 25.05.2018.

[5]Hornsey, I. S., 2003, „A History of Beer and Brewing." Royal Society of Chemistry. p. 305.

[6]National Institute of Statistics, Romania, www.insse.ro, Accessed 25.05.2018.

[7]Plants for a Future: Humulus lupulus Plants for a Future.https://pfaf.org/user/plant.aspx?latinname=Humulus+lupulus, Accessed 04.06.2018.

[8]Schönberger, C., Kostelecky, T., 2012, 125th Anniversary Review: The Role of Hops in Brewing. Journal of the Institute of Brewing (Wiley Online Library). 117 (3).

[9]Trade statistics for international business development –Trade map, https://www.trademap.org/Country_SelProductCountry_TS.aspx?nvpm=1|642||||1210|||4|1|1|2|2|1|2|2|1,Accessed 27.05.2018.

[10]University of Minnesota Libraries: The Transfer of Knowledge. Hops- "Humulus lupulus". Lib.umn.edu. 2008-05-13. Accessed 20.05.2018.

[11]Ursu, A., Şurcă, E., Petre I.L., 2017, Indicators of Economic Efficiency for Conventional and Ecological Agriculture", ASE Publishing House, Bucharest, p. 86.

[12]Vlad, M., Veverca, D., Turek –Rahoveanu, P., Chetroiu, R. Iurchevici, L., Dachin, A., Bădan, D., 2017, Impact on the financing of the agricultural sector through the support schemes established on the basis of the European regulations on the CAP and the financing of the support from the National Budget, ICEADR, www.iceadr.ro, Accessed 20.05.2018.