

WINTER WHEAT CROP YIELD AND ITS INFLUENCE ON PROFITABILITY

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Abstract

In order to obtain a good yield and high profitability for the winter wheat crop, a good interaction between the plant and the environment is needed for carrying out a strategic planning of the best agricultural practices. The most representative ones aim at the choice of varieties with genetic characteristics and high production capacity, the application of an optimal level of fertilization and the integrated fight against pathogens, which are key factors that contribute to increasing the productivity and quality of wheat harvests. The paper presents the analysis of the yield and profitability of the wheat crop in three large crop farms of different sizes in Romania. From the analysis carried out, in order to reach the profitability threshold, the following results were highlighted: on the farm of 60 ha, in the year 2021, on a cultivated area of 35.5 ha, the total production realized and sold must be 214.41 tons; on the farm of 600 ha, the cultivated area being 86 ha, the total production obtained and sold must be 514.24 tons; on the 3,000 ha farm, which had a cultivated area of 709.62 ha, the total cultivated and sold production must be 4,209.48 tons. It is necessary to specify the fact that in 2019 and 2020 the profitability threshold could not be reached, in most cases. This situation was due to drought, high production costs and low farm gate prices. The conclusion of the study is that the profitability of the winter wheat crop is difficult to be increased, taking into account the high and growing production expenses registered annually by farmers. In this situation, the increase in farm dependence on subsidies to ensure a favourable raw product for the winter wheat crop has clearly emerged.

Key words: winter wheat crop, yield, profitability, subsidies

INTRODUCTION

Cereals present a series of characteristics that are highly appreciated by the world's population, representing the most valuable group of plants for human activity and existence. Cereals are grown on almost all continents, but on different surfaces. The cereal category includes: wheat, triticale, rye, millet, oat, rice, corn, sorghum) [4, 9, 14].

The cereal sector holds a key position in the agriculture of the European Union. It is necessary to mention the fact that the EU is in the first position in terms of the production and trade of cereals worldwide. In order to ensure the stability of the cereal sector at the EU level, income support is granted to farmers [13]. The cereal sector supplies important raw materials both for human food

and for animal feed. In this context, worldwide commercial exchanges with grains have a dynamic character and hold a significant share of the total trade in agri-food products [1].

According to published studies, wheat was domesticated more than ten thousand years ago, which attests to the fact that this crop has maintained its status as an essential plant in terms of ensuring global food security [3].

Worldwide, wheat is the most important cultivated plant from which bread is obtained, being cultivated annually on an area of 217 million hectares [3, 4, 6]. Regarding the wheat crop at the level of the European Union, according to official sources, it is in the first place, representing over 50% of the obtained grain production [13].

At present, bread is the basic food for 40% of

the world's population. Wheat culture presents a series of advantages such as: the grains show good convertibility over long periods of time; the grains are easily transported over long distances; cultivation technology is mechanized; wheat is a precursor plant for many crops; wheat lends itself to different pedoclimatic conditions etc. [4, 6, 10, 11].

Regarding the importance of wheat, it has been found that, currently, it provides a fifth of the protein and dietary calories for humans [3].

Cereal producers, implicitly wheat producers, have to face several challenges, namely: changing climatic conditions; large variations related to valuation prices on the international market; increasing profitability in the conditions of increasing competitive pressure; reducing the cost of production in the conditions of increasing prices of production factors, preserving biodiversity, reducing soil works in order to regenerate and conserve the soil [2].

The profitability of the winter wheat crop is influenced by a number of factors such as: yield per hectare; pedoclimatic conditions; soil fertilization; seed quality; production cost; the capitalization price etc. It is necessary to specify the fact that soil fertilization is a key solution that determines the elimination of many problems related to agricultural land [7, 12].

Another obvious aspect in the current context is represented by the growth of the world's population, implicitly by the increase in demand for wheat [3]. In this situation, producers: either focus on increasing the productivity of this crop; or look for solutions to replace wheat. None of the previously presented options represent a simple way to ensure food security, because they are conditioned by a series of endogenous and exogenous factors.

In terms of increasing the productivity of the wheat crop, while respecting the conditions imposed by the environment, the emphasis can be placed on: irrigation of the crop and on major investments in research [3, 5]. These investments made by the states would represent, on the one hand, the future

provision of food for the population, and on the other hand, would represent an indirect form of subsidizing producers.

In Romania, the area cultivated with wheat, the total production of wheat and the average production per hectare have registered variations over time. In 2021, Romania cultivated an area of 2,175 thousand hectares with wheat, achieving a total wheat production of 10,433 thousand tons. Romania obtained 7.5% of the total wheat production achieved at the level of the European Union, in the year 2021. These results placed Romania in fourth place both in cultivated area and in wheat production achieved, after the following countries: France, Germany and Poland. The average production per hectare for the wheat crop was 4,797 kg/ha in 2021. These results were possible on the one hand, due to the concentrated efforts of the producers and farmers, and on the other hand, due to the subsidies received by the producers for this crop [8].

It is necessary to mention the fact that, in unfavorable agricultural years, the granting of subsidies represents a helping hand to producers in order to maintain the viability of wheat farms.

MATERIALS AND METHODS

The present paper focused on the yield of winter wheat production and the influence on profitability, at the level of three large crop farms in Romania that are sized differently. The main indicators that were analyzed are: cultivated area; average production; total production; production value; subsidies; raw product; total expenses; gross income; net income; production cost and recovery price. These indicators were taken from the wheat crop budget and the annual financial statements of each farm under study. The period for which the analysis of these indicators was carried out was 2019-2021. Within the study, the variation of the indicators in absolute and relative value was followed. In order to present the research results as relevant as possible, they were presented in tabular and graphic form. It is necessary to mention the fact that specialized

studies were consulted to highlight, on the one hand, the importance of the wheat crop, and on the other hand, the correlation between the yield of the crop and profitability.

RESULTS AND DISCUSSIONS

The three large crop farms are located in Romania, South-Muntenia Region, Ialomita County, the agricultural area that creates

favourable conditions for the cultivation of winter wheat. The data that were the basis of the analysis were provided by the farmers, based on the culture budgets and annual financial statements.

Within the large crop farm of 60 ha, the evolution of the main technical-economic indicators for the winter wheat crop is presented in Table 1.

Table 1. The budget of the winter wheat crop on the 60 ha farm

Specification	U.M.	Year			2020/2019		2021/2020	
		2019	2020	2021	Absolut -ha-	Relative -%-	Absolut -ha-	Relative -%-
Surface cultivated with winter wheat	ha	10	40.5	35.5	+30.5	+4.05	-5.00	-0.88
Average production	kg/ha	5,000	2,000	6,000	-3,000	-0.40	+4,000.00	+3.00
Total production	kg	50,000	81,000	213,000	+31,000	+1.62	+132,000	+2.63
Production value	lei	34,000	62,370	174,660	+28,370	+1.83	+112,290.00	+2.80
Subsidies	lei	29,881.80	50,081.49	105,944.78	+20,199.69	+1.68	+55,863.29	+2.12
Raw product	lei	63,881.8	112,451.5	280,604.8	+48,569.7	+1.76	+168,153.30	+2.50
Total expenses	lei	47,413.9	148,495.7	175,818.4	+101,081.8	+3.13	+27,322.70	+1.18
Gross income	lei	16,467.90	-36,044.2	104,786.4	-52,512.1	-2.19	+140,830.60	+2.91
Net income	lei	15,907.6	-37,075.3	10,2389.8	-52,982.9	-2.33	+139,465.10	+2.76
Production cost	lei/kg	0.95	1.83	0.83	+0.88	+1.93	-1.00	-0.45
Capitalization price	lei/kg	0.68	0.77	0.82	+0.09	+1.13	+0.05	+1.06

Source: Own data processing.

During the analyzed period, total production also increased, respectively by 62% in 2020 compared to 2019 and by 162.96% in 2021 compared to 2020 (Figure 1).

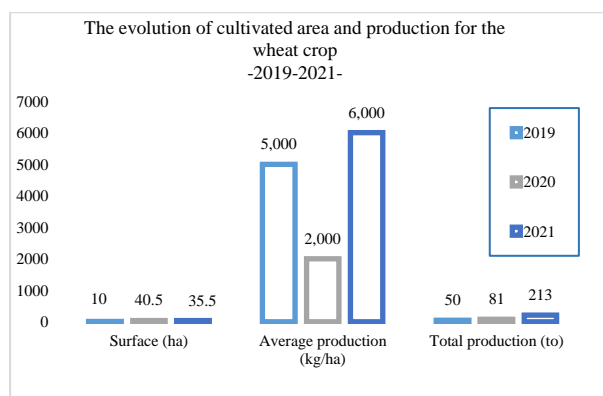


Fig.1. 60 ha farm: areas and productions for winter wheat culture
 Source: Own results.

In the period 2019-2021, the analysis highlighted an oscillation of the cultivated area: an increase of 305% in the year 2020 compared to 2019; a decrease of 12.35% in 2021 compared to 2020.

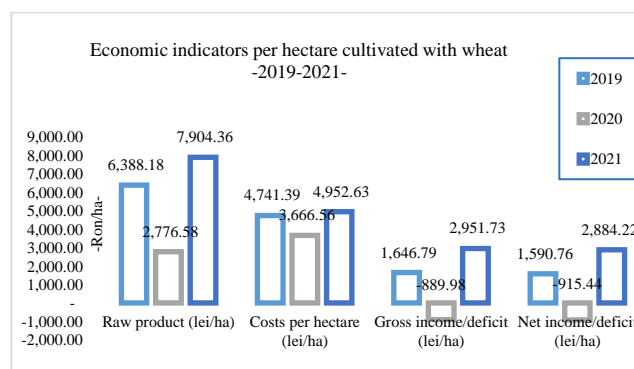


Fig. 2. 60 ha farm: income and expenses per hectare cultivated with winter wheat
 Source: Own results.

Production also had the same evolution in the analysed period. There is a decrease in average production in 2020 compared to 2019, i.e. by 60%, followed by an increase in 2021 by 200% compared to 2020.

Regarding the gross product made for each hectare cultivated with wheat, it was found that in 2020 the most unfavorable economic situation was recorded for this crop, with a gross product located at a level of 56.54% compared to the level recorded in year 2019 and at a level of 64.87% compared to the gross product of 2021 (Figure 2).

The production expenses per hectare varied during the analysis period, decreasing by 22.67% in 2020 compared to 2019 and increasing by 35.08% in 2021 compared to 2020. The total expenses per area cultivated with winter wheat framed on an upward trend, given that the area cultivated with winter wheat varied during the analysis period as follows: (+) 213.19% in 2020 compared to 2019 and (+) 18.4% in 2021 compared to 2020 (Figure 3).

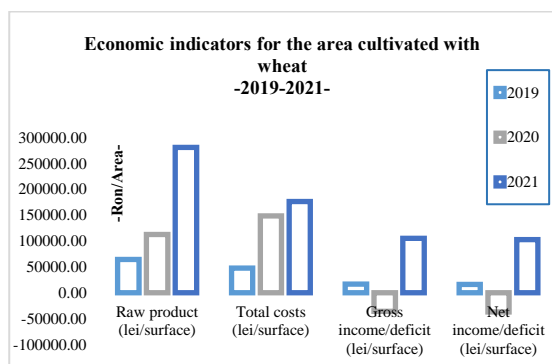


Fig. 3. 60 ha farm: income and expenses for the area cultivated with winter wheat
 Source: Own results.

Considering that the productions were small, as of 2020, the 60ha farm recorded a deficit in the wheat crop, which could not be compensated either by capitalizing on the production or by the subsidies received. In this context, it was decided to reduce the areas cultivated with winter wheat. The best year for the winter wheat crop in terms of income was 2021, with a net income that exceeded the net income in 2019 by 543.7%.

The cost of production, influenced both by the total expenses incurred on the wheat crop and

by the productions achieved, increased significantly in 2020 compared to 2019 and 2021. This aspect was highlighted based on the small quantitative productions, the production cost being 1.83 lei/kg in 2020 compared to 0.95 lei/kg in 2019 and 0.83 lei/kg in 2021. The analysis showed that the years 2019 and 2021 were good agricultural years for the winter wheat crop, in which the farm obtained quantitatively significant productions. As for the capitalization price, it was mainly influenced by the market, the quality of the product and the negotiation with the customers that the farm carried out. It is noted that, with the exception of 2021, the year in which the capitalization price for winter wheat was approximately equal to the production cost, in 2019 and 2020 the farm capitalized on wheat production at lower prices than the expenses incurred, as follows: with 0.27 lei/kg in 2019 and 1.06 lei/kg in 2020 (Figure 4). It is necessary to underline the fact that the deficit in spending on the winter wheat crop was partially covered by the operating subsidies received, but the results were not positive.

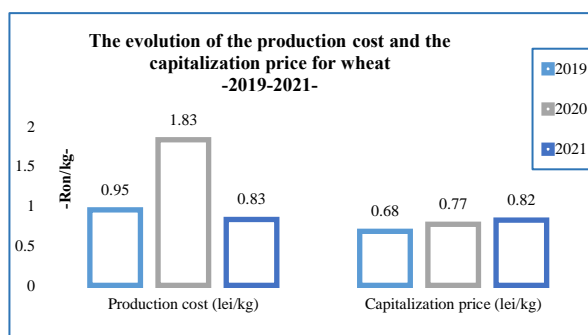


Fig. 4. 60 ha farm: production cost and selling price for winter wheat
 Source: Own results.

To cover the production expenses, the 60ha farm was required to have a minimum production as follows: 69.72 tons (2019), 192.85 tons (2020) and 214.41 tons (2021). Under these conditions, on the 60ha farm, it was found that it did not record favorable financial results for the winter wheat crop, in the entire analyzed period, because a yield deficit was recorded in 2019 (-19.72 tons), in 2020 (-111.85 tons) and in 2021 (-1.41 tons) (Table 2 and Figure 5).

Table 2. Yield and profitability for the winter wheat crop on the 60 ha farm

Specification	MU	2019	2020	2021
The production yield necessary to cover expenses	tons	69.72	192.85	214.41
The production surplus/deficit after covering production expenses		-19.72	-111.85	-1.41

Source: Own data processing.

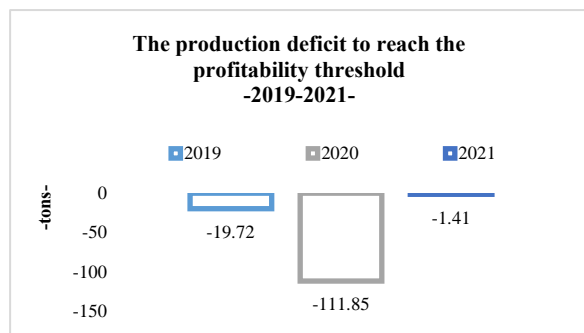


Fig. 5. 60 ha farm: production deficit for the winter wheat crop
 Source: Own results.

Within the large crop farm of 600 ha, the main technical-economic indicators for wheat cultivation are presented in Table 3.

At this farm, the area cultivated with wheat varied in the period 2019-2021, by 32.65% (2020 compared to 2019) and by 45.22% (2021 compared to 2020).

At the same time, the productions had an oscillating evolution during the analysed period, noting the reduction of both the average productions and the total production in 2020.

This situation was due to the pedological drought but also to unfavourable meteorological phenomena (Table 3).

It is necessary to specify the fact that the total production achieved in the agricultural year 2019-2020, insignificant quantitatively and qualitatively, was mostly used for the payment of the lease, according to the signed contracts (Figure 6).

Table 3. The winter wheat crop budget at the large crop farm of 600 ha

Specification	U.M.	Year			2020/2019		2021/2020	
		2019	2020	2021	Absolut -ha-	Relative -%-	Absolut -ha-	Relative -%-
Surface cultivated with winter wheat	ha	203	157	86	-46	-0.77	-71.00	-0.55
Average production	kg/ha	6,129	246	7,066	-5,883	-0.04	+6,820.00	+28.72
Total production	kg	1,244,187	38,622	607,676	-1,205,565	-0.03	+569,054	+15.73
Production value	lei	854,756.47	26,533.31	498,294.32	-828,223	-0.03	+471,761.01	+18.78
Subsidies	lei	258,115.43	201,097.76	122,637.13	-57,017.7	-0.78	-78,460.63	-0.61
Raw product	lei	1,112,871.90	227,631.07	620,931.45	-885,241	-0.20	+393,300.38	+2.73
Total expenses	lei	815,726.31	557,243.66	503,955.55	-25,8483	-0.68	-53,288.11	-0.90
Gross income	lei	297,145.59	-329,612.58	116,975.90	-626758	-1.11	+446588.48	+0.35
Net income	lei	289,466.10	-334,039.98	91,728.88	-623,506	-1.15	+425768.86	+0.27
Production cost	lei/kg	0.66	14.43	0.83	13.77	+21.86	-13.60	-0.06
Capitalization price	lei/kg	0.69	0.80	0.98	0.11	+1.16	+0.18	+1.23

Source: Own data processing.

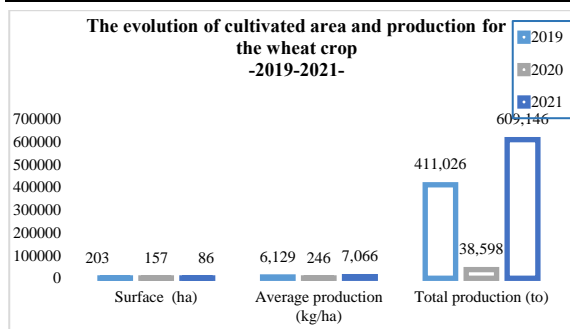


Fig. 6. 600 ha farm: areas and productions for the wheat crop
 Source: Own results.

The agricultural year 2020-2021 is notable for high productions in the wheat crop, an average production of 7.066 kg/ha which contributed to compensating the production deficit in the winter wheat crop, so that it exceeded the level of total productions in previous years (48.20% higher than in 2019). Regarding the gross product per hectare cultivated with winter wheat, an unfavourable situation is observed in 2020, the gross product being 73.64% lower compared to the gross product recorded in 2019 and 397.98% higher in 2021 from the previous year (Figure 7).

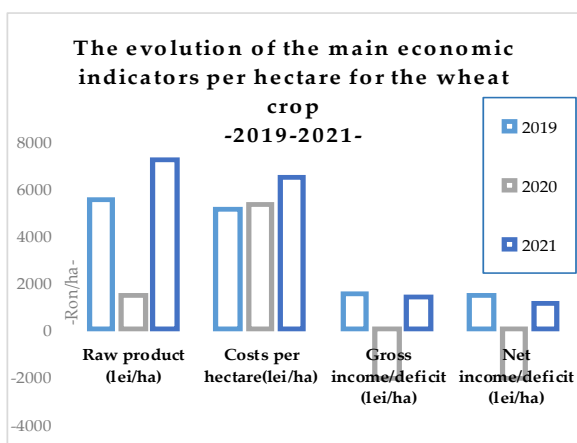


Fig. 7. 600 ha farm: Income and expenses per hectare cultivated with winter wheat
 Source: Own results.

Production costs per hectare cultivated with winter wheat registered an upward trend during the analysis period: 3.92% higher in 2020 compared to 2019 and 22.45% higher in 2021 compared to 2020.

At the same time, total expenses evolved downward, taking into account the fact that the area cultivated with wheat decreased

during this period and a decrease of 32.69% in 2020 compared to 2019 and 9.56% in 2021 was highlighted compared to 2020 (Figure 7). The revenues achieved during the period 2019-2021, with the exception of 2020, which marked a loss for this crop and which could not be compensated by the subsidies received, in the years 2019 and 2020, were higher than the expenses, but down by 7.08% in 2021 compared to 2019, considering the cultivation of smaller areas.

In this context, the reduction of the area attracted the reduction of the total production expenses incurred, and the incomes were conditioned in this case, by the average production and implicitly by the total production (Figure 8).

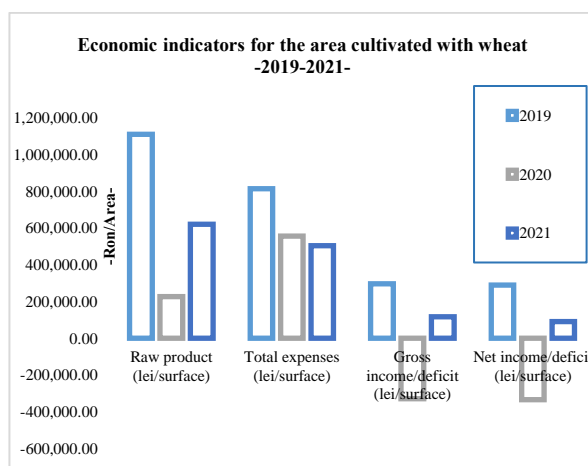


Fig. 8. 600 ha farm: income and expenses for the area cultivated with winter wheat
 Source: Own results.

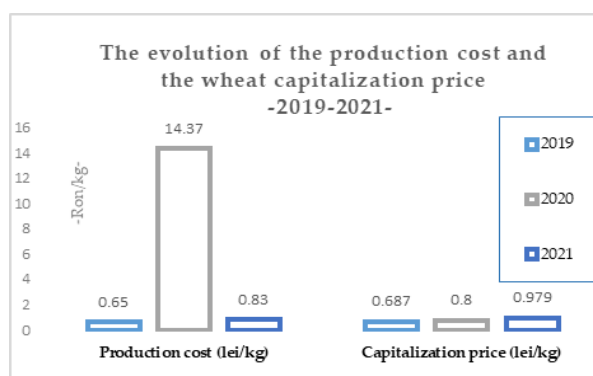


Fig. 9. 600 ha farm: production cost and sale price for winter wheat
 Source: Own results.

The cost of production was influenced both by the total costs for the wheat crop and by the productions achieved.

The increase in the cost of production from 2020 is noted based on the low average productions compared to 2019 and 2021, respectively 14.37 lei/kg, compared to 0.65 lei/kg in 2019 and 0.83 lei/kg in 2021, agricultural years in which the farm achieved high yields (Figure 9).

It is noted that the wheat capitalization price increased from one year to another during the analysis period, but it exceeded the production cost in 2019 and 2021. The differences in expenses in 2020 were not covered by the subsidies received by the farm, leading to negative results in 2020 and positive results in 2019 and 2021 (Figure 9).

In order to cover production expenses and reach the profitability threshold for the winter wheat crop, a minimum total production of: 1,182.21 tons (2019) was required within the 600 ha farm; 696.55 tons (2020) and 514.24 tons (2021). In these conditions, the 600 ha farm recorded a profitability for the winter wheat crop in 2019 and 2021.

Table 4. The yield and profitability of the wheat crop for the 600 ha farm

Specification	MU	2019	2020	2021
The production yield necessary to cover expenses	tons	1,182.21	696.55	514.24
The production surplus/deficit after covering production expenses		61.97	-657.93	93.43

Source: Own data processing.

It was highlighted that in the years in which the yield of the crop was exceeded by 61.97 tons (2019) and by 93.43 tons (2020), the profitability threshold was reached.

The production deficit led to the recording of unfavorable results for the winter wheat crop in 2020, being (-) 657.93 tons (Table 4 and Figure 10).

However, productions had an oscillating evolution during the analyzed period.

There is a halving of average production in 2020 compared to 2019, i.e. 49.19%, followed by an increase in 2021 by 119.04% compared to 2020 and by 11.29% compared to 2019.

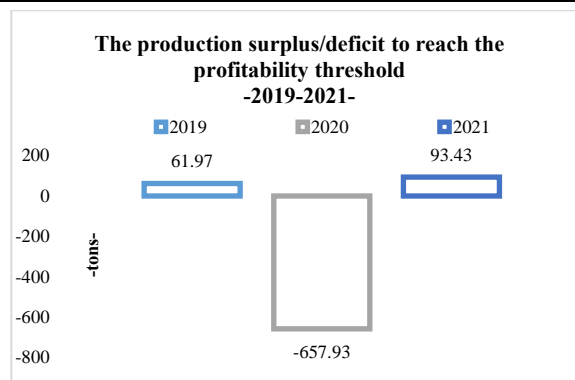


Fig. 10. 600 ha farm: the production deficit for the winter wheat crop

Source: Own results.

Within the large crop farm of 3,000 ha, the evolution of the main technical-economic indicators for wheat cultivation are presented in Table 5.

The total area cultivated with wheat owned in 2019 was of 811.24 ha, and decreased by 11.17 %, (2020) and by 1.52% (2021) compared to the previous year (Figure 11).

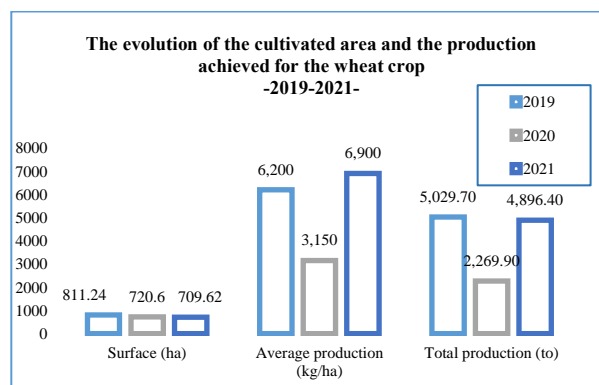


Fig. 11. 3,000 ha farm: areas and productions for winter wheat crop

Source: Own results.

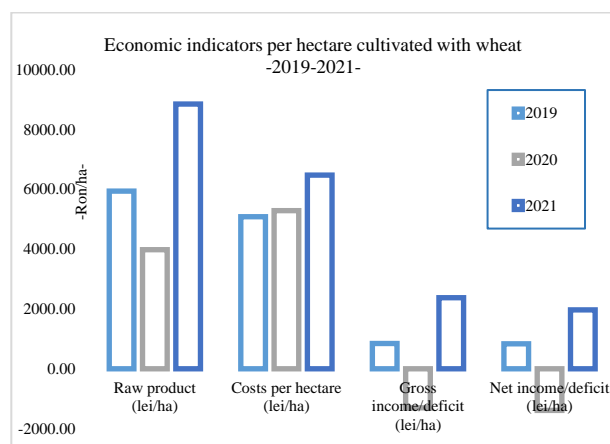


Fig. 12. 3,000 ha farm: income and expenses per hectare cultivated with wheat

Source: Own results.

From the analyzed data, it was observed that the total production followed the same trend, but noting that in 2021 it represented 97.35% of the production in 2019, although the cultivated area decreased by 101.62 ha, which denotes a good yield of this crop (Figure 11). Production expenses per cultivated hectare registered an upward trend during the analysis period, by 3.92% (2020 compared to 2019) and by 22.45% (2021 compared to 2020). At the same time, the total expenses for the winter wheat crop evolved downward, taking into account that the area cultivated with wheat decreased by 7.78% in 2020 compared to 2019 and by 1.52% in 2021 compared to 2020 (Figure 13).

Considering the small productions in 2020, the 3000 ha farm recorded a wheat crop deficit, a deficit that could not be compensated by the subsidies received. The best year for the wheat crop in terms of income was 2021, with a net income that exceeded the net income in 2019 by 158.50% (Figure 13).

It is noted that, except for the year 2021, when the recovery price for wheat exceeded the production cost by 0.15 lei/kg, in 2019 and 2020 wheat was valued at prices lower than the costs involved, respectively by 0.07 lei/kg in year 2019 and by 0.88 lei/kg in 2020.

It is necessary to underline the fact that in the respective years (2019 and 2020), this deficit of expenses for the wheat crop was covered by the operating subsidies received (Figure 14).

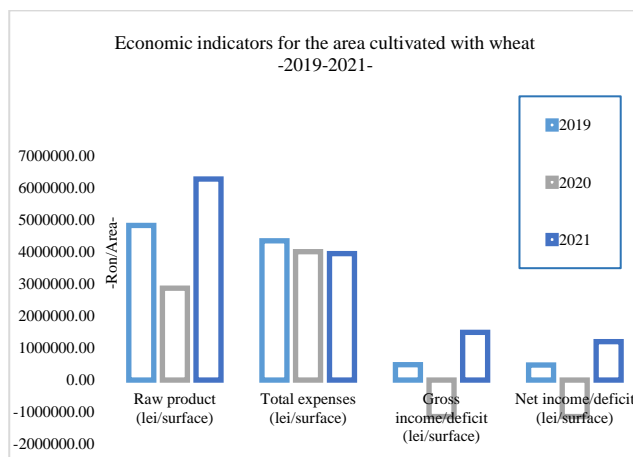


Fig. 13. 3,000 ha farm- income and expenses for the area cultivated with winter wheat.
 Source: Own results.

The production cost was influenced both by the total expenses incurred and by the productions achieved and recorded an increase in 2020 compared to 2019 and 2021. These aspects were recorded based on the small quantitative productions, the production cost being in this case of 1.68 lei/kg (2020) compared to 0.82 lei/kg (2019) and 0.94 lei/kg (2021) (Figure 14).

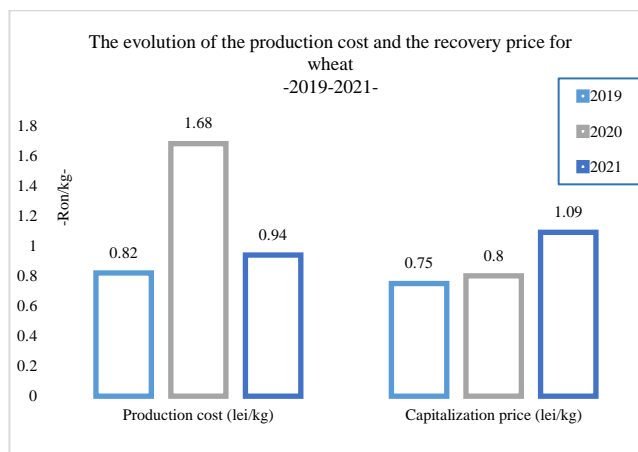


Fig. 14. 3,000 ha farm: production cost and sale price for winter wheat
 Source: Own results.

In order to reach the profitability threshold for the winter wheat crop, within the 3000 ha farm, a minimum total production of 5,486.40 tons (2019), 4,756.37 tons (2020) and 4,209.48 tons (2021) was required.

Table 6. The yield and profitability of the winter wheat crop for the 3,000 ha farm

Specification	MU	2019	2020	2021
The production yield necessary to cover expenses	tons	5,496.40	4,756.37	4,209.48
The production surplus/deficit after covering production expenses		-466	-2,486.48	686.89

Source: Own data processing.

Under these conditions, the 3,000 ha farm registered a profitability of the winter wheat crop in 2021, the year in which the yield of the crop exceeded the profitability threshold with 686.89 tons. The production deficit that led to the recording of negative results for the winter wheat crop was recorded in 2019 (-

0.46 tons) and 2020 (-2.48 tons) (Table 6 and Figure 15).

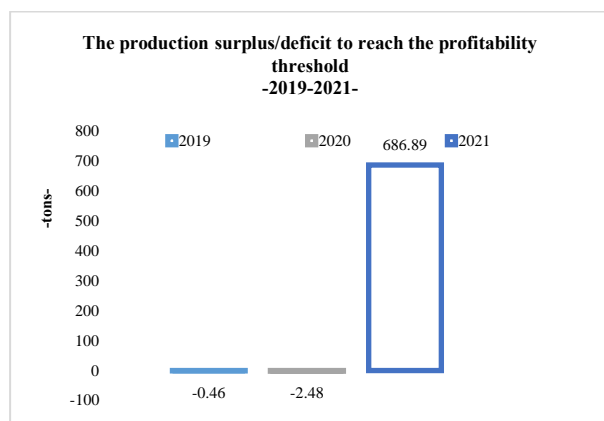


Fig. 15. 3,000 ha farm: the production surplus/deficit for the winter wheat crop

Source: Own results.

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CONCLUSIONS

The analysis regarding the influence of the yield of winter wheat production on the profitability of this crop, carried out on three farms of different sizes in Romania, highlighted that the production expenses generally had a negative impact on the profitability of the wheat crop against the background of the constant increase in the input prices, which significantly increased these costs. In this situation, the farms were unable to find efficient substitutes with lower prices to reduce production costs. Regarding the production of the winter wheat crop, it was found that this also had, in general, a negative impact on the economic efficiency of the winter wheat crop against the backdrop of climate change. The influence of climate changes is more and more visible, difficult to anticipate and control, and has reduced the production of the winter wheat crop

quantitatively and qualitatively. In order to reach the profitability threshold for the winter wheat crop, it was highlighted that:

- Within the 60 ha farm, the production yield deficit in 2019 was of 19.72 tons, respectively a loss of 1,360.68 lei; in 2020, the production yield deficit was of 111.85 tons, respectively a loss of 8,948 lei; in 2021, the production yield deficit was of 1.41 tons, respectively a loss of 138.18 lei.

- Within the 600 ha farm, the production yield deficit in 2020 was of 657.93 tons, respectively a loss of 526,346.06 lei; in the years 2019 and 2021, a production yield surplus was found as follows: in 2019 it was of 61.97 tons (42,762.72 lei) and in 2021 it was of 93.43 tons (91,566.93 lei).

- Within the 3,000 ha farm, the production yield deficit in 2019 was of 466.72 tons, respectively a loss of 350,034 lei; in 2020, the production yield deficit was of 2,486.48 tons, respectively a loss of 1,989,187.2 lei, and in 2021, there was a production yield surplus of 686.89 tons, respectively, a surplus of this crop of 748.71 lei.

The paper highlighted the necessity of subsidizing agricultural activities, including the winter wheat crop, regardless of the size of the farms and the favorable agro-pedo-climatic conditions.

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