

THE EVOLUTION OF AGRICULTURAL YIELDS. A CASE STUDY ON TIMIS COUNTY

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Abstract

Over the last period of time, we are witnessing a perturbation of the climate, this having a direct influence over the agricultural yields. Luckily, on one hand Timis County has a soil with a higher quality, suitable for a large span of crops due to the close levels of groundwater, thus granting the crops to overcome more easily long periods of drought. On the hand modern agricultural equipment grants the farmers the usage of specific crop technologies, in order to keep the water into the soil and to prevent erosion and the scarce effects of drought. This study aims to follow the evolution of yield performance over the course of three years - 2018, 2019 and 2020. The performance of agricultural establishments can be appreciated through the results obtained over the course of production process. Although over the course of the three years deviations of both rainfall and temperatures were registered, superior yields were reported for all Timis County.

Key words: yield, climate change, agricultural production, evolution.

INTRODUCTION

Although the Timiș County has an agricultural potential above the average of most agricultural regions in Romania, the context of economic and social changes recorded in Romanian society after 1989 has determined a sinuous stage of redefinition, determined by a series of socio-economic processes such as: re-privatization, economic restructuring, rural-urban migration, external migration, intense development of localities located near major cities, or depopulation of isolated localities. (Toma et al., 2009; Otiman, 2011; MADR, 2014; Vasile et al 2006).

All these phenomena have left their mark on the level of productivity and profitability of this sector with very good climatic favorability conditions, land with natural fertility superior to other regions, and a tradition in cultivating plants. (Da Rocha, 2006; Afonso, 2007; Antohi, 2011; Eftimie & Matei, 2014; Panait & Alecu, 2016).

With a total area of 869,665 ha (3.65% of the total area of the country), respectively 702,066 ha of agricultural land (80.7% of the total area), of which: 531,037 ha arable land (of which: irrigated arable land = 7,011 ha, non-irrigated

arable land = 526,113), 121,347 ha natural pastures, 28,619 ha natural meadows, 3,871 ha vineyards, 9,171 ha orchards (of which: irrigated = 240 ha), 82 ha grapevine plantations. Timiș county is the most important agricultural county in the country, both in terms of cultivated area and volume of production.

Funds attracted through financing programs for agriculture, as well as private and foreign investments in this sector, have led to the consolidation of agricultural land and the establishment of commercial agricultural farms, which support the level of production achieved.

MATERIALS AND METHODS

Through this study, an analysis was conducted on the agricultural potential of the county, expressed through the natural fertility and suitability of agricultural land for cereal crops, legumes and technical plants.

Most of the county is occupied by zonal soils, namely in the north-western part there are leached chernozems and chernozems of hayfields, and then in the hilly area, different types of ilvastre soils succeed from west to east.

The soil of Timiș county offers favorable conditions for the cultivation of agricultural crops, especially for cereal crops, but also for technical and forage plants, fruit trees and grapevines (Figures 1 and 2).

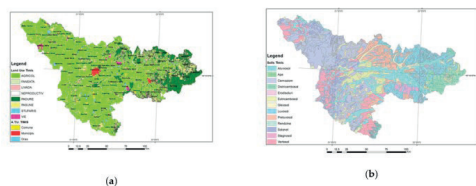


Figure 1. (a) Land use in Timiș County; (b) Soil types in Timiș County

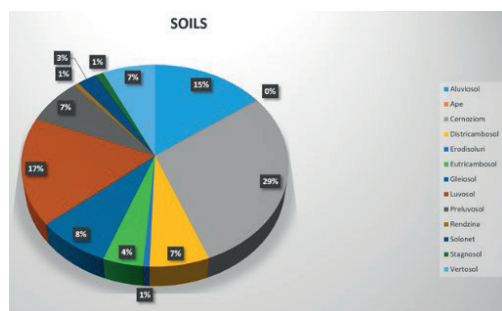


Figure 2. The distribution of soil types in Timiș County

From the perspective of the legal status of those working on agricultural land in Timiș County (Figure 3), it can be observed that 55% belongs to legal entities and 45% to individuals, of which 33% are men and only 13% are women.

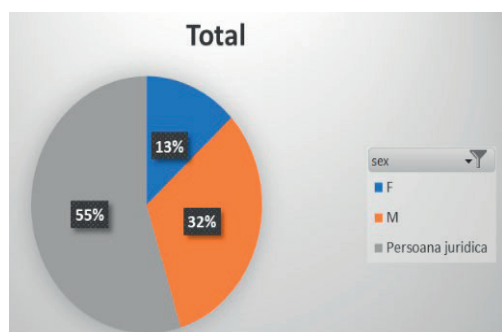


Figure 3. Distribution by legal status

RESULTS AND DISCUSSIONS

Compared to the reference year 2018, in which the largest cultivated area was recorded (507,536 ha), in 2019 the cultivated area

decreased by 7,206 ha. However, this reduction was due to owners who hold small land areas abandoning their cultivation due to various reasons, especially aging and lack of financial resources. In 2020, the year when the Covid-19 pandemic started, the cultivated area decreased significantly by 165,013 ha compared to the area cultivated in 2018 (Table 1). The main reason for this situation was the restrictions imposed at the beginning of the spring campaign and the delays in the supply chain for inputs, which made it impossible for large agricultural farms in the county to establish spring crops. As a result, this reduction in the private sector's cultivated area is also observed.

Table 1. Evolution of the cultivated areas in Timiș County

Cultivated area	2018		2019		2020	
	Total (ha)	Privat (ha)	Total (ha)	Privat (ha)	Total (ha)	Privat (ha)
	507.5	502.9	500.3	496.1	342.5	337.4
%	100	100	99	99	67	67
Diff			-7.20	-6.821	-165.0	-165.4

Table 2 presents the evolution of wheat cultivated areas, average production, and total production at the level of Timiș County during the analyzed period.

Table 2. The evolution of cultivated areas, average and total wheat yield at the level of Timiș County

Year	Total To	Avg. kg/ha	Total To	Avg. kg/ha	Total To	Avg. kg/ha
	2018	702.36	5.12	735.01	5.50	502.58
Diff			32.65	378	-199.77	-474
Area	137100		133615		108106	
Diff			-3484		-28994	

The largest area cultivated with wheat was achieved in 2018, with 137,100 hectares, followed by the area in 2019 with 133,615 hectares, a decrease of 3,484 hectares, mainly due to the areas cultivated by individuals, which also contributed to the reduction of the total cultivated area in the county. However, the weather conditions in the autumn of 2019, especially the severe drought from June to September, followed by a period of almost continuous rainfall in October, led to a reduction in the wheat sown area by 28,994 ha. Regarding the average yields achieved, these ranged from 4,649 kg/ha in 2020 to 5,501 kg/ha in 2019. Data regarding the total wheat

production in Timiș County show yields ranging from 502,583 tons in 2020, a year with the smallest cultivated area and the lowest average production per hectare, to 735,018 tons in 2019, a year that recorded a smaller cultivated area of approximately 3,500 hectares, but whose average production favored obtaining the highest total production. In fact, of the three years analyzed, 2019 was the most favourable for wheat cultivation.

Table 3 shows the evolution of the areas, average and total yields of corn in Timiș County during the analyzed period.

Table 3. The evolution of the surface area, average and total production of corn at the level of Timiș County

	Total	Avg.	Total	Avg.	Total	Avg.
	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020	
Yield	1.505.7	9.42	1.726.0	10.42	741.71	6.639
Diff			220.35	995	-764.01	-2.786
Area	159759		165652		111721	
Diff			5892		-48038	

The highest maize yield was achieved in 2019 (1,726,089 tons), the year when the largest area of 220,359 ha was cultivated and the highest average yield of the analyzed period was achieved (10,420 kg/ha). It is worth mentioning that 2019 was an exceptional year from a climatic point of view, especially in terms of the distribution of precipitation during the maize growing season. In 2020, the restrictions imposed by the pandemic and the problems in securing inputs (customs blockades and the inability to secure hybrid seeds and fertilizers) were the causes that led to a drastic reduction of the cultivated area by 48,038 ha, and due to the mentioned reasons, the average yield was only 6,639 kg/ha.

Table 4 presents the evolution of the areas, average yields, and total yields of rye in Timiș County during the analyzed period.

Table 4. Evolution of the areas, average and total yields of rye at the level of Timiș County

	Total	Avg.	Total	Avg.	Total	Avg.
	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020	
Yield	3	2.000	59	1.123	92	5111
Diff			56	-877	89	3111
Area	1,5		53		18	
Diff			51		17	

Rye, a cereal crop with many agricultural uses and advantages, is very rarely cultivated in

Timiș County. However, based on the analyzed data starting from 2019, this crop is on an upward trend both in terms of cultivated areas and average yields per hectare.

Table 5 shows the evolution of the cultivated areas, average yields, and total yields of barley in Timiș County during the analyzed period.

Table 5. Evolution of the areas, average and total yields of barley at the level of Timiș County

	Total	Avg.	Total	Avg.	Total	Avg.
	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020	
Yield	33.19	5.867	70.14	5.15	49.13	4.73
Diff			36.95	-709	15.94	-1.13
Area	5657		13600		10373	
Diff			7943		4716	

It should be noted that barley is also on an upward trend in terms of both cultivated areas and average yields per hectare, with the largest areas being cultivated in 2019 (16,600 ha) and 2020 (10,373 ha). However, the Timiș County provides very favourable conditions for wheat cultivation, which is why farmers have significantly reduced the areas cultivated with other cereal crops.

In table 6, the evolution of the cultivated areas, average yields, and total productions of triticale in Timiș county is presented for the analyzed period. By analyzing the data related to the cultivated area and yields of triticale, it can be observed that this crop is grown on approximately 3,500-4,000 ha each year, with an average yield ranging between 4,700-5,400 kg/ha.

Table 6. Evolution of the areas, average and total yields of triticale at the level of Timiș county

	Total	Avg.	Total	Avg.	Total	Avg.
	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020	
Yield	20.642	5.339	18.093	4.968	19.758	4.799
Diff			-2.549	-371	-884	-540
Area	3866		3642		4117	
Diff			-224		251	

Table 7 shows the evolution of the areas, average yields, and total production of oats in Timiș County during the analyzed period. The areas cultivated with oats in Timiș County during the analyzed period ranged from 3055 ha in 2020 to 3294 ha in 2019, while average yields ranged from 2300 kg/ha to approximately 3000 kg/ha. It should be

mentioned that the areas cultivated with oats are of the spring type, and farmers only cultivate them on those areas where they were not able to sow wheat in the fall

Table 7. Evolution of the areas, average and total yields of triticale at the level of Timiș County

	Total		Avg.		Total		Avg.	
	To	kg/ha	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020			
Yield	8.981	2.797	9.581	2.909	7.292	2.387		
Diff			600	112	-1.68	-410		
Area	3211		3294		3055			
Diff			83		-156			

Table 8 presents the evolution of sunflower acreage, average and total production in Timiș county during the analyzed period. The data highlights the importance of this crop in the structure of crops at the county level, except for the issues mentioned in 2020. In 2018, the cultivated area of sunflowers reached 80,383 ha, with an average production of 2548 kg/ha and a total production of 204,816 tons. In the 2019 agricultural year, the cultivated area reached 78,239 ha, with an average production of 3529 kg/ha and a total production of 276,105 tons. We consider that the good distribution of precipitation during the sunflower vegetation period in 2019 was the main cause for obtaining an average production of over 3500 kg/ha.

Table 8. Evolution of the areas, average and total yields of sunflower at the level of Timiș County

	Total		Avg.		Total		Avg.	
	To	kg/ha	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020			
Yield	204.81	2.548	276.10	3.529	61.716	2.640		
Diff			71.289	981	-143.1	92		
Area	80383		78239		23377			
Diff			-2144		-57006			

Table 9 presents the evolution of the areas, average and total yields of rapeseed at the level of Timiș county, during the analyzed period. Rapeseed, the second oilseed crop both nationally and in Timiș county, covers areas of around 24000-27000 ha, not due to lack of interest from farmers but due to restrictions on crop rotation with sunflower and soybeans (annually, the cultivated areas with these three oilseed crops represent 30% of the arable land in the county). Average yields, depending on weather conditions, range between 2600 kg/ha and 3100 kg/ha.

Table 9. Evolution of the areas, average and total yields of rapeseed at the level of Timiș County

	Total		Avg.		Total		Avg.	
	To	kg/ha	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020			
Yield	80.251	2.935	43.551	2.670	76.933	3.104		
Diff			-36.70	-265	-3.318	169		
Area	27343		16311		24785			
Diff			-11032		-2558			

In table 10, the evolution of soybean surfaces, average and total production in Timiș County is presented for the analyzed period. Soybean is also an important crop and present in the crop structure, especially in commercial farms. The largest area cultivated in the analyzed period was in 2018, with 31,070 ha. The highest average yield per hectare was obtained in 2019 (2800 kg/ha), a very favorable year in terms of accumulated precipitation during the vegetation period.

Table 10. Evolution of the areas, average and total yields of rapeseed at the level of Timiș County

	Total		Avg.		Total		Avg.	
	To	kg/ha	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020			
Yield	55.336	1.781	59.352	2.800	33.307	2.141		
Diff			4.016	1.019	-22.02	360		
Area	31070		21197		15557			
Diff			-9873		-15513			

Table 11 presents the evolution of the surfaces, average and total production of sugar beet at the level of Timis County, during the analyzed period. Sugar beet, with all the advantages it offers both economically and agronomically, being a very good crop for rotation, has a very small share in the crop structure of Timis County. In practice, farmers were forced to gradually reduce the cultivated areas and abandon this crop starting from 2020, due to the closure of processing factories, despite the fact that there were very favorable conditions in terms of soil fertility, temperature, and humidity.

Table 11. Evolution of the areas, average and total yields of sugar beet at the level of Timiș County

	Total		Avg.		Total		Avg.	
	To	kg/ha	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020			
Yield	53.08	60.45	10.29	17.09				
Diff			-42.79	-43.36				
Area	878		602					
Diff			-276					

Table 12 presents the evolution of the areas, average and total yields of fodder beet at the level of Timiș County, during the analyzed period. As far as the cultivated areas and average yields of fodder beet in Timiș County are concerned, around 150 ha are cultivated with an average yield of 20 tons/ha.

Table 12. Evolution of the areas, average and total yields of sugar beet at the level of Timiș County

	Total		Avg.		Total		Avg.	
	To	kg/ha	To	kg/ha	To	kg/ha	To	kg/ha
Year	2018		2019		2020			
Yield	2.960	20.600	2.664	18.600	2.664	19.800		
Diff			-296	-2.000	-296	-800		
Area	144		143		135			
Diff			-1		-9			

CONCLUSIONS

The geographic conditions and suitability of arable land in Timiș County are accurately reflected by the crop structure. The most significant areas, around 70% of arable land, are cultivated with cereals, with wheat and corn representing 90% of these crops. In terms of territorial favorability, it can be said that the restrictive factor is caused by the lack of moisture during the vegetation period. In terms of thermal and natural fertility, there are very favorable conditions for a large number of species. Oilseed crops such as sunflower and rapeseed occupy about 20% of the county's arable land, and if soybean areas are added, the percentage increases to 25%, which is beneficial in terms of ensuring a minimum three-year rotation. The conditions generated by the Covid-19 pandemic have had an impact on both cultivated areas and the average yields achieved in 2020. Another beneficial aspect for obtaining high and consistent yields is represented by the method of cultivation of these areas. At the county level, 55% of the areas are cultivated within commercial farms, following appropriate technologies, which are reflected in the level of yields obtained in the end.

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