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ECONOMIC EFFICIENCY OF THE MECHANISATION TECHNOLOGY IN MAIZE

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Abstract

The choice of aggregates is also made depending on the direct operating costs. If two aggregates, according to the cost of the works, require the same production costs, the one that satisfies the requirements of the machine system is chosen. When performing works with different agricultural aggregates, the optimal option is always chosen, which is evaluated according to the minimum value of the number of aggregates that take part in the execution of the work or according to the minimum value of time, respectively according to fuel consumption. Agricultural aggregates, while moving on the ground, consume a large amount of energy, which is why the problem arises of determining, on a scientific basis, some constructive and operating parameters at which the energy consumption is minimal. The present work presents an analysis of the consumption and costs of mechanised works and materials used in maize in the territory of Gurasada commune, Hunedoara County, Romania, in the year 2022-2023, in order to optimize the cultural technology. The mechanization technology for corn crop in the studied area was realized on a soil with high fertility. The agricultural machinery used for the applied technology is the one that the farm has. The main mechanization works for corn cultivation were: land fertilization, land preparation, ploughing, sowing, weeding, mechanical harrowing, as well as harvesting. After studying the corn crop over a longer period taking into account the pedo-climatic conditions as well as the productions obtained, we can conclude the following: can be obtained good yields if a series of recommendations given in the conclusions will be respected. In order to obtain a profit in the corn culture, it is recommended to use drought-resistant hybrids with high production potential.

Key words: *economic efficiency, mechanic aggregates, maize technology*

INTRODUCTION

Agriculture has been, since ancient times, the essential source of food and clothing production for the entire population of the globe [11]. The intensive use of agricultural machines ensures the increase of labour productivity in agriculture, making it possible that, parallel to the expansion of mechanisation, each agricultural producer can feed, through the products obtained, an increasing number of people [3]. Solving the future problems of agriculture involves the use of high-yield tractors, as well as of complex aggregates capable of solving the large volume of mechanised works on time and with increased efficiency [17]. Advanced and high-performance agriculture in terms of production and labour productivity in different countries is based on a particularly important techno-economic segment, the mechanisation of agricultural works. Equipping a modern and sustainable agriculture according to the experience of leading countries in this field is done with a wide range of machines and installations, of which the machines that constitute the energy base are of great importance and economic efficiency [9], [5]. Maize is the third most important crop in the world. Along with wheat and barley, they form the basis of the diet of the largest part of the world's population, directly or transformed into animal products [1]. This position, from an agricultural point of view, is motivated by a series of particularities, as follows:

-It has a high production capacity, about 50% higher than other cereals;

-It has a high ecological plasticity, which allows it to spread over a wide area, giving large and relatively constant harvests, less influenced by climatic changes;

-It is a weeding plant, a good precursor for most crops;

-It supports monoculture for several years;
-It has a high multiplication factor (150-400);
-It allows a better staggering of agricultural works since it demands a later sowing in the spring;
-Its culture is 100% mechanisable;
-Its harvesting is done without the risk of shaking;
-It makes very good use of organic and mineral fertilisers, as well as of irrigation water;
-Its production valorisation possibilities are very varied [25].

Thanks to the application of more and more efficient technologies, as well as to the creation and expansion of maize hybrids in culture, conditions have been met for maize production to increase continuously, in some countries even spectacularly [21].

Crop Rotation

Maize is little pretentious to the precursory plant and can be cultivated for several years in monoculture. However, the results are influenced by the precursory plant. Thus, the best precursors are legumes for grains and annual or perennial fodder crops (peas, alfalfa, clover, soybeans, etc.). Under the conditions of the current crop structure, maize enters the rotation with wheat. The main inconvenient of this rotation is the attack of fusariosis (a disease common to both plants), which causes crop losses in both wheat and maize. Sorghum, Sudan grass and millet are not recommended as precursors. Maize supports monoculture for many years, provided the correct technology is applied, especially in terms of fertilisation, weed control, and disease and pest control. However, its cultivation for more than 2-3 years on the same surface leads to a decrease in soil fertility, to a reduction in stable soil aggregates, and to an increase in the reserve of weeds, diseases, and specific pests.

Fertilisation

Maize is a plant that consumes a lot of nutrients. The specific consumption and related secondary production for 100 kg of grains is 1.8-2.8 kg N, 0.86-1.4 kg P_2O_5 and 2.4-3.6 kg K_2O; minimum limits are recorded at the level of some large productions and maximum ones in the case of small productions per unit area [24]. Maize reacts strongly to chemical fertilisation [23]. The yield increases are higher following the application of nitrogen fertilisers, reaching 14-16 kg grains/1 kg N a.s. Phosphorus fertilisers result in increases of 4-6 kg grains/1 kg P_2O_5 a.s. Potassium ensures increased yields, on brown-loamy soils of 3-6 kg grains/1 kg K_2O a.s. High yields can only be obtained through optimal fertilisation with all three elements [20]. The doses of chemical fertilisers are established depending on the planned production, specific consumption, soil fertility, precursor, and rainfall. Organic fertilisation gives good results on all types of soil. Maize, having a long vegetation period, makes good use of manure [22]. The effect of litter is very favourable on loamy brown and sandy soils: a rate of 20-30 t/ha is recommended [10]. Green fertilisers give very good results in maize culture. In areas with rainfall of over 650 mm, after a precursor with an early harvest, the cultivation of an intermediate plant (preferably a legume) is a measure of soil protection and, at the same time, of high maize yields in economic conditions [16].

Soil Works

Through soil works, the following objectives must be achieved:
-Obtaining a loose soil layer in depth and shredded on the surface;
-Storing and preserving as much water as possible in the soil;
-Intensifying biological activity;
-Reducing the degree of weeding of the soil;
-Ground levelling;
-Reducing erosion on sloping land;
-Eliminating excess water on heavy soils, etc.

Ploughing will be done immediately after harvesting the precursor [15].The depth of ploughing differs depending on the type of soil and it ranges between 20 and 30 cm [7]. On light soils or on soils with a thin arable layer, the depth will be 20-25 cm, and on normal or heavy soils, 25-30 cm [12].

Seeds and Sowing

The seed must be a hybrid, belong to a zoned hybrid, have a minimum purity of 98% and a germination rate of over 90%.

Maize sowing will start when, in the morning, at 8 o'clock, in the soil 10 cm deep, the temperature is 8°C and the trend is increasing [8]. Sowing too early causes the "hatching" of a certain percentage of seeds, the delayed emergence of the others, and a reduced growth rate in the young plants [19].

When sowing is delayed, there is a risk of a water deficit necessary for germination, and the phenophases with high sensitivity for water (flowering-fertilisation) are "pushed" to the summer, during periods with high temperatures and low humidity [4].

Maintenance Works

Maintenance works must ensure weed, disease, and pest control [14].

Of the total increase in maize yield achieved through different phyto-technical methods, 26% comes from weed control, 20% from fertilisers, and 10% from density [6]. The amount of maize harvest losses caused by weeding, according to the results from 15 experimental stations in Romania, represents 30-90% of the harvest, i.e., 3,000-7,000 kg/ha [13]. Controlling weeds must be done in an integrated concept, primarily using agrotechnical methods (crop rotation, soil work, mechanical maintenance work) [2]. But effective weeds control cannot be done without the use of herbicides [4]. The choice of herbicides must be based on the dominant weed species, the rotation in which the crop falls, and the humus content of the soil. Weed control can be done only by mechanical and manual work, only with the help of herbicides or combined. Controlling weeds without the use of herbicides involves a large volume of mechanical and manual work.

Irrigation

In dry springs, a dawn watering is done with 300-400 m^3/ha. In the water-critical phenophases, the maintenance of soil moisture at a depth of 80 cm must be ensured by watering with rates of 400-800 m^3/ha. Maize is harvested at full ripeness, when the kernels have less than 30% moisture. Maize harvesting can be staggered over a longer period without crop loss. Losses can still occur when the harvest period is prolonged too much because of breaking the stems, of diseases and pests, or of climate phenomena – wind, rain, etc.In today's conditions, most agricultural producers use complex chemical fertilisers, particularly fertilisers that have nitrogen as their active substance. Improper storage and use of chemical nitrogen fertilisers can cause serious harm and poisoning to humans and animals. The irrational use of fertilisers causes an excess of nitrogen and phosphates to appear, which has a toxic effect on the microflora in the soil and leads to the accumulation of these elements in the vegetation. The limit between deficiency and excess of an element is difficult to estimate, everything depending on the nature of the plants and the environment.

In this context, the purpose of this research is to analyze the impact of mechanized works and consumption of materials and labor on the costs of mechanised works and economic efficiency of this used mechanized technology in maize grown in the territory of Gurasada commune, Hunedoara County, Romania, in the year 2022-2023, in order to optimize the cultural technology.

MATERIALS AND METHODS

Gurasada is a commune in Hunedoara County, Romania, located at the foot of the Apuseni Mountains near the Zamului Depression. The total area of the commune is 9,295 ha. In general, in this area, the soil is productive, it has a high fertility, and agricultural exploitation is carried out with means of improvement (chemical and natural fertilisers, etc.).

The studies in this paper were carried out in the Gurasada area during 2022-2023. The area cultivated with grain maize was 35 ha.

The main mechanised works in maize and the aggregates used were:

-Fertilisation: New Holland 8560 tractor + Lemken 110 fertiliser machine;

-Ploughing: New Holland 8560 tractor + Lemken Opal 110 reversible plough;

-Soil preparation: New Holland 8560 tractor + Terradisc Barella disc harrow;

-New Holland 8560 tractor + Kunh 300 rotary harrow;

-Maize sowing: Case IH 9056 tractor + Gaspardo SP 530 seeder;

-Herbicide: Preciculture UT 140 self-propelled sprayer;
-Mechanical weeding: Case IH 9056 tractor + CPU 6 cultivator;
-Maize harvesting: Case IH 1660 combine + Oros 6039 cob picker.

Choice of tractors and combines

The types of tractors are chosen depending on the technological process of the works and on the biological properties of the crops, according to the following indicators: ground clearance, gauge, gauge dimensions, plot size, energy consumption of agricultural machines, land condition, soil moisture, and manoeuvrability aggregate. The choice of aggregates is also made depending on the direct operating costs. If two aggregates, according to the cost of the works, require the same production costs, the one that satisfies the requirements of the machine system is chosen. When performing works with different agricultural aggregates, the optimal option is always chosen, which is evaluated according to the minimum value of the number of aggregates that take part in the execution of the work or according to the minimum value of time, i.e., according to fuel consumption. Agricultural aggregates, moving on the ground, consume a large amount of energy, which is why the problem arises of determining, on a scientific basis, some constructive and operating parameters at which the energy consumption is minimal. The power source of an aggregate is the tractor. It is included in the composition of all agricultural aggregates, being the essential element in mechanisation technology.

Two types of tractors (New Holland 8560 tractor, Case IH 9056 tractor) and a self-propelled combine harvester (Case IH 1660) equipped with an Oros cob picker were used to perform the mechanised work on maize.

The New Holland 8560 tractor was used to fertilise, plough, and prepare the soil for sowing. The operating parameters of the New Holland 8560 tractor are:
-Engine type: Ford, 6 cylinders in line;
-Total displacement: 7.5 l;
-Nominal power: 160 HP;
-Nominal speed: 2,000 rpm;
-Nominal engine torque: 670 Nm;
-Gearbox: SemiPowerShift – 18 steps, 4 x 4 all-wheel drive;
-Tractor weight: 5,443 daN;
-Diesel tank capacity: 321 l.

The Case IH 9056 tractor was used for sowing and weeding.

The operating parameters of the Case IH 9056 tractor are:
-Engine type: Case IH D358, 6 cylinders in line;
-Total displacement: 5.9 l;
-Nominal power: 95 HP;
-Nominal speed: 2,200 rpm;
-Nominal engine torque: 465 Nm;
-Gearbox: mechanical – 16 steps, all-wheel drive 4 x 4;
-Tractor weight: 4,672 daN;
-Diesel tank capacity: 128 l.

The self-propelled combine Case IH 1660 was used to harvest maize in the form of grains. It is equipped with a 190 HP diesel engine, and has cylinder capacity 7.6 l. The bunker has a volume of 5,780 l. The combine has an axial threshing machine, and the cleaning system has a screening area of 4 m^2. Combine weight = 9,000 daN.

The cob picker Oros 6039 is equipped with a 6-row cob chopper. The technical, technological, and economic performances of agricultural aggregates are assessed through the following technical indices, also called use or exploitation indices: working depth, working width, working speed, traction resistance force, driving power, working capacity, load level of the energy source, and fuel consumption.

RESULTS AND DISCUSSIONS

For the maize crop in the Gurasada area, three fertilisations were carried out:
-One basic fertilisation in the fall of 2022;
-Two fertilisations in vegetation (when sowing and weeding) in the spring of 2023.

Basic fertilisation was done with the Eurospand Jolly 32 fertiliser spreader carried and driven by the New Holland 8560 tractor. Basic fertilisation was done with complex fertilisers (16:16:16), the amount administered being 250 kg/ha. The spreading width was 24 m, the working speed was 10 km/h, the diesel consumption was 2 l/ha.

The cost/ha of basic fertilisation includes:

-Wage costs W_C;
-Fuel costs F_C;
-Amortisation costs A_C;
-Daily maintenance costs DM_C;
-Overhead charges costs OC_C.

The costs of basic mechanised fertilisation work/ha are synthesised in Table 1.

Table 1. Costs of basic mechanised fertilisation works

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	4
Diesel costs	F_C	12
Amortisation costs	A_C	5
Daily maintenance costs	DM_C	4
Overhead charges costs	OC_C	5
TOTAL COSTS	T_C	30

Source: Own calculation.

Mechanized ploughing

The ploughing works on the plots cultivated with maize were carried out in the fall of 2018. For these works, the Lemken Opal 110 reversible plough was used in combination with the New Holland 8560 tractor. Ploughing was carried out by turning the furrows in the same part of the plot, by reversing the plough, the ploughing depth being 26 cm. The Lemken Opal 110 plough is a reversible plough with four double bodies.

The plough bodies have lamellar furrows, and the ploughing width on the body is 35 cm. The plough is equipped with front bodies for incorporating plant residues, and the reversal of the plough frame is done by hydraulic control of the force cylinder.

The working speed was 8 km/h, and the working capacity was 0.8 ha/hour, i.e., 7 ha/day.

For one ploughed hectare, 24 l of diesel were consumed. The costs of the ploughing are synthesised in Table 2.

Table 2. Costs of mechanised ploughing

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	26
Diesel costs	F_C	144
Amortisation costs	A_C	12
Daily maintenance costs	DM_C	8
Overhead charges costs	OC_C	38
TOTAL COSTS	T_C	228

Source: Own calculation.

Soil mechanized preparation

The preparation of the soil for sowing was carried out in the spring of 2023. For a good preparation of the germinal bed, two mechanised works were carried out: discking and harrowing. These works were aimed at destroying weeds, levelling the soil, breaking up clods, and loosening the soil.

This work was carried out with the Terradisc Barella disc harrow in aggregate with the New Holland 8560 tractor. The Terradisc Barella disc harrow is a battery-mounted disc harrow. The mass of the harrow is 2,200 kg, the distance between the batteries with discks is 900 mm, and the working width is 4 m. The harrow has several 34 notched discs with a diameter of 510 mm and is equipped with lamellar rollers at the rear. This work was carried out at a speed of 10 km/h, at a working width of 4 m, at a working depth of 12 cm, with a daily productivity of 14 ha with a diesel consumption of 10 l/ha.

The costs of this work are presented in Table 3.

Table 3. Costs of discking

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	15
Diesel costs	F_C	60
Amortisation costs	A_C	12
Daily maintenance costs	DM_C	13
Overhead charges costs	OC_C	20
TOTAL COSTS	T_C	120

Source: Own calculation.

The work with the Kuhn 300 rotary harrow was carried out in aggregate with the New Holland 8560 tractor. It is equipped with 20 vertical knives and has a working width of 3 m.

Table 4. Costs of the mechanised work with the rotary harrow

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	16
Diesel costs	F_C	48
Amortisation costs	A_C	8
Daily maintenance costs	DM_C	8
Overhead charges costs	OC_C	16
TOTAL COSTS	T_C	96

Source: Own calculation.

The work was carried out at a speed of 12 km/h, the diesel consumption was 8 l/ha, and the productivity was 10 ha/day. The costs of the mechanised work with the rotary harrow are synthesised in Table 4.

Sowing

The sowing work was carried out with the Gaspardo SP 530 seeder in aggregate with the Case IH 9056 tractor. Along with the sowing, phase fertilisation was also carried out by incorporating mineral fertilisers into the soil with the fertilisation equipment of the seeder. The Gaspardo SP 530 seeder is equipped with 6 sections for sowing in nests at a distance between rows of 75 cm and has a working width of 4.5 m. As a precision seeder, it is equipped with an on-board device and reading sensors for each row, which monitor the number of grains, the area sown, etc. Sowing density was 68,000 grains/ha, seed Pioneer 9903. Fertilisation with complex fertilisers (16.16.16) rate was 120 kg/ha. The working speed of the sowing aggregate was 7 km/h, the productivity was 3 ha/h, with an average diesel consumption of 5 l/ha. The costs of sowing and fertilising are presented in Table 5.

Table 5. Costs of sowing and fertilizing

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	18
Diesel costs	F_C	30
Amortisation costs	A_C	7
Daily maintenance costs	DM_C	5
Overhead charges costs	OC_C	12
TOTAL COSTS	T_C	72

Source: Own calculation.

Protection against Weeding

Protection against weeding was done pre-emergently, 2-3 days after sowing, with the Preciculture UT 140 self-propelled sprayer. The technical characteristics of the Preciculture UT 140 spraying machine are:
-Fiat brand diesel engine, supercharged, 6 cylinders, displacement 5.9 l, power 150 HP;
-Mass = 6,890 kg;
-Volume of the pesticide tank = 4,000 l;
-Width of herbicide ramps = 27 m;
-Number of nozzle diffusers = 54 pcs.;
-Adjustable ramp height = 800-3,500 mm;
-Hydrostatic transmission with 4 hydromotors (4 x 4 traction);
-Flow rate of the hydraulic pump = 870 l/min.
The pesticide Adengo was used in a dose of 400 ml/ha. For uniform distribution over the entire area, the work was done in compliance with the following technological requirements: constant work speed and constant solution flow. The solution rate applied was 250 l/ha. The working speed was 14 km/h, the working width was 27 m. First, we did the test with water and adjusted the flow of the nozzles and the working pressure according to the flow of the machine (125 l/min). The working pressure of the nozzles was adjusted to the value of 2.4 bar for a flow rate of each nozzle of 2.2 l/min. Diesel consumption was 1.2 l/ha. The costs of the weeding are synthesised in Table 6.

Table 6. Costs of the protection against weeding

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	3
Diesel costs	F_C	7
Amortisation costs	A_C	8
Daily maintenance costs	DM_C	2
Overhead charges costs	OC_C	4
TOTAL COSTS	T_C	24

Source: Own calculation.

Mechanical weed control

Mechanical weed control was done with the aggregate consisting of the Case IH 9056 tractor and the CPU-6 universal weed cultivator equipped with fertilisation equipment. Together with the mechanical grid, 200 kg/ha of nitrolime were incorporated into the soil. The cultivator is equipped with 7 anti-weeding sections between the rows and performs mechanical weeding on 6 intervals between the rows, the sections on the edges rake half an interval. The sections were adjusted on the cultivator frame at 75 cm between the sections.

Table 7. Costs of mechanical anti-weeding + fertilizing

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	18
Diesel costs	F_C	24
Amortisation costs	A_C	4
Daily maintenance costs	DM_C	7
Overhead charges costs	OC_C	11
TOTAL COSTS	T_C	64

Source: Own calculation.

Table 7 shows the costs of mechanical weeding.
For weeding, the tractor was entered on the same tracks as for sowing. The average diesel consumption was 4 l/ha.

Harvesting

Mechanised maize harvesting was carried out in the fall of 2023 with the Case IH 1660 self-propelled grain harvester, to which an Oros 6039 6-row cob picker was mounted instead of the header. Harvesting is of particular importance because it requires a large amount of work. Grain harvesting can begin when grain moisture drops below 30%. If there are no storage possibilities in the silo, where the maize can dry, then it is recommended to harvest when the humidity of the grains drops below 16%. Delayed harvest leads to crop losses and delayed tillage for crops that are sown in the fall after maize. In order to fit the optimal harvesting period, it is necessary to cultivate different varieties with different ripening times and to have high-performance mechanical equipment.

The average production obtained from the area cultivated with maize was 8 t/ha, the productivity was 2.5 ha/hour, and the average consumption of diesel was 20 l/ha.

Table 8. Costs of harvesting

Costs per ha	Symbol	Value	
		RON/ha	RON/t
Wages costs	W_C	16	2
Diesel costs	F_C	120	15
Amortisation costs	A_C	16	2
Daily maintenance costs	DM_C	8	1
Overhead charges costs	OC_C	32	4
TOTAL COSTS	T_C	192	24

Source: Own calculation.

Simultaneously with the harvesting, the maize cobs were also chopped and the harvest was transported. The costs per ha and per ton of harvesting are synthesised in Table 8.

Table 9 presents the costs of the transport.

Table 9. Costs of transport

Costs per ha	Symbol	Value RON/ha
Wages costs	W_C	8
Diesel costs	F_C	48
Amortisation costs	A_C	9
Daily maintenance costs	DM_C	7
Overhead charges costs	OC_C	14
TOTAL COSTS	T_C	86

Source: Own calculation.

Table 10 presents the costs per ha of the materials invested in maize.

Table 10. Costs of materials used in maize

Material	Amount	Value RON/ha
Pioneer 9903 seeds	68,000 seeds/ ha	684
Complex fertilisers (16:16:16)	250 kg/ha	320
Nitrolime	200 kg/ha	216
Herbicides	-	64
Overhead charges costs	-	256
TOTAL COSTS	-	1,540

Source: Own calculation.

Costs of mechanized works

Maize cultivation on 35 ha in the Gurasada area was completely mechanised. The values of the mechanised works performed (fertilising, ploughing, soil preparation, sowing, weeding, mechanical weeding, harvesting, and transport) are synthesized in Table 11.

Table 11. Costs of mechanised works in maize

Work	Costs					
	Wages	Diesel	Depreciation	Daily maintenance	Overhead charges	Total
Fertilisation	4	12	5	4	5	30
Ploughing	26	144	12	8	38	228
Discking	15	60	12	13	20	120
Harrowing	16	48	8	8	16	96
Sowing	18	30	7	5	12	72
Weeding	3	7	8	2	4	24
Mechanic weeding	18	24	4	7	11	64
Harvesting	16	120	16	8	32	192
Transport	8	48	9	7	14	86
TOTAL	124	493	81	62	152	912

Source: Own calculation.

Economic efficiency in using this mechanized technology in maize cropping

Grain maize is a profitable crop in the Gurasada area.

The costs per ha were 2,452 RON, of which inputs (materials used) represented 1,540 RON/ha (63%), and costs with mechanised works 912 RON/ha (37%).

At an average production of 8,000 kg/ha, it results a direct cost of 0.31 RON per kg.

The lowest purchase price of maize kernels, from the production of 2023, was 0.40 RON per kg, i.e., 400 RON/t, i.e., a price of 3,200 RON/ha. It follows that the minimum profit was 748 RON/ha cultivated with maize, i.e., and the profit rate is 30.50% (748/2,452 x 100) (Table 12).

Table 12. Economic efficiency in maize cultivation using the present mechanized technology

	MU	Value	%
Maize yield	Kg kernels/ha	8,000	
Production costs:	RON//ha	2,452	100.0
- Materials	RON//ha	1,540	62.80
-Mechanized works	RON//ha	912	37.20
Production cost	RON/kg	0.31	
Calculation at the minimum acquisition price of maize kernels in Hunedoara county in 2023			
Minimum acquisition price	RON/kg	0.40	
Minimum Income	RON/kg	0.09	
Minimum Income per ha	RON/ha	3,200	
Minimum profit	RON/ha	+748	
Minimum profit rate	%	30.50	
Calculation at the average acquisition price of maize grains in Hunedoara county in 2023			
Production	Kg grains/ha	6,000	
Average acquisition price	RON/kg	0.70	
Income	RON/ha	4,200	
Profit	RON/ha	1,748	
Profit rate	%	71.28	

Source: Own calculation.

Taking into consideration maize yield in kg grains, that is 6,000 kg/ha, and the average acquisition price of maize grains in Hunedoara county is RON 0.70/kg, the farmers could obtain 4,200 RON profit per ha and a profit rate of 71.28% (Table 12).

Of course, the actual profit can be higher if the maize is harvested at low humidity, stored in silos, and marketed later at a better price.

CONCLUSIONS

The studies presented in this work were carried out in the maize, on the territory of Gurasada commune, Hunedoara County, Romania. Following the experience accumulated in recent years in the culture of gain maize, and considering the soil and climate conditions of the studied area, and the productions obtained in recent years, the following conclusions and recommendations can be made.

The mechanised works worth 912 RON/ha have the following share of costs: 493 RON the diesel (54%), 124 RON the wages (14%), 81 RON the depreciation (9%), 63 RON the daily maintenance (7%), the difference of 16% (152 RON) representing the overhead charges. These mechanised work costs can be reduced if diesel fuel is subsidized. The diesel engines on the tractors and self-propelled machines we have worked with are supercharged engines with low diesel consumption. Good yields per ha in grain maize in the conditions of Gurasada can be obtained if:

-Optimal fertilisation with nitrogen, phosphorus, and potassium is ensured;

-Mechanical works are carried out in the optimal period, on time, and qualitatively;

-Sowing is carried out in the optimal season;

-Soil setting is avoided by repeated passes with agricultural aggregates;

-Soil is kept loose through germinal bed preparation and weeding. In order to obtain profit in maize cultivation, it is recommended to use drought-resistant hybrids with high production potential.

From an economic point of view, this mechanized technology is profitable assuring a minimum profit of 748 RON/ha if maize is marketed at 400 RON/ton maize kernels or a profit of 1,748 RON/ha if the maize grains are commercialized at the average acquisition price of 700 RON per ton.

REFERENCES

[1]Bacău, C., Mateoc-Sîrb, N., Ciolac, R, Mateoc, T., Teodorescu R.I, Tabără, V., 2021, Study on the production and use of biomass energy in the Timis County, Rom Biotechnol Lett., 26(2):2434-2440.

[2]Brinzan, O., Drăgoi, M., Bociort, D., Țigan, E., Mateoc-Sîrb, N., Lungu, M., 2020, A Market-Based Economic Instrument to Better Use Water in Agriculture, Sustainability, 12(4):1473.

[3]Bucată, I.V., Diaconescu, Ș., Gieraths, J, Weiller, W., 2003, Agricultura ecologică (Organic farming), Alma Mater Publishing House, Bucharest, 28-30.

[4]Chirita, R., Lauer, KF, Sarpe, N, 2004, Control of Johnson grass in maize with new broad-spectrum herbicides in Western Romania, Zeitschrift fur pflanzenkrankheiten und pflanzenschutz, Journal of plant diseases and protection, 19:725-731.

[5]David-Feier, S., Mateoc-Sîrb, N., Mateoc, T., Bacău, C., Duma Copcea, A., Mihuț, C., 2020, Agriculture and sustainable soil use in Timiş county, Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 20(1):207-214.

[6]Deacu, E., 2017, Romania has a high agricultural potential, but it is lacked of productivity (România are potenţial agricol ridicat, dar îi lipseşte productivitatea), Adevarul.ro,
https://adevarul.ro/economie/afaceri/studiu-romania-potential-agricol-ridicat-lipseste-productivitatea,
Accesed on Ian. 25, 2022.

[7]Duma Copcea, A., Mateoc-Sîrb, N., Mihuț, C., Niță, L., Mateoc, T., Niță, S., Sîrbu, C., Ștef, R., Scedei, D., 2021, Management of soil resources in Giarmata, Timiş county, Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 21(1):253-257.

[8]Duma Copcea, A., Mihuț C., Popa D., 2018, Studies regarding minimum soil tillage Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 18(1):153-156.

[9]Gavrilescu, C., Florea, A., David, S., Popescu, A., Mateoc –Sîrb, N., 2016, Agri-food organic products - A fast increasing market, Journal of Biotechnology, 231(S):94.

[10]Goșa, C.I., Mateoc-Sîrb, N., 2014, Agricultural lands bonitation and estimation of crop production in Almajului Valley, Caras-Severin county, Geoconference on Water Resources, Forest, Marine and Ocean Ecosystems, 2:11-14.

[11]Grad, I., Mănescu, C., Mateoc, T., Mateoc-Sîrb,N., 2014, Studies on the agriculture systems practiced in Romania, Scientific Papers Series Management Economic Engineering in Agriculture And Rural Development, 14(1):139-142.

[12]Lato, K. I., Popa, M., Lato, A., Corches, M., Radulov, I., Berbecea, A., Crista, F., 2019, Economic efficiency of main soil types from West region of Romania for various agricultural crops, Journal of Environmental Protection and Ecology, 20(2): 1022–1028.

[13]Lato, K. I., Lato, A., Nita, L., Dumitru,Duma-Copcea, A., Corches, M. T., 2022, Soil- genetic factors involved in soil degradation (the inferior Timis river basine), Scientific Papers Series A, Agronomy, 65: 91-96.

[14]Mateoc-Sîrb, N., Zagoni, A., Mateoc T., Sârb, G.S., Manescu, C., Câmpan, C., Dornea, M., 2013, Increasing the economic efficiency of agricultural farms through the cultivation of energetic plants and production of biofuels, Current Opinion in Biotechnology, 24(S): 139.

[15]Mateoc-Sîrb, N., Mateoc, T., Manescu, C., 2014, Research on the labour force from Romanian agriculture, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 14(1):215-218.

[16]Mihut, C., Duma-Copcea, A., Mihut, A., 2018, Evaluation of the production capacity of agricultural land from the perimetre of the Periam locality, Timis County for its sustainable use. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 1891), 253-256.

[17]Mihuț, C., Ciolac, V., Moatăr, M., Mircov, V., Okros, A., 2019, Contributions to the use of modern technologies to optimize the recording of the agricultural area cultivated in a conventional system on the territory of Târnova commune, Arad County, Romania. International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, 2019. https://doi.org/10.5593/sgem2019/2.2/S11.093.

[18]Mihuț, C., Duma-Copcea, A., Mihuț, A., 2018, The infleuence of the mineral and organic fertilizers on soil reaction in the apple tree plantation of the Timisoara Didactical Station, Scientific Papers Series-Management, Economic Engineering in Agriculture and Rural Development, 18 (1): 253-256.

[19]Mihuț, C., Mateoc-Sîrb, N., Duma Copcea, A., Niță, L., Okros, A., Niță, S., Mateoc-Sîrb, T., Mircov, V., 2022, Assessment of fertilization plans on basic crops. A case study, Scientific Papers: Management, Economic Engineering in Agriculture & Rural Development, Vol, 22(4).

[20]Niță, L., Grozav, A., Rogobete, Gh., 2019, Natural and Anthropic Soil Acidification in the West of Romania, Chemistry Journal, 70(6):2237-2240.

[21]Niță, S., Niță, L.D., Mateoc–Sîrb, N., Duma Copcea, A., Mateoc-Sîrb, T., Mihuț, C., Mocanu, N., 2022, The agro-productive efficiency of some rapeseed hybrids in the pedoclimatic conditions in the Gătaia plain, Timiș county, Romania., Scientific Papers: Management, Economic Engineering in Agriculture & Rural Development, Vol. 22(4).

[22]Popescu, A., 2017, Maize culture- an intensive or an extensive production system in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 17(1):351-356.

[23]Tărău, D., Niţă, L., David, Gh., 2020, Soil Science in the 3rd Millennium (Știința solului în mileniul III), Banat Agriculture Journal (Agricultura Banatului), 4(145):25-38.

[24]Toth, A., Mateoc-Sîrb, N., David, S., Mateoc, T., Mănescu, C., Venig, A., Sârb, Gh, 2016, Organic agriculture: An opportunity for sustainable development of Romanian villages, Journal of Biotechnology, 231(S):83.

[25]Vass, H., Mănescu, C., Murg-Sicoe, O., Mateoc, T., Mateoc-Sîrb, N., 2021, Study on climate change issue and environmental degradation in Romania, Management Agricol, Lucrări Științifice Seria I, 2021, 23(2):89-96.