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IMPACT OF COUPLED SUPPORT ON SURFACES AND PRODUCTIONS OF MAIN CROPS THAT BENEFIT FROM THIS TYPE OF SUPPORT

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Abstract

Direct payments granted in agriculture play an extremely important role for the incomes of Romanian farmers. This type of payments are funds from the European Union budget, more precisely from the European Agricultural Guarantee Fund (EAGF), and in Romania these payments are granted through various schemes such as: Single area payment scheme, Redistributive payment, Young farmers payment, payment for agricultural practices beneficial for climate and environment, but also Coupled support. In relation to the amounts granted per hectare, on the one hand, the most targeted by farmers, is coupled support, which is granted to sectors considered economically, socially and environmentally important and which are affected by certain difficulties. The aim of this paper is to identify the progress made in certain cultures that have been encouraged through this form of support. The analyzed data comes from the Agency for Payments and Intervention for Agriculture. The conclusion is that this support plays an important role for agricultural practices related to climate change and the environment protection, having the role of crop diversification.

Key words**:** *direct payments, coupled support, European funds*

INTRODUCTION

The European Agricultural Grant Fund (EAGF) is a fund set up at European Union level to support Member States' agriculture. At the Romanian level, these funds are managed by the Agency for Payments and Intervention for Agriculture (APIA) [7, 3]. These funds also aim to finance the following expenses:

- measures to regulate or support agricultural markets;
- direct payments to farmers in the context of the common agricultural policy;
- the Union's financial contribution to measures to inform and promote agricultural products on the Union's internal market
- the Union's financial contribution to the program to encourage the consumption of fruit and vegetables in schools.

Coupled support scheme - can be granted to the sectors and productions provided in art. 52 para. (2) of Regulation (EU) no. 1307/2013, considered important for economic, social and environmental reasons and which are affected by certain difficulties [10].

According to Order 619/2015 on coupled support in the plant sector, those wishing to receive this type of support must meet a number of specific conditions depending on each crop they grow. Thus for [9]:

Coupled support for **soybean** cultivation:

- maximum annual production of 1,300 kg of soybeans/ha,
- capitalizes on a minimum production of 1,300 kg of soybeans/ha,
- uses officially certified seed.

Coupled support for alfalfa:

- have achieved a minimum annual production of 15 tonnes/ha of green mass or 3.75 tonnes/ha of dry mass,
- have marketed at least the minimum production envisaged,
- have consumed with the animals they own, registered in the RNE, and/or have stored for consumption with them at least the minimum expected production obtained on the farm,
- uses officially certified seed.

Coupled support for peas for industrialization

- concluded an annual contract with a registered industrialization unit for food safety,
- delivers a minimum quantity of 1.9 tonnes/ha of peas to a registered processing unit,
- uses officially certified seed.

Coupled support for grain beans for industrialization

- concluded an annual contract with a registered industrialization unit for food safety,
- deliver the minimum quantity of 0.85 tonnes/ha of beans to a registered industrial unit for food safety,
- uses officially certified seed.

Coupled support for rice

- marketing of a minimum production of 4,500 kg/ha of rice,
- uses officially certified seed.

Coupled support for hops

- concluded a contract with a brewery or processing units for pharmaceutical purposes
- prove the minimum production of 490 kg of dried hop cones/ha.

Coupled support for sugar beet

- have a contract for the production of sugar beet with a sugar factory,
- prove the marketing of a minimum production of 26,400 kg/ha,
- uses officially certified seed.

Coupled support for early, semi-early and summer potato cultivation:

- demonstrate the marketing of a minimum production of 12.5 tonnes/ha,
- uses officially certified seed.

The paper analyzes the changes that have occurred in the vegetable sector on the area and yields obtained from crops like: hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes, as well as in the case of alfalfa, as a result of granting coupled support for these types of crops.

MATERIALS AND METHODS

The data used in this study are from the Payments and Intervention Agency for Agriculture (number of beneficiaries, amount granted, amount) and were correlated with data on area and production of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes, as well as in the case of alfalfa, analyzing the data from a quantitative and qualitative point of view. The main statistical indicators were also determined, such as: arithmetic mean, standard deviation, coefficient of variation, minimum period and maximum period. At the same time, the correlation coefficient was determined, using the Excel program to determine the values, using the equation [11]:

$$Correl(X,Y)=\frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2\sum(y-\bar{y})^2}}$$

The arithmetic mean or mean value of a series of values is the ratio of the sum of the values of the series to their number.

$$\overline{X}=\frac{x_1+x_2+\ldots\ldots x_n}{n}=m$$

The standard deviation is expressed using the same unit of measurement as the values in the series under consideration and is a very accurate indicator of the spread of the series.

$$\sigma=\sqrt{D}\ \text{sau}\ \sigma=\sqrt{\frac{(x_1-\overline{X})^2+(x_2-\overline{X})^2+\ldots\ldots+(x_n-\overline{X})^2}{n-1}}$$

The coefficient of variation represents the ratio between the standard deviation and the average, when the average is different from 0, and the expression is made in percentages.

$$C.V.=\frac{\sigma}{\overline{X}}$$

RESULTS AND DISCUSSIONS

Analyzing the area cultivated with hops in the period 2014-2019, an oscillating trend is found, with a minimum value of the period of 225 ha and a maximum value of 257 ha. The annual rate has a positive value of 0.7%. The calculated standard deviation is 14.1 ha, and the coefficient of variation is 5.8% (Table 1).

In the case of rice cultivation, there is a downward trend in terms of cultivated area, with a minimum of the analyzed period of 7,427 ha and a maximum of 12,719 ha. The rate has negative values of 10.2%, and the coefficient of variation has a value of 20%, indicating a relative degree of heterogeneity of the analyzed data (Table 1).

Table 1. Analysis of the main statistical indicators on the area under hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and lucerne in the period 2014-2019 (ha)

Culture	Years					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Hop	243	225	257	227	255	252
Rice	12,719	11,106	9,435	9,125	8,251	7,427
Pease	27,364	31,702	43,218	106,562	120,247	104,448
Beans	12,071	12,561	14,918	11,170	11,391	11,007
Soy beans	79,910	128,156	127,266	165,143	169,422	158,149
Sugar beet	31,280	26,596	24,924	28,204	25,723	22,729
Early, semi-early and summer potatoes	27,984	28,887	28,359	27,114	27,968	28,020
Lucerne	361,571	364,540	380,248	391,114	408,678	412,861
The main statistical indicators	**Min**	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
	ha	**Ha**	**ha**	**%**	**ha**	**%**
	225.0	257.0	243.2	0.7	14.1	5.8
	7,427.0	12,719.0	9,677.2	-10.2	1,936.8	20.0
	27,364.0	120,247.0	72,256.8	30.7	42,472.3	58.8
	11,007.0	14,918.0	12,186.3	-1.8	1,461.0	12.0
	79,910.0	169,422.0	138,007.7	14.6	33,813.1	24.5
	22,729.0	31,280.0	26,576.0	-6.2	2,933.8	11.0
	27,114.0	28,887.0	28,055.3	0.0	580.3	2.1
	361,571.0	412,861.0	386,502.0	2.7	21,683.4	5.6

Source: data processed INS, Accessed on 22.09.2020 [8].

In the case of the area cultivated with peas, there is a significant increase, so that if in 2014, the cultivated area was 27.4 thousand hectares, in 2019 the area was over 120 thousand hectares. Thus, it was possible to determine an annual growth rate of 30.7% and a coefficient of variation of 58.8%, indicating a high degree of heterogeneity of the analyzed data. This impressive increase can be attributed to aid in agriculture, through coupled support, but especially to support agricultural practices that are beneficial to the climate and the environment, with the role of crop diversification (Table 1).

As in the case of pea cultivation, the area cultivated with soybeans registered a significant increase, as in 2014 the cultivated area was 79.9 thousand hectares, in 2019 the cultivated area was over 158 thousand hectares. The annual growth rate has positive values of 14.6%, and the coefficient of variation has a value of 24.5% indicating a relative degree of heterogeneity of the analyzed data. This sharp increase in soybean acreage is largely due to increased market demand (being a high-protein food), but also to support in agriculture, such as support for climate-friendly and environmentally friendly agricultural practices, with the role of diversifying cultures. Leguminous crops also play an extremely important role in crop rotation, enriching the soil with nitrogen. (Table 1) [1, 2, 6].

Regarding the area cultivated with sugar beet, there is a sharp decrease, from 31.3 thousand hectares cultivated in 2014 to a cultivated area of 22.7 thousand hectares. The annual rate has a negative value of 6.2%, and the coefficient of variation was calculated at 11%. The reduction of areas can be attributed to the elimination of quotas, but especially to the lack of processing units, so that in order to receive coupled support, the producer must prove the processing of a minimum production of 26.4 t/ha. (Table 1) [4, 5].

In the case of alfalfa, there is also an increase in the cultivated area, registering a minimum of the period of 361.6 thousand hectares and a maximum of the period of 412.8 thousand hectares, with an annual growth rate of 2.7%. and a coefficient of variation of 5.6% indicating that the string of data analyzed is homogeneous (Table 1).

In the case of total soybean production, there is an upward trend, except for the last year analyzed when the production obtained was lower by 10.7% compared to 2018. Also the annual rate shows an increase of 15.4% in the analyzed period, and the coefficient of variation has a value of 31.4% which indicates the heterogeneity of the analyzed data series. It should be noted that in this case, the production obtained is largely influenced by the cultivated area (Table 2).

Table 2. Analysis of the main statistical indicators on production obtained from hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Hop	268	224	208	124	219	218
Rice	45,159	49,773	43,635	43,311	43,355	39,991
Pease	51,017	55,302	78,808	282,245	172,512	221,572
Beans	19,748	19,966	19,087	16,125	17,298	14,095
Soy beans	202,892	262,061	263,380	393,495	465,609	415,942
Sugar beet	1,398,570	1,040,827	1,012,186	1,174,502	978,266	917,163
Early, semi-early and summer potatoes	431,329	420,222	401,935	449,459	431,175	401,373
Lucerne	6,071,232	5,730,897	5,505,202	5,915,928	6,971,521	6,222,965
The main statistical indicators	**Min**	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
	t	**T**	**t**	**%**	**t**	**%**
	124.0	268.0	210.2	-4.0	47.1	22.4
	39,991.0	49,773.0	44,204.0	-2.4	3,209.9	7.3
	51,017.0	282,245.0	143,576.0	34.1	96,647.9	67.3
	14,095.0	19,966.0	17,719.8	-6.5	2,319.0	13.1
	202,892.0	465,609.0	333,896.5	15.4	104,811.0	31.4
	917,163.0	1,398,570.0	1,086,919.0	-8.1	175,002.4	16.1
	401,373.0	449,459.0	422,582.2	-1.4	18,731.9	4.4
	5,505,202.0	6,971,521.0	6,069,624.2	0.5	508,697.3	8.4

Source: data processed INS, Accessed on 22.09.2020 [8].

As regards the production of sugar beet, there is a declining trend due in large part to the reduction in the area under sugar beet. Thus, the maximum of the period was recorded a production of 1.4 million tons (2014), and the lowest production was obtained in 2019, when it was 917 thousand tons. The annual rate has a negative value of 8.1%, and the coefficient of variation has a value of 16.1% (relatively homogeneous data) (Table 2).

Table 3. Analysis of the main statistical indicators on the average production obtained from hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
Hop	1,103	996	809	546	860	866
Rice	3,551	4,482	4,625	4,746	5,254	5,384
Pease	1,864	1,744	1,823	2,649	1,435	2,121
Beans	1,252	1,287	1,250	1,402	1,477	1,238
Soy beans	2,539	2,045	2,070	2,383	2,748	2,630
Sugar beet	44,711	39,135	40,611	41,643	38,031	40,351
Early, semi-early and summer potatoes	15,328	14,470	14,100	16,503	15,343	14,267
Lucerne	16,786	15,706	14,475	15,124	17,057	15,067
The main statistical indicators	**Min**	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
	t	**T**	**t**	**%**	**t**	**%**
	546.0	1,103.0	863.3	-4.7	189.1	21.9
	3,551.0	5,384.0	4,673.7	8.7	655.1	14.0
	1,435.0	2,649.0	1,939.3	2.6	411.9	21.2
	1,238.0	1,477.0	1,317.7	-0.2	98.7	7.5
	2,045.0	2,748.0	2,402.5	0.7	292.7	12.2
	38,031.0	44,711.0	40,747.0	-2.0	2,309.4	5.7
	14,100.0	16,503.0	15,001.8	-1.4	906.9	6.0
	14,475.0	17,057.0	15,702.5	-2.1	1,025.1	6.5

Source: data processed INS, Accessed on 22.09.2020 [8].

The average rice production registers an upward trend in the analyzed period, so that the yield shows an increase of about 51% in 2019, compared to the average production recorded in 2014. The annual rate is 8.7% and the coefficient of variation records a value of 14% (Table 3). In the case of hop cultivation, it is noted that the average production obtained in 2017 (minimum period) was of 546 kg/ha, compared to the production recorded in 2014, when it was 1.1 t/ha, aspect due to the unfavorable meteorological conditions that determined variations of the average registered productions (Table 3).

Table 4. Analysis of the main statistical indicators on the number of farmers who accessed coupled support for crops of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years				
	2015	2016	2017	2018	2019
Hop	3	3	3	3	3
Rice	7	8	10	10	11
Pulses	35	108	663	681	317
Soy beans	1,766	2,915	3,792	3,290	3,880
Sugar beet	894	823	891	860	689
Early, semi-early and summer potatoes	59	66	90	93	101
Lucerne	6,156	10,627	21,702	29,979	35,963
The main statistical indicators					
Min	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
no.	**no.**	**no.**	**%**	**no.**	**%**
3.0	3.0	3.0	0.0	0.0	0.0
7.0	11.0	9.2	12.0	1.6	17.9
35.0	681.0	360.8	73.5	302.4	83.8
1766.0	3,880.0	3,128.6	21.7	856.3	27.4
689.0	894.0	831.4	-6.3	84.6	10.2
59.0	101.0	81.8	14.4	18.2	22.3
6156.0	35,963.0	20,885.4	55.5	12,578.6	60.2

Source: data processed APIA, Accessed on 22.09.2020 [8].
* 2015, 2016 pea and bean crops were allocated separate funds for each crop.

It can be noted that in the period 2015-2019 3 farmers received a granted coupled support for growing hops, which this culture in our country is a niche crop, with certain peculiarities in terms of cultivation conditions (Table 4).

In the case of farmers who have grown soybeans, there is an increase in their number from 1,766 in 2015 to 3,880 in 2019, representing an increase of about 120%. This may be due to the need for farmers to diversify crops, thus enriching the soil with nitrogen, but also as a result of meeting the conditions to obtain payments for agricultural practices beneficial to the climate and the environment (Table 4).

Table 5. Analysis of the main statistical indicators on the area for which coupled support was granted for crops of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	Years				
	2015	2016	2017	2018	2019
Hop	207.4	231.9	239.3	246.7	245.6
Rice	8,738.7	6,959.0	6,903.8	7,630.8	7,705.4
Pulses	1,083.9	2,211.1	6,367.7	2,795.2	2,948.7
Soy beans	107,812.8	119,506.6	149,098.8	130,303.3	138,073.0
Sugar beet	22,133.9	21,843.6	24,633.5	22,364.6	21,625.3
Early, semi-early and summer potatoes	1,399.2	1,781.8	2,245.9	2,425.4	2,421.5
Lucerne	35,352.1	63,242.2	116,073.0	138,291.6	153,106.3
The main statistical indicators					
Min	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
ha	**ha**	**ha**	**%**	**ha**	**%**
207	247	234	4.3	16.1	6.9
6,904	8,739	7,588	-3.1	742.2	9.8
1,084	6,368	3,081	28.4	1,977.8	64.2
107,813	149,099	128,959	6.4	16,023.4	12
21,625	24,634	22,520	-0.6	1,214.3	5.4
1,399	2,425	2,055	14.7	450.8	21.9
35,352	153,106	101,213	44.3	50,169.7	49.6

Source: data processed APIA, Accessed on 22.09.2020 [8].

In the case of hop cultivation, it is observed that in 2019, out of the total of 252 hectares cultivated, 97.4% of this area was granted coupled support. There is also a positive annual rate of 4.3% and a coefficient of variation of 6.9% (Table 5).

In the case of soybean cultivation, in 2019, approximately 87% of the area cultivated with soybeans at national level, benefited from subsidies through coupled support. One of the reasons why the percentage is lower is due to the weather conditions that made it difficult to obtain a mandatory minimum production of 1.3 t/ha, but also to the sale the production (Table 5).

And in the case of alfalfa it can be seen that only 37% of the total cultivated area met the conditions for granting coupled support. This was hampered by the conditions for granting as required by the minimum production of 15 t/ha green mass (or 3.75 t/dry mass) and the sale or use it on the farm of its own feed (Table 5).

Table 6. Analysis of the main statistical indicators on the average area for which coupled support was granted for crops of hops, rice, peas, beans, soybeans, sugar beet, early, semi-early and summer potatoes and alfalfa in the period 2014-2019

Culture	**Years**				
	2015	**2016**	**2017**	**2018**	**2019**
Hop	69.1	77.3	79.8	82.2	81.9
Rice	1,248.4	869.9	690.4	763.1	700.5
Pulses	24.5	15.2	9.6	4.1	9.3
Soy beans	61.0	41.0	39.3	39.6	35.6
Sugar beet	24.8	26.5	27.6	26.0	31.4
Early, semi-early and summer potatoes	23.7	27.0	25.0	26.1	24.0
Lucerne	5.7	6.0	5.3	4.6	4.3
The main statistical indicators					
Min	**Max**	**Aver.**	**Annual rhythm**	**Std. dev.**	**C.V.**
ha	**ha**	**ha**	**%**	**ha**	**%**
69	82	78	4.3	5.4	6.9
690	1,248	854	-13.5	231.5	27.1
4	24	13	-21.5	7.7	61.8
36	61	43	-12.6	10.1	23
25	31	27	6.1	2.5	9.3
24	27	25	0.3	1.4	5.5
4	6	5	-7.2	0.7	14.0

Source: data processed APIA, Accessed on 22.09.2020 [8].

In the case of hop and rice crops whose number of beneficiaries is low, compared to the cultivated area for which coupled support was granted, it is noted at the level of 2019, the average area that accessed coupled support for hops was 81.9 ha, respectively 700.5 ha for rice (Table 6).

On the other hand, in the case of legumes or alfalfa crops, whose high number of beneficiaries determined an average area of 9.3 ha in the case of legumes, respectively 4.3 ha in the case of alfalfa growers (Table 6).

Table 7. Analysis of the correlation coefficient between different variables in the case of soybean cultivation

	Area (ha)	*Total production (t)*	*Average production (t/ha)*	*No. Farmers*	*Sum (total/culture)*	*Quantum (euro/ha)*	*Coupled support surface*	*Average area*
Area (ha)	1							
Total production (t)	0.97	1						
Average production (t/ha)	0.91	0.98	1					
No. Farmers	0.77	0.74	0.71	1				
Sum (total/culture)	-0.36	-0.51	-0.58	0.14	1			
Quantum (euro/ha)	-0.98	-0.95	-0.89	-0.89	0.22	1		
Area for which the subsidy was granted	0.83	0.73	0.63	0.93	0.21	-0.90	1	
Average area	-0.64	-0.66	-0.66	-0.94	-0.08	0.79	-0.79	1

Source: data processed APIA, Accessed on 22.09.2020 [8].

Analyzing the correlation coefficient between the total production and the surface, a direct correlation is found, so that the two variables vary in the same direction. Also, the value of the coefficient of variation of 0.97 indicates a very close level of correlation between the two variables (Table 7).

Analyzing the coefficient of variation between the quantum and the surface, an inverse correlation is found, so that the two correlated variables vary in the opposite direction. Also, the value of the coefficient of variation of 0.98 indicates a very close level of correlation between the two variables. In practice, if the area under soybeans tends to increase, the amount of coupled support tends to decrease, as the amount allocated to the measure is related to the area (Table 7).

Analyzing the correlation coefficient between the total production and the surface, a direct correlation is found, so that the two variables vary in the same direction. Also, the value of the coefficient of variation of 0.75 indicates a level of close correlation between the two variables (Table 8).

Analyzing the coefficient of variation between the quantum and the surface, an inverse correlation is found, so that the two correlated variables vary in the opposite direction. Also, the value of the coefficient of variation of 0.92 indicates a very close level of correlation between the two variables. In practice, if the area cultivated with alfalfa tends to increase, the amount of coupled support tends to decrease, as the the amount allocated to this measure is related to the area (Table 8).

Table 8. Analysis of the correlation coefficient between different variables in the case of alfalfa culture

	Area (ha)	*Total production (t)*	*Average production (t/ha)*	*No. farmers*	*Sum (total/culture)*	*Quantum (euro/ha)*	*Coupled support surface*	*Average area*
Area (ha)	1							
Total production (t)	0.75	1						
Average production (t/ha)	0.30	0.85	1					
No. Farmers	0.98	0.74	0.30	1				
Sum (total/culture)	-0.63	-0.65	-0.46	-0.70	1			
Quantum (euro/ha)	-0.92	-0.64	-0.21	-0.90	0.78	1		
Area for which the subsidy was granted	0.98	0.73	0.28	0.99	-0.75	-0.96	1	
Average area	-0.92	-0.79	-0.43	-0.96	0.66	0.76	-0.91	1

Source: data processed APIA, Accessed on 22.09.2020.

CONCLUSIONS

These financial aids to farmers play an extremely important role both for their income and for supporting and growing of this crops at the national level. The restrictive conditions imposed for the granting of coupled support are relevant, but this support should complement another measure to finance investments in processing units. This should not be done only through the European funds available through the National Rural Development Program [11].

Also, Romania's agriculture must focus mainly on crops suitable for us in the country, but in close connection with the needs of the market.

It should be noted that the decrease in the area cultivated with rice may be due mainly to unfavorable cultivation conditions for our country, the production obtained causing high production costs, not being able to compete with the rice imported from Asian countries.

At the same time, it can be noted that this support plays an important role and is closely related to the support for agricultural practices beneficial to climate and the environment, having the role of crop diversification. Legumes also play an extremely important

role in crop rotation, enriching the soil with nitrogen.

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