

## STUDIES REGARDING WORKING TECHNOLOGY FOR CORN CULTIVATION WITHIN THE FARM CARMEN LAND ACTIVITIES S.R.L. FROM INEU CITY, ARAD COUNTY

M.A., DRĂGAN, Casiana, MIHUȚ, S., CILAN, Anișoara, DUMA COPCEA, V., MIRCOV

*University of Agricultural Sciences and Veterinary Medicine "King Mihai I of Romania" from Timisoara, 300645, 119 Calea Aradului, Romania, Phone: +40256277001, Fax: +40256200296  
Corresponding author: anisoaradumacopcea@usvt.ro*

**Abstract.** *The aim of the paper is to optimize the organization of mechanical work in agriculture, addressing several essential aspects for improving production:*

*-Choosing and using the best methods: This includes the identification of agricultural processes and technologies that ensure high yields with minimal expenses. By choosing the right technologies, production efficiency can be maximized and resources consumed can be reduced.*

*-.Succession of works in the cycle of agricultural production: All works and operations must be coordinated in an optimal way to ensure increased efficiency. This means that the stages of production must be chained in such a way as to optimize the use of available equipment and resources.*

*-Impact of modern technologies: The emergence of advanced agricultural machinery allows a significant increase in agricultural production and reduces production costs. The use of these modern machines contributes to a better management of resources, optimizing both the quantity and quality of agricultural production. This holistic approach aims to increase efficiency in agriculture, while reducing costs and resources. One of the fundamental objectives of modern agriculture is the intensive development of agricultural production, with the aim of obtaining high yields per unit of area, but with minimal costs per unit of product. This is an essential condition for increasing sustainability and economic efficiency in agriculture. The experimental studies carried out at the farm Carmen Land Activities S.R.L. from Ineu, Arad county, had as their main objective the optimization of the work technology for corn culture. During the experimental period, several factors influenced crop productivity, including:*

*-Climatic conditions: Variables such as temperature, rainfall and soil moisture have played an essential role in the evolution of maize cultivation.*

*- Sowing time: Choosing the optimal time for sowing was essential for obtaining the highest harvests.*

*-Plant nutrition: Ensuring the necessary elements for good development and rooting of the corn contributed to the health and resistance of the crop.*

*-Crop rotation: It was important to maintain soil fertility and prevent specific diseases or pests.*

*-Quality of mechanical work: The correct and precise execution of mechanical work (plowing, harrowing, cultivating) had a major impact -on the quality and quantity of corn production. A high-performing and productive agriculture requires modern machinery and work techniques well adapted to the specific conditions. These studies demonstrate how important the integration of several technical and natural factors is to ensure successful agriculture based on efficiency and high productivity.*

**Keywords:** *technology, culture, cultivation, agricultural production*

### INTRODUCTION

The mechanization of agricultural work is accompanied by an increase in the consumption of energy and primarily of fuels. In the conditions of the energy crisis, it is of great importance to know the growth rate of consumption and the relationship that exists between the fuel requirement and labor productivity in agriculture. (ANIȘOARA DUMA COPCEA, ET AL, 2024)

This stage is characterized by additional energy investments in the form of fuels, chemical fertilizers and agricultural machinery aimed at increasing the quantities of agricultural products so that the demands of a growing population can be met. (NIȚĂ, L, et al, 2019, NIȚĂ, L, et al, 2024). As a result of the upward evolution of mechanization, an increase in energy consumption for the production and use of agricultural machines is expected worldwide. (CASIANA MIHUȚ, ET AL, 2022)

The increase in energy consumption has a decisive role in increasing labor productivity in agriculture. It is known that 5 kg of fuel (diesel) is equivalent to the mechanical work obtained from the operation of a 1 HP

engine for a period of 33 hours or of a person working for approximately 329 hours. So that a single kilogram of liquid fuel (diesel) is equivalent to the effort of 66 hours of manual work. (D POPA, ET AL, 2023, VLAD DRAGOSLAV MIRCOV, ET AL, 2024)

at the farm Carmen Land Activities S.R.L. from Ineu, Arad county, had as their main objective the optimization of the work technology for corn culture.

During the experimental period, several factors influenced crop productivity, including:

-Climatic conditions: Variables such as temperature, rainfall and soil moisture have played an essential role in the evolution of maize cultivation.

- Sowing season: Choosing the optimal time for sowing was essential for obtaining the highest harvests.

-Plant nutrition: Ensuring the necessary elements for good development and rooting of the corn contributed to the health and resistance of the crop.

-Crop rotation: It was important to maintain soil fertility and prevent specific diseases or pests.

-Quality of mechanical work: The correct and precise execution of mechanical work (plowing, harrowing, cultivating) had a major impact -on the quality and quantity of corn production. A high-performing and productive agriculture requires modern machinery and work techniques well adapted to the specific conditions.

These studies demonstrate how important the integration of several technical and natural factors is to ensure successful agriculture based on efficiency and high productivity. (ADALBERT OKROS, ET AL, 2024, OKROS, A., et al, 2015).

In recent decades, fuel consumption has increased in all countries faster than the increase in agricultural production or population growth. Globally, the population has almost doubled in the last 30 years, while energy consumption has doubled in the last decade. The studies done by researchers in the country over a certain period show that in the case of corn, while the total production increased 5 times, the fuel consumption for this crop increased 12 times. Each newly introduced unit of energy ensures an increasingly reduced increase in agricultural production, the unfolding of the global energy crisis accentuates the deficit and leads to an increase in the price of fuel delivery, a fact that requires that in the next period new effective ways be found to limit the consumption of fuel, one of the solutions being the use of combined aggregates for soil work, implicitly for direct sowing. (CASIANA MIHUȚ ET AL, 2022, CASIANA MIHUȚ ET AL 2024).

Romania is one of the largest corn producers in the European Union. It is a plant that can prove very profitable, if certain requirements related to the cultivation and care of the corn crop are respected. It has about 50% more production capacity than other cereals. Maize also has a wide distribution area, as it is little influenced by climate change. (DAVID, SAIDA FEIER, ET AL, 2020 , NICOLETA MATEOC-SÎRB, ET AL, 2022, NICOLETA MATEOC-SÎRB ET AL, 2024, TEODOR MATEOC ET.AL, 2024). In addition, maize has a high resistance to heavy rains, drought, diseases and pests.

Agricultural and harvesting work in the case of corn cultivation can be fully mechanized. Maize is used both for human consumption and as animal feed. It can also be used to obtain biofuels and cellulose, and some parts of the husk, such as corn silk, can also be used for medicinal purposes. (DUMA COPCEA ANIȘOARA, ET AL, 2023, DURAU CARMEN CLAUDIA, ET AL, 2022). Maize is a plant that also supports monoculture, as long as mineral and organic fertilizers are applied. However, rotation is also recommended, in order not to reduce the content of humus and macroelements in the soil. So, although monoculture is possible over long periods, crop rotation is recommended to achieve optimal production.

Annual grain and fodder legumes, grass cereals, flax, hemp, sunflower, potato, fodder beet and sugar beet are recommended as precursor plants. Wheat-maize rotation is also practiced, but experts recommend that this rotation be interrupted by cultivating another plant. Alfalfa is not recommended as a predecessor plant for corn, especially in dry areas, because alfalfa uses a lot of water and leaves little reserve in the soil for corn. It is also not recommended to grow corn after sorghum or Sudan grass. (S BUNGESCU, ET AL., 2021).

Maize is a good precursor plant for spring crops and for winter wheat if hybrids with a shorter growing season are grown. Maize is grown on soils loosened in depth, shredded on the surface, cleared of weeds and with a large reserve of water. Depending on the preceding plant, weeding, scarification, and plowing are done at depths

of up to 28 cm. Minimum work involves tilling the soil with a disc harrow or loosening the soil with a chisel followed by working with a disc harrow. (ANIȘOARA DUMA COPCEA, ET AL, 2024).

## **MATERIAL AND METHOD**

### **DESIGN OF THE STUDIED WORK PROCESSES**

#### Designing the technological plowing process

Autumn plowing is recommended regardless of whether the cultivated land is intended for spring or autumn sowing. Autumn plowing favors the restoration of the soil structure, the destruction of weeds by bringing them to the surface and subjecting them to the action of frost, but also the accumulation of a larger amount of necessary water. The soil is loosened by plowing, thus creating the optimal ratio between capillary and non-capillary lacunar space. Spring work is much easier by performing this operation in autumn, as early as possible.

The depth of the plowing alternates from one year to another and depending on the crop rotation, and this is a very favorable measure. When carrying out the plowing work, the aggregate from the company's equipment consisting of the Steyr 6240 Absolute CVT tractor and the Maschio Gaspardo Unico plow was used.

The Maschio Gaspardo Unico plow is a 4+1 plow with a very robust frame. It is equipped with Tungsten knives, Tungsten coulter tip, side deflectors and hydraulic cylinder for working width with memory. The ground clearance is 80 cm, the distance between the bodies is 95 cm and its frame is made of a 140 x 140 x 10 mm beam.

The power required for this plow is 180-260 HP.

#### Designing the technological process to administer solid fertilizers

Every farmer knows that fertilization is not done during periods of vegetative rest, because in this case the fertilizers would be consumed unnecessarily. The first fertilization of a new agricultural season is done in the spring as early as possible, together with the soil preparation work for the new crops. Seeds need nutrients to germinate, and once sprouted, plants consume important resources during the growth period. That's why spring fertilization is very important, following that during the summer the amount of fertilizer should be reduced, and the administration should be done only if absolutely necessary.

You must know that nitrogen, phosphorus and potassium - the three nutrients that make up complex fertilizers - act interdependently, and if one of them is present in an insufficient amount, the effects of the other two will also be affected.

In the farm, the fertilizers were applied directly to the artura on an area of 400 hectares. I applied a dose of 220 kg/ha of NPK-15-15-15 on an area of 150 hectares. And on the rest of the surface, namely 250 ha, I administered 120 kg/ha of NPK because the preceding crop was alfalfa, which is a plant that fixes nitrogen in the soil

The sowing work was carried out with the aggregate consisting of the Steyr 6240 CVT tractor and the Mirka seeder for grass plants from Maschio Gaspardo.

## **RESULTS AND DISCUSSION**

The plowing work was carried out with the aggregate consisting of the Steyr 6240 ABSOLUTE CVT tractor (figure 1) and the Maschio Gaspardo Unico plow (figure 2).



Figure 1 The Steyr 6240 ABSOLUTE CVT tractor



Figure 2 The Maschio Gaspardo Unico L4+1 plow

To carry out the plowing work, the plowing unit consisting of the Steyr tractor + the Maschio Gaspardo Unico L plow worked at a speed between 8-10 km/h, with a productivity of up to 1-1.4 ha/h, respectively 10-12ha/shift. The average fuel consumed was /ha. In table 1, we have presented the data obtained from the calculation of the economic indices.

Table 1

Technological sheet for the mechanization of plowing works (expenses per hectare for plowing)

NoCrt	Economic indices	Symbol	Lei/ha
1	Direct expenses	CD	150,0
	Of which:	Cs	20,0
	-retributions	CC	195,0
	-combustible	CA	15,0
	- amortization	CDT	10,0
	- technical service		
2	Ancillary expenses	CAX	35,0
3	Total	CT	275,0

On the surface of 400 ha, the fertilizers were applied directly on the branches. On an area of 150 hectares, the dose of 220 kg/ha of NPK-15-15-15, and on the surface of 250 ha we administered 120 kg/ha of NPK, because on this surface the preceding crop was alfalfa which indicates that there is nitrogen in the soil.

Figure 3 shows the Maschio Gaspardo Zeno 32 fertilizer spreader, which has a capacity of 3500 kg and a working width of up to 36 meters.

Shown in Figure 3 and Figure 4 is the Steyr 6240 CVT Tractor with the Maschio Gaspardo Zeno 32 Fertilizer Spreader attached.



Figure 3. Maschio Gaspardo Zeno 32 fertilizer spreader



Figure 4. Steyr 6240 CVT tractor

Table 2

The technological sheet for the mechanization of fertilizer administration works

NoCrt	Economic indices	Symbol	Lei/ha
1	Direct expenses	CD	50,0
	Of which:	CS	20,0
	-retributions	CC	195,0
	-combustible	CA	15,0
	- amortization	CDT	10,0
	- technical service		
2	Ancillary expenses	CAX	20,0
3	<b>Total</b>	<b>CT</b>	<b>60,0</b>

The sowing work was carried out with the aggregate consisting of the Steyr 6240 CVT tractor and the Mirka seeder for grass plants from Maschio Gaspardo. (figure 5)



The Mirka 8R seed drill is intended for the precision sowing of corn, sunflower, soybean, sugar beet, etc. seeds. It works in aggregate with tractors of over 220 HP, requiring a compact and solid tractor with an appropriate ballast due to the fact that it is carried and carries out the sowing on a number of 8 rows at a distance of 70 cm between the rows. The Mirka seeder with fertilizing equipment has as main features.

Table 3

Technological sheet for the mechanization of corn sowing work (expenses per sown hectare)

NoCrt	Economic indices	Symbol	Lei/ha
1	Direct expenses	CD	<b>60,0</b>
	Of which:	Cs	20,0
	-retributions	Cc	195,0
	-combustible	CA	15,0
	- amortization	CDT	10,0
	- technical service		
2	Ancillary expenses	CAX	<b>18,0</b>
3	<b>Total</b>	<b>CT</b>	<b>85,0</b>

The sowing work was carried out at a speed of 11 km/h. The aggregate productivity was 6ha/h with a fuel consumption of 4 liters/ha representing an hourly consumption of 24 liters/ha. The sowing rate was 70,000 plants/ha, at a distance of 70 cm between rows, resulting in a distance of 19.3 cm between plants. The sowing work is permanently monitored from the tractor cabin through the Seeder Monitor MCE12000 monitor which indicates the distance between the slopes, the number of grains per hectare for each row in part of the 8, with the help of photocell type sensors and the speed of travel.

## CONCLUSIONS

Following this experimental activity, the following conclusions and recommendations can be drawn:

- The factors that influenced the production of corn during the experimental period were primarily the climatic conditions, the time of sowing but also ensuring the nutrition of the plant with the elements it needs for good rooting, good development, crop rotation, but let's not forget of the quality obtained through mechanical works which is very important for a performing and productive agriculture;
- The mechanical works carried out in the optimal period year after year have a major influence on the production, because the well loosened ground, without lumps, ensures a uniform and well-developed emergence of the plant. In order to ensure the necessary work at the optimal time, which from the experience of the last years has been shorter and shorter, we have come to the conclusion that we need modern technique, more efficient, more productive and more reliable machines;
- For a good development of the plant, a suitable fertilization is also necessary, in the present case it was applied on the ploughing, following that after emergence we should apply another fertilization;
- The choice of the corn hybrid is a decisive factor, we could say in some cases, because depending on the studied area, the sowing season, we must check and study their zoning according to the existing soil type, as well as the temperature in the soil from which a certain hybrid can be sown, because there is a great diversity of corn hybrids that can be sown if the temperature in the soil is 5° C;
- The studied area being a plain with moderate temperatures during the summer, I opted for Pioneer genetics, because I was satisfied with this genetics having the expected results;
- The machines used during the experimental period are relatively new, less than 3 years old, that's why we had no problems during the works, no interruptions or dead times during the work period;
- A good operation, an increased reliability of the machines consists largely of the way of working with them, the maintenance performed and the oil changes done on time and properly;
- For the preparation of the work equipment, an hour is needed before going to the field in order to be able to properly clean the equipment and to grease it. This is how we manage to have a good operation without interruptions of the aggregate;
- It is recommended to continue the studies regarding the optimization of corn culture technology both with "minimum tillage" type works and with classical works, in order to study the technology both economically and from the point of view of the required amount of work, creating a middle way, a balance for profitable and sustainable agriculture;
- It is recommended to continue the research on corn cultivation technology, for a better depth, and to verify these calculations for several years in a row, adding the value of the necessary materials (seed, herbicides, chemical fertilizers and foliar fertilizers) to them, as well as the expenses for mechanical maintenance, harvesting and transport, in order to have a much more detailed and concrete situation from an economic point of view on the profitability of the corn crop.

## BIBLIOGRAPHY

BUNGESCU S, I CABA, COPCEA A DUMA, D POPA, R SALANKI, C GIURGIU, C MELNECIUC, P VALER, 2021, In-depth experimental research regarding the verification of spraying machines in large culture farms in the western area of Romania, International Symposium, ISB-INMA TEH', Agricultural and Mechanical Engineering, Bucharest, Romania, 29 October 2021.

DAVID, SAIDA FEIER, MATEOC-SIRB, NICOLETA., MATEOC, T., BACĂU, CRISTINA, ANISOARA DUMA COPCEA, MIHUT, CASIANA, 2020 - Agriculture and sustainable soil use in Timiș county, Romania, scientific papers series management, economic engineering in agriculture and rural development vol. 20, issue 1, 2020 PRINT ISSN 2284-7995, E-ISSN 2285-3952.

DUMA COPCEA ANIȘOARA, CASIANA MIHUȚ, NICOLETA MATEOC-SÎRB, LUCIAN NIȚĂ, ADALBERT OKROS, IAROSLAV LAȚO, TEODOR MATEOC, DANIEL POPA, 2023 - Studies on minimum wheat tilling, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 23, Issue 2, 2023 PRINT ISSN 2284-7995, E-ISSN 2285-3952.



DUMA COPCEA ANIȘOARA, NICOLETA MATEOC SÎRB, CASIANA MIHUȚ, 2024, Importance of economic efficiency in choosing fertiliser aggregates, Scientific Papers Series Management, Economic Engineering in Agriculture & Rural Development . 2024, Vol. 24 Issue 1, p345-352. 8p.

DURAU CARMEN CLAUDIA, CASIANA DOINA MIHUȚ, ANISOARA CLAUDIA DUMA-COPCEA, ADALBERT OKROS, VLAD DRAGOSLAV MIRCOV, 2022 - Appreciation on biodiversity in several permanent grasslands in Timis county, Romania. A case study, Conference: 22nd SGEM International Multidisciplinary Scientific GeoConference 2022, DOI: 10.5593/sgem2022V/6.2/s25.10.

MATEOC TEODOR, IOANA ANDA MILIN, RAMONA CIOLAC, CAMELIA MĂNESCU, CASIANA MIHUȚ, NICOLETA MATEOC-SÎRB, 2024, Study regarding the interest of Romanian consumers for organic agriculture, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 24, Issue 2, 2024 PRINT ISSN 2284-7995, E-ISSN 2285-3952.

MATEOC-SÎRB NICOLETA, PAULA DIANA OTIMAN, ADELINA VENIG, SAIDA FEIER DAVID, CAMELIA MĂNESCU, ANIȘOARA DUMA COPCEA, TEODOR MATEOC, 2024, Analysis of the dynamics of organic agriculture in the European Union with an emphasis on Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 24, Issue 2, 2024 PRINT ISSN 2284-7995, E-ISSN 2285-3952.

MATEOC-SÎRB<sup>1</sup>NICOLETA<sup>2</sup>, CRISTINA-VIORICA BACĂU<sup>1</sup>, ANIȘOARA DUMA COPCEA<sup>1</sup>, TEODOR MATEOC-SÎRB<sup>1</sup>, CAMELIA MĂNESCU<sup>1</sup>, SIMONA NIȚĂ<sup>1</sup>, OANA SICOE-MURG<sup>1</sup>, GABRIEL SUSTER, 2022, Agricultural trends in romania in the context of the current trends of the world economy, Journal of Applied Life Sciences and Environment <https://jurnalalse.com>, <https://doi.org/10.46909/alse-552068> Vol. 55, Issue 3 (191) / 2022: 335-350.

MIHUȚ CASIANA, ANIȘOARA DUMA COPCEA, ADALBERT OKROS, VLAD MIRCOV, 2024, The impact of climate changes on agricultural lands in the Sânnicolau mare area, Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 24, Issue 1, 2024 PRINT ISSN 2284-7995, E-ISSN 2285-3952.

MIHUȚ CASIANA, VALERIA CIOLAC, ANIȘOARA DUMA COPCEA, ADALBERT OKROS, DANIELA SCEDEI, 2022, Analysis of the influence of pedogenesis factors on soil formation using modern methods, International Multidisciplinary Scientific GeoConference: SGEM; Sofia, Vol. 22, Iss. 3.1, (2022). DOI:10.5593/sgem2022/3.1/s13.27.

MIHUȚ;CASIANA DOINA ANIȘOARA CLAUDIA DUMA - COPCEA; ADALBERT OKROS; CARMEN CLAUDIA DURAU; ANTOANELA LENA COZMA, 2022, Conservative tillage soil systems in context of the climate changes. Proceedings of 22nd International Multidisciplinary Scientific GeoConference SGEM 2022. DOI: 10.5593/sgem2022V/4.2/s19.28. Issue 10.5593/sgem2022V/4.2 ISSN 1314-2704; ISBN 978-619-7603-50-7 Volume 22 Issue 4.2.

MIRCOV VLAD DRAGOSLAV, CASIANA MIHUȚ, ANTOANELA COZMA, 2024, Climate changes and its effects on soils and agriculture in western and south-western Romania, Scientific Papers. Series B, Horticulture. Vol. LXVIII, No. 1, 2024 Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653.

NIȚĂ, L., GROZAV, A., ROGOBETE, GH., Natural and Anthropic Soil Acidification in the West of Romania, Chemistry Journal, 70(6):2237-2240, pp. 64-68, 2019.

NITA, LD; NITA, S; IMBREA, F; LATO, KI; COPCEA, AD; HÎNDA, IA; BATRÎNA, SL, 2024, Physico-geographical conditions defining the quality and quantity of resources in almajuluivalleyarea, Caras-Severin county, Scientific Papers-Series A-Agronomy, Volume 68, Issue 1, Page 157-163.

OKROS ADALBERT \*, CASIANA MIHUȚ\*, ALEXANDRU RINOVETZ\*\*, 2024, Economic efficiency of sunflower production depending on technology, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 24, Issue 2, 2024 PRINT ISSN 2284-7995, E-ISSN 2285-3952.

OKROS, A., Fertility status of soils in western part of Romania Journal of Biotechnology, Volume 208(S63): 3-14, pp. 80-84, 2015.

POPA D, A-K HEITZ, M HEITZ, 2023, Influence of different fertilization programs on dry seeds production of common bean, IX South-Eastern Europe Symposium on Vegetables and Potatoes 1391, p. 437-442.