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Modern cultivation technologies in improvement of corn quality

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Abstract. Research on the development of sustainable and productive methods of corn cultivation is becoming relevant due to the growing demand for food resources and the need to optimise agrotechnical processes. The study aims to conduct a comparative analysis of maize cultivation under different tillage methods. A field experiment was conducted to achieve this goal, phenological observations of corn plant development was made, and grain quality was studied. The results of the maize yield analysis show that ploughing to a depth of 30 cm produces the highest maize yield of 91.6 c/ha while disking to a depth of 15 cm results in the lowest yield of 80.6 c/ha. The study proved that the method of tillage affects grain quality indicators, in particular, the content of crude fibre, starch, protein and crude fat. Thus, when ploughing to a depth of 30 cm, the starch content in the grain was 70.9%, crude fibre – 2.12%, protein – 10.2%, and crude fat – 4.225%. The correlation and regression analysis showed that the coefficient of determination (R^2) for tillage is about 0.9, which means that the model accurately describes the available data, and for grain quality indicators, R^2 is in the range of 0.66-0.99, which also indicates a strong relationship between the factors under study. The practical significance of the research results is that they can serve as a basis for optimising the agronomic processes of maize cultivation to increase yields and improve grain quality

Keywords: productivity; chemical composition of grain; ploughing; morphological and biometric parameters; agrotechnical solutions; agriculture

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INTRODUCTION

Modern agriculture is constantly evolving, relying on advanced technologies to achieve high productivity and crop quality. One of the key crops that is important for food and feed production is corn. The growing demand for this crop puts great pressure on agricultural systems, requiring improved tillage practices to maximise the quality and quantity of maize produced (Korchak *et al*., 2023).

V. Dumych *et al*. (2023) note that one of the key challenges for farmers is the need to ensure a high-quality crop to meet the needs of the population. Modern tillage technologies can optimise sowing, irrigation and crop care, reducing resource consumption and increasing production efficiency. The competitiveness of Ukrainian agricultural production is closely linked to the introduction of innovative approaches and the use of advanced technologies. According to Yu.V. Mashchenko & I.M. Sokolovska (2023), precision agriculture provides an opportunity to individualise approaches to soil cultivation, considering its properties and the needs of a particular site. Modern monitoring and automation systems allow farmers to obtain accurate data on soil and plant conditions, assisting in informed decision-making to improve crop yields and quality.

V.M. Kabanets *et al*. (2023) and T. Marchenko *et al*. (2023) also emphasise that alternative tillage systems, such as no-till or minimum tillage, can sometimes contribute to higher yields than conventional methods, such as mouldboard tillage, depending on the soil type. The authors' research also indicates the impact of different tillage systems on maize grain quality, including size and nutrient content. At the same time, environmental aspects are becoming increasingly important in the agricultural sector. Modern technologies can reduce the environmental impact of agricultural processes, preserving natural resources and reducing the risk of soil and water pollution. In this context, P.V. Lykhovyd and V.O. Sharii (2023) emphasise the complexity and contextuality of issues related to maize cultivation. Therefore, it is essential to address the specifics of the terrain and specific agronomic factors when choosing the optimal tillage system to achieve the best results.

I.M. Masik *et al*. (2021) note that improving tillage technologies in the agricultural sector is an important area for achieving not only economic stability but also sustainable development, ensuring food security and addressing environmental sustainability. In this context, the use of modern tillage technologies to improve the quality of corn appears to be a necessary element of the strategy for sustainable development of the agricultural sector and meeting the needs of modern society. Despite the numerous scientific research available, the study of modern tillage technologies for maize cultivation is an important area of research, as there are aspects that remain unexplored and require further clarification. These include the specific properties of different soil types, the effectiveness of technologies in extreme weather conditions, the environmental impact of technologies and their impact on food quality and safety. A detailed study of these aspects is key to developing more comprehensive and sustainable approaches to maize production. Such a comprehensive approach will contribute to the sustainable development of the agricultural sector and ensure food security in the face of current challenges.

Thus, insufficient consideration of tillage and maize cultivation technologies can cause significant problems in agriculture. This includes negative impacts on the ecosystem, possible crop losses and product contamination, inefficient use of resources, environmental pollution by chemicals and lack of innovation. Solving these problems requires in-depth scientific and technological research, as well as the implementation of effective approaches to agricultural production. Therefore, in the modern agricultural sector, research aimed at improving soil cultivation technologies that contribute to the efficiency of growing high-quality corn grain is becoming increasingly important.

The study aimed to conduct a comparative analysis of corn cultivation under different tillage methods in the western forest-steppe of Ukraine. The following objectives were set: to determine how the selected tillage methods affect corn yields and to assess the impact of different tillage methods on grain quality indicators: crude fibre, starch, protein and crude fat content.

MATERIALS AND METHODS

To determine the productivity and quality of maize grain during 2021-2023, a field experiment was conducted with phenological, laboratory and field observations of the growth and development of plants grown under different soil cultivation conditions in the western Forest-Steppe of Ukraine. The study was conducted on sod-podzolic light loamy soil. The amount of humus in this type of soil varies from 1% to 1.4%, the humus is of fulvate type. The reaction of the soil solution is acidic: the pH of KCl ranges from 4.6 to 6.1, and the hydrolytic acidity is 1.7-2.9 mg-eq/100 g of soil. Nutrient reserves are very low: nitrogen content ranges from 0.06% to 0.09%, phosphorus from 0.05% to 0.09%, and potassium from 1% to 1.5%. There are also low levels of trace elements.

Plots of different tillage systems were laid out for the experiment: variant 1 – ploughing to a depth of 30 cm, variant 2 – chisel tillage to a depth of 45 cm, and variant 3 – disking to a depth of 15 cm. The experiment was replicated three times, with a total plot size

of 350 m^2 and an area of 100 m^2 per plot. The maize predecessor in the experiment was soybeans. Corn was sown when the top (0-10 cm) soil layer was warmed up to a temperature of 10-12 degrees Celsius. The optimum seeding depth was 6-8 cm, plant density was 60 thousand/ha, seeding rate was 20-25 kg/ha, and row spacing was 70 cm. In the experiments, the seed material of the mid-early maize hybrid Phenomenon (FAO 220) by Syngenta was sown. It is important to note that mineral fertiliser, diammonium phosphate $(NH_4)_2$ HPO_4, was also applied at a rate of 140 kg/ha for the main tillage.

Maize growth parameters, such as plant height, cob height and number of leaves, were determined directly in the field during periodic phenological observations. The length of the cob and the weight of 1000 kernels were obtained directly at harvest by measuring and weighing. Grain quality indicators, including crude fibre, starch, protein and crude fat content, were determined by refractometric method using an Atago PAL-3 refractometer (Japan). Corn yields were calculated manually, from each plot separately. Accurate measurements and records were made following all necessary protocols and methodologies to ensure data reliability (Order of the Ministry of Agrarian Policy of Ukraine No. 250, 2003; Determining the quality..., 2023).

Furthermore, during the data analysis, a correlation and regression analysis of the impact of tillage on the yield and quality of maize grain was conducted. The results obtained were processed to determine their reliability using the multivariate analysis of variance MANOVA method. For this purpose, Microsoft Excel software and Statistica 10 software packages were used. Differences between the results obtained were determined at the significance level of $P \leqslant 0.05$ using the Student's t-test. The authors adhered to the standards of the Convention on Biological Diversity (1992) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1979).

RESULTS

The morphological and biometric parameters of maize plants, such as plant height, cob height, number of leaves, number of cobs per 100 plants and cob length, play an important role in determining the physiological structure and size of plants. These parameters are key to assessing the growth and productivity of the maize crop. The use of modern tillage technologies can have a significant impact on these parameters. For example, the optimal tillage method can provide better accessibility of nutrients, water and air to plants, which contributes to their more active growth and development. According to the results obtained, the assessment of morphological and biometric parameters indicates that ploughing to a depth of 30 cm leads to the highest values of most parameters. In particular, the height of plants under this treatment was 281 cm, which is 8 cm and 18 cm, respectively, more than in the variants of chisel tillage and disking.

An important indicator of maize development is the number of leaves, as it determines the plant's ability to photosynthesise and the efficiency of using light energy potential. The more leaves a plant has, the more surface area it has for photosynthesis, which increases the synthesis of organic matter and energy storage. Modern tillage practices can influence the number of leaves by improving soil structure, ensuring plant access to nutrients and optimising growth conditions. Ensuring optimal leaf growth in terms of quantity and quality is important to maximise photosynthesis and thus ensure high quality and yield of maize. In addition, the number of leaves can serve as an indicator of the overall health of the plant and its adaptation to the environment. Appropriate use of modern tillage practices ensures favourable conditions for maize growth and can influence its physiological state, including leaf quantity and quality.

In the study, the largest number of leaves (15.4) was formed by ploughing to a depth of 30 cm, while the number of leaves was also at the optimum level and amounted to 14.7 when chisel tillage was performed to a depth of 45 cm. It is worth noting that in areas with lower rainfall, deeper cultivation can help to preserve moisture and reduce the risk of plant desiccation. In wet areas, where water resistance may be a problem, shallower tillage may be advisable.

The number of cobs and their quality are key factors for maize yield and quality. Typically, a higher number of cobs per plant results in a higher total grain yield. However, it is important to keep in mind that to achieve maximum yields, sufficient nutrition and optimal conditions for each cob should be provided. Increasing the number of ears per plant can be considered one of the strategies to reduce the impact of stressful conditions such as drought or other abnormal weather conditions. The optimal number of cobs per plant can contribute to a more even distribution of nutrients. This can lead to an increase in cob size, weight and grain. The number of cobs can also affect grain quality, shape, colour, structure and chemical composition. However, it is important to maintain a balance between quantity and quality, as excessive cob density can also result in smaller cob size and grain. Taking these aspects into account, optimal management of the number of ears can help to achieve the desired balance between yield and grain quality of maize. Careful monitoring and maintenance of optimal growth conditions are key to achieving maximum effect.

According to the data obtained, the largest number of heads of cabbage per 100 plants was formed by ploughing to a depth of 30 cm and chisel tillage to a depth of 45 cm and was 106 and 104 pcs, respectively. The length of the head of cabbage was also the largest for ploughing and was 24 cm (Table 1).

Table 1. *Morphological and biometric parameters of maize plants (average for 2021-2023)*

Soil cultivation method	Plant height, cm	Header mounting height, cm	Number of leaves, pcs.	Number of heads of cabbage per 100 plants, pcs.	Head length, cm
Ploughing to a depth of 30 cm	281	96.4	15.4	106	24
Chisel tillage to a depth of 45 cm	273	95.9	14.7	104	23.6
Disking the soil to a depth of 15 cm	262	93.7	13.6	103	23.2

Source: *compiled by the authors*

Thus, the results obtained indicate that the choice of tillage method has an important impact on the development and characteristics of maize. Ploughing to a depth of 30 cm was the most effective among the methods considered. Grain productivity indicators, such as grain yield, grain weight and weight per 1000 grains, determine the efficiency of maize cultivation and grain quality. Grain yield indicates the proportion of useful product in the total weight of the ear, while grain weight per ear and weight per 1000 kernels are determined by genetic and agronomic factors. Evaluation of grain productivity indicators indicates that ploughing to a depth of 30 cm shows the highest grain yield (83.7%) and the highest grain weight per ear (82 g). This method of cultivation is also marked by the highest weight of 1000 grains – 290 g. Compared to ploughing to a depth of 30 cm, disking the soil to a depth of 15 cm showed lower grain productivity. The grain yield was 82.8%, the weight of grain per ear was 78 g, and the weight of 1000 grains was 94 g (Table 2).

Table 2. *Corn grain productivity indicators (average for 2021-2023)*

Soil cultivation method	Grain yield, %.	Grain weight, g		Weight of 1000 grains, g
		From one cob	From one plant	
Ploughing to a depth of 30 cm	83.7	82	113	290
Chisel tillage to a depth of 45 cm	83	79	100	285
Disking the soil to a depth of 15 cm	82.8	78	94	273

Source: *compiled by the authors*

Given the results of the analysis of corn yields over three years, it can be determined that ploughing to a depth of 30 cm is the most productive technology, which provides 91.6 c/ha of yield. This method was used to achieve stable and high crop yields. The least efficient in this case was disking the soil to a depth of 15 cm, with this method of cultivating the soil yielding 80.6 c/ha and some instability of results compared to other tillage methods. Thus, the choice of the optimal tillage method is important for successful maize cultivation (Table 3).

Table 3. *Corn yield, tonnes per hectare*

Soil cultivation method	Year			Average for 2021-2023
	2021	2022	2023	
Ploughing to a depth of 30 cm	91.9	91.3	91.5	91.6
Chisel tillage to a depth of 45 cm	89.1	89.2	89.3	89.2
Disking the soil to a depth of 15 cm	80.5	80.4	80.9	80.6
$HIP_{0.05}$	2.25	1.98	2.19	2.06

Source: *compiled by the authors*

Modern soil cultivation technologies can significantly improve corn production and grain quality. An important indicator of corn grain quality is starch content, especially in the context of its use in fuel processing. Over the years, research has shown that the starch content in grain averaged 64.3-70.9%. The maximum starch content in the grain (70.9%) was recorded when ploughing to a depth of 30 cm. In the context of the main tillage methods, chiselling to a depth of 45 cm and especially disking to a depth of 15 cm indicate a decrease in protein and crude fat content compared to ploughing. At the same time, the impact of these methods on

the fibre content of grain was not detected (Table 4). Thus, modern tillage methods, in particular ploughing, can affect the quality of maize grain by ensuring the optimal content of starch and other chemical components. According to the results of the study, ploughing to a depth of 30 cm demonstrates the highest values among the tillage methods considered for all parameters under consideration - crude fibre, starch, protein and crude fat content. Such indicators characterise the high quality and nutritional value of the crop, which can be an important factor for feed producers, the food industry and other industries that use corn in their operations.

Table 4. *Chemical composition of corn grain depending on the method of soil cultivation, % (average for 2022-2023)*

Soil cultivation method	Content in grain, %.			
	Raw fibre	Starch	Protein	Raw fat
Ploughing to a depth of 30 cm	2.12	70.9	10.2	4.22
Chisel tillage to a depth of 45 cm	2.1	69	9.8	4.18
Disking the soil to a depth of 15 cm	2.09	64.3	9.3	3.53

Source: *compiled by the authors*

Thus, the method of soil cultivation affects the morphological and biometric parameters, grain productivity and yield of maize. This emphasises the importance of choosing the optimal method to achieve the desired results in the cultivation of this crop. However, to verify the reliability of the results obtained, a correlation and regression analysis was conducted. This highly effective statistical method is used to identify relationships between different variables. In this study, correlation and regression analysis were used to determine the relationship between the tillage method and yield, as well as between the tillage method and grain quality of corn. This analytical approach allows us to find out how significantly the selected tillage methods affect the yield and quality of the crop. According to the correlation and regression analysis, the reliability value for 2021 was R=0.9206, for 2022 – R=0.8881, and 2023 – R=0.8976, which means that the model accurately describes the available data. For the grain quality indicators, the coefficient of determination (R^2) is in the range of 0.66-0.99, which also indicates a strong relationship between the factors (Fig. 1).

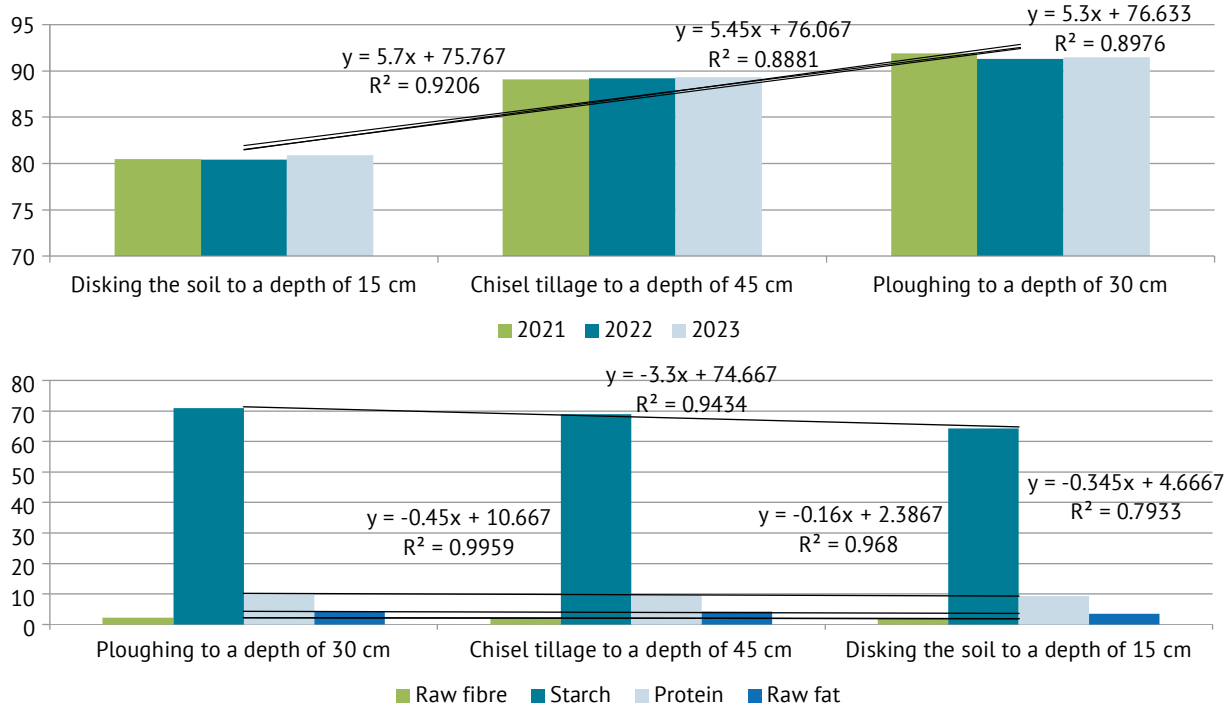

Figure 1. *Correlation and regression analysis of the influence of the tillage method on corn yield and quality (average for 2021-2023)*

Source: *compiled by the authors*

The results of the study of maize cultivation and the impact of tillage methods point to important aspects of agricultural practice. Ploughing to a depth of 30 cm stands out as the optimal method for ensuring high yields and grain quality. Not only does this approach contribute to higher grain yields, but it also improves the chemical composition of the grain, particularly the high starch content, which is key in the context of fuel production. On the other hand, chiselling and disking were less effective, resulting in less grain and lower quality in terms of chemical composition. Such a thorough analysis of tillage practices in terms of grain productivity and quality provides agronomists and farmers with a basis for making informed choices about the best maize cultivation practices depending on specific conditions and production goals.

Summarising the data presented, it is important to note that maize cultivation is a complex process that requires attention to various aspects, including soil tillage. Based on the data presented, 30 cm ploughing can be recommended as the optimal tillage method for achieving maximum yield and grain quality of maize in the western forest-steppe of Ukraine.

DISCUSSION

Ukrainian agriculture plays a key role in the production of plant-based food products. Thanks to favourable climatic conditions, vast land area and long-standing agricultural traditions, Ukraine is actively developing the cultivation of various crops, including corn, which is growing steadily. However, agricultural production faces serious challenges, including climate change, efficiency and environmental friendliness, which must be addressed to ensure the sustainable development of plant-based food production in Ukraine. Current trends in the cultivation of plant-based food products in Ukraine demonstrate the need to integrate the latest technologies, comply with environmental standards and adapt to global challenges. Important aspects include ensuring product quality, efficient use of resources and creating a sustainable agricultural sector that meets the requirements of modern consumers and considers environmental aspects.

Due to the rapid development of modern tillage technologies, especially in the agricultural sector, the choice of the optimal method can significantly affect the yield and quality of any crop, including corn. Research conducted by scientists and our results also reveal important aspects of the impact of different tillage methods on corn production and quality. Y. Wang *et al.* (2021) indicate that tillage depth can affect the development of the corn root system. Deeper tillage methods can stimulate the development of plant roots, which helps them to penetrate deeper soil layers and better supply the plant with water and nutrients. M. Korchak (2022) and O. Tsyliuryk *et al.* (2023) emphasise that the choice of tillage method plays a key role in maize cultivation and achieving optimal yield and product quality results. The integration of innovative methods that consider modern requirements and standards in agriculture can help achieve more efficient and sustainable results in growing the crop. This study identifies the importance of selecting optimal agronomic practices to achieve successful results in agriculture.

According to G.P. Kovács *et al.* (2023), proper tillage improves soil structure and ensures the availability of nutrients for plants. This can have a positive impact on the development of maize, as it provides important conditions for its growth and the formation of a quality crop. In addition, according to A. Kundu *et al.* (2024), efficient tillage creates optimal conditions for the growth of vegetative mass and plant roots. This is a key aspect in maintaining plant resistance to stressful conditions, and a healthy and well-developed root system helps plants to better adapt to environmental changes and ensures their optimal physiology, which is also demonstrated in the study.

J. Li & Q. Lin (2023) add that the use of modern tillage technologies can help increase soil permeability and regulate soil moisture, which is important for maize growth in different climates. This research confirms that the right choice of tillage practices is key to optimising crop conditions and maximising its potential. Given the variety of agronomic methods and technologies, it is important to choose those that meet specific business conditions and contribute to higher yields and product quality. This approach considers the individual characteristics of soils, climatic conditions and other factors that may affect the cultivation of specific crops. M. Vandyk's (2023) research focuses on the biological activity of the soil, which can vary depending on the method of cultivation. The general approach is to use agricultural practices in a balanced way that promotes the development of beneficial biota and preserves soil structure to maintain yields and environmental sustainability.

T. Sullivan *et al.* (2023) point out that some tillage practices can have an impact on limiting weed spread and pest development. For example, deep ploughing can be an effective method of weed control compared to other methods. The deep rotation of the soil can help to plough weeds to a greater depth, reducing their ability to germinate and compete with crops. Another confirmation of the study can be found in the statements of other scientists who have investigated the impact of different tillage methods on corn production. R.K. Adhikari *et al.* (2023) and J.D. Clark *et al.* (2021)

pointed out the significant effect of ploughing on the depth of the topsoil on grain yield and quality of maize. Similar to our results, they confirm that this method of cultivation contributes to high grain yield, high grain weight per ear, and high weight per 1000 kernels.

The study also agrees with H.S. El-Beltagi *et al.* (2022) and M.N. Harish *et al.* (2022), who suggest the importance of modern tillage practices for improving maize quality and yield. The results indicate that traditional methods, in particular, shelf ploughing to a depth of 30 cm, are optimal for achieving the highest grain productivity. These findings emphasise the importance of proper tillage for achieving optimal results in agriculture, particularly in the context of maize production. Optimised tillage can improve not only soil structure, but also provide favourable conditions for plant growth and development, increasing their resistance to stress and contributing to yield growth (Taranenko *et al.*, 2019; Auzins *et al.*, 2023). Furthermore, considering the research of scientists such as I.M. Kovalenko & I.M. Masik (2018), it is possible to argue that innovative approaches to soil cultivation and the use of modern technologies can also have a significant impact on maize cultivation. Their views on the importance of developing stress-tolerant varieties and hybrids and the use of precision farming systems highlight the need to expand the arsenal of methods to achieve optimal results.

In support of this, according to W. Hassan *et al.* (2022), it is necessary to integrate different tillage approaches in the context of maize cultivation. The authors emphasise the importance of considering individual soil characteristics and soil structure when choosing a tillage method. They also emphasise that the use of modern technologies, such as precision farming and monitoring systems, can help to optimise the process of growing corn and increase its productivity. Thus, considering the opinion of scientists and researchers, it can be noted that improving tillage methods and introducing modern technologies in agriculture can contribute not only to increasing yields but also to creating a sustainable and efficient environment for corn cultivation (Wang & Hu, 2021; Halko *et al.*, 2023).

When discussing the findings of the study, it is important to consider an integrated approach to maize cultivation and tillage, ensuring a balanced impact on the plant, soil and environment. Many of these findings are compatible with general trends in agriculture and highlight the importance of choosing the right technologies to optimise corn yield and grain quality. Such results from different scientists confirm the conclusions of the study. Thus, in summary, it is possible to state that the choice of the optimal tillage method is becoming a key aspect for achieving the best results in maize cultivation, which is of practical importance for agronomists and farmers in improving the productivity and quality of this important crop.

CONCLUSIONS

Implementation of optimal soil tillage is a key element in modern agriculture, in maize cultivation. The study results show that tillage has a decisive impact on the development and yield of maize. Optimising the conditions for photosynthesis, water supply and nutrient supply to plants are key aspects that can be achieved by choosing the right tillage method. Ploughing to a depth of 30 cm proved to be the most favourable for the formation of the optimal number of leaves – 15.4 pcs. and the number of cobs per 100 plants – 106 pcs., which determines the overall success of corn cultivation.

The results of the maize cultivation analysis indicate that the yield increases when ploughing to a depth of 30 cm, reaching a maximum value of 91.6 cwt/ha, compared to the less efficient method of disking the soil to a depth of 15 cm, where the yield is only 80.6 cwt/ha. The study also confirms the impact of tillage on grain quality. For example, the grain obtained by ploughing to a depth of 30 cm had a starch content of 70.9%, crude fibre content of 2.12%, protein content of 10.2% and crude fat of 4.22%. These results emphasise the importance of choosing the optimal tillage method to achieve not only high yields but also improved grain quality. Correlation and regression analysis confirm a significant relationship between tillage practices, yield and quality of corn. The model used for the analysis accurately reflects the available data, which underlines the reliability of the results. Thus, to achieve maximum yield and grain quality of maize in the western Forest-Steppe of Ukraine on sod-podzolic light loamy soil, it is recommended to use ploughing to a depth of 30 cm as the optimal tillage method. This study can serve as a basis for an informed choice of maize cultivation technology, providing practical value for farmers and agronomists in choosing optimal agronomic solutions. Future research should examine the effectiveness of tillage under stressful conditions, such as drought or extreme temperatures, to help determine how different methods may affect crop resilience. Limitations of the study include the area of the study and the type of soil, which may limit the generalisability of the results to other regions with different climates and soils.

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CONFLICT OF INTEREST

None.

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Використання сучасних технологій обробітку ґрунту для підвищення якості кукурудзи

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Анотація. Дослідження розвитку стійких та продуктивних методів вирощування кукурудзи стає актуальним завданням у зв'язку із зростаючим попитом на продовольчі ресурси та необхідністю оптимізації агротехнічних процесів. Мета дослідження – провести порівняльний аналіз вирощування кукурудзи за різних способів обробітку ґрунту. Для досягнення цієї мети було закладено польовий дослід, здійснено фенологічні спостереження за розвитком рослин кукурудзи та вивчено якісні показники зерна. Отримані результати аналізу врожайності кукурудзи свідчать, що за проведення оранки на глибину 30 см формується найбільша врожайність кукурудзи – 91,6 ц/га, а за дискування ґрунту на глибину 15 см встановлено найменшу урожайність – 80,6 ц/га. За результатами дослідження доведено, що спосіб обробітку ґрунту впливає на показники якості зерна, зокрема: вміст сирої клітковини, крохмалю, протеїну та сирого жиру. Так, за оранки на глибину 30 см вміст крохмалю в зерні становив 70,9 %, сирої клітковини – 2,12 %, протеїну – 10,2 %, а сирого жиру – 4,225 %. Виконаний кореляційно-регресійний аналіз довів, що коефіцієнт детермінації (R^2) для обробітку ґрунту становить близько 0,9, це означає, що модель точно описує наявні дані, а для показників якості зерна R^2 перебуває в діапазоні 0,66-0,99, що також характеризує наявний сильний зв'язок між досліджуваними факторами. Практичне значення отриманих результатів дослідження полягає в тому, що вони можуть слугувати основою для оптимізації агротехнічних процесів вирощування кукурудзи з метою збільшення врожайності та покращення якості зерна

Ключові слова: врожайність; хімічний склад зерна; оранка; морфолого-біометричні показники; агротехнічні рішення; сільське господарство