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PHYTOSANITARY CONDITION OF MAIZE AGROCOENOSIS DEPENDING ON MEASURES TO REGULATE PEST ORGANISMS IN THE CONDITIONS OF THE NORTHERN STEPPE OF UKRAINE

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The article presents the results of a study on the impact of primary soil cultivation methods and herbicide application schemes on the productivity of maize hybrids Miting, Varkhol, and Blackrock. The research findings indicate that the application of different primary soil cultivation methods significantly affects the population of dominant harmful organisms whose life cycles are associated with the arable layer of soil. For instance, in the variant with plowing, the spread of sclerotinia in the Varkhol hybrid crops was 11.6%, while in the crops of the Blackrock and Miting hybrids it was 10.4% and 8.3%, respectively. In contrast, in the variant with disk tillage, the spread of white rot in Miting hybrid crops was 9.3%, while in the crops of Varkhol and Blackrock hybrids it was 16.9% and 14.5%, respectively.

The use of different primary soil cultivation methods also influenced the population of soil-dwelling phytophagouses and pests, part of whose biological cycle is associated with the surface layer of soil. For example, under plowing, the population of Agriotes sputator L. ranged from 3.5 to 4.0 pests/m², while Pedinus femoralis L. had a population density of 1.5-2.0 pests/m², Ostrinia nubilalis Hbn had 1.5-1.8 pests/plant, and Scotia segetum Schiff. Eux. had 2.0-2.5 pests/m². These numbers were significantly lower compared to variants where disk tillage was used.

The method of soil cultivation had the greatest impact on the group of harmful organisms known as weeds. Under plowing, the total number of weed species before harvesting in the control group without herbicide application was 117.9 weeds/m², while in the chiseling variant this figure was 131.3 weeds/m², and under disk tillage it reached 167.3 weeds/m². The application of different herbicide application schemes had varying effects on weed infestation levels and was characterized by different levels of control over segetal vegetation. The most effective scheme turned out to be a combination of pre-emergence (Fortendo KS, 4.0 l/ha) and post-emergence (Mezotrek Ultra MD, 2.0 l/ha) applications, which resulted in high technical efficiency of herbicide use ranging from 95.7% to 97.0%, depending on the variant.

The highest maize grain yields were obtained in the variant with plowing using pre-emergence and post-emergence herbicide applications, where it amounted to 11.78 t/ha for the Miting hybrid and 11.22 t/ha and 10.54 t/ha for the Blackrock and Varkhol hybrids, respectively.

Key words: *maize, pests, phytopathogens, weeds, pesticides, hybrids, yield.*

Марковська О.Є., Дудченко В.В., Піковський М.Й., Мечет А.О. Фітосанітарний стан агроценозу кукурудзи залежно від заходів регулювання шкодочинних організмів в умовах Північного Степу України

У статті представлено результати дослідження впливу способів основного обробітку ґрунту та схем застосування гербіцидів на продуктивність гібридів кукурудзи Мітинг, Вархол та Блекрок. За результатами дослідження встановлено, що застосування різних *способів основного обробітку ґрунту суттєво впливало на чисельність домінуючих видів шкідливих організмів, життєві цикли яких пов'язані з орним шаром ґрунту.*

Так, у варіанті з оранкою поширення склеротиніозу у посівах гібриду Вархол становило 11,6%, у посівах гібридів Блекрок та Мітинг – 10,4 й 8,3% відповідно, тоді як у варіанті з дисковим обробітком ґрунту, поширення білої гнилі у посіві гібриду Мітинг становило 9,3%, у посівівах гібридів Вархол та Блекрок – 16,9 та 14,5% відповідно.

Застосування різних способів основного обробітку ґрунту також мало вплив на чисельність грунтоживучих фітофагів та шкідників, частина біологічного циклу яких пов'язана з поверхневим шаром ґрунту. Так, за використання оранки чисельність Agriotes sputator L. становила 3,5-4,0 шкідників/м^2, Pedinus femoralis L. – 1,5-2,0 шкідника/м^2, Ostrinia nubilalis Hbn – 1,5-1,8 шкідника/рослину, Scotia segetum Schiff. Eux. – 2,0-2,5 шкідника/м^2. Це було значно менше, ніж у варіантах дискового обробітку ґрунту.

Найбільше спосіб обробітку ґрунту впливав на таку групу шкідливих організмів як бур'яни. Так, за використання оранки сумарна кількість видів бур'янів перед збиранням культури у контролі без застосування гербіцидів становила 117,9 бур'янів/м^2, у той час як у варіанті із чизелюванням цей показник становив 131,3 бур'янів/м^2, а за дискування – 167,3 бур'янів/м^2. Застосування різних схем внесення гербіцидів неоднаково впливало на забур'яненість посівів та характеризувалось різним рівнем контролю сегетальної рослинності. Найбільш ефективною виявилася схема з комбінацією допосівного (Фортендо КС, 4,0 л/га) та післясходового внесення (Мезотрекс Ультра МД, 2,0 л/га), що дозволило отримати високу технічну ефективність застосування гербіцидів – 95,7-97,0% залежно від варіанту досліду. Найвищу врожайність зерна кукурудзи отримали у варіанті з оранкою за використання допосівного та післясходового внесення гербіцидів, де вона становила по гібриду Мітинг 11,78 т/га, по гібридах Блекрок і Вархол 11,22 та 10,54 т/га зерна відповідно.

Ключові слова: *кукурудза, шкідники, фітопатогени, бур'яни, пестициди, гібриди, врожайність.*

Problem Statement. Maize is among the top three most productive and widely cultivated agricultural crops that humanity has grown for centuries. With an exceptionally strong yield potential that has long surpassed 30 t/ha of grain [1, 2, 3], maize provides high economic efficiency in agricultural production almost every year even under challenging conditions in Ukraine [4, 5, 6].

The realization of maize's genetic potential depends on a range of biotic and abiotic factors, among which one of the most important is the formation of a complex of harmful organisms in the agrocenosis that can significantly reduce the productivity of the crop if they develop extensively and there is no reliable and effective control [7]. From the germination phase until nearly the end of the vegetation period, and in some cases even after harvest, a multitude of phytopathogenic microorganisms develop on the root system, above-ground mass, and grain of maize, with their activity potentially leading to yield reductions of 25-30% or more [8].

Given that maize can be grown for extended periods in monoculture without a decrease in productivity, agricultural enterprises often practice either continuous sowings or short-rotation crop rotations. This situation inevitably affects the increase in the population of polyphagous and specialized phytophagouses, with about 200 species of harmful insects present in Ukraine's conditions, some of which require annual constant monitoring and can cause grain yield losses of 20-30% [9].

Equally important in the technology of growing maize is weed control, which can reduce crop productivity by 20-70% depending on the species composition, quantity, and duration of competition [10]. Due to its biological characteristics, maize has slow growth rates at initial stages; therefore, effective control of weed vegetation in crops is an extremely important component of an integrated crop protection system.

Soil cultivation, while creating optimal conditions for the development of plant root systems, can also serve as an effective preventive measure to limit the population of harmful species, especially at the early stages of plant development [11, 12].

Thus, a scientifically justified combination of appropriate phytosanitary field conditions, soil cultivation methods, and chemical control measures can ensure reliable protection for maize agrocenosis and create preconditions for obtaining high and sustainable yields of the crop.

The analysis of recent research and publications. The most sensitive period for maize in terms of damage from phytophagouses and maintaining the necessary plant density is the period from seed germination to the emergence of seedlings and young plants. During this time, young plants are damaged by soil-dwelling pests: larvae of the winter moth, wireworms, false wireworms, and larvae of leaf-rolling insects. Living in the soil, they feed on the young maize seedlings, severely chewing them and leading to thinning of the crop stands. Subsequently, aphids such as the corn aphid and common cereal aphid, six-spotted and striped leafhoppers, the corn stem borer moth, and various species of polyphagous cutworms develop on the plants [13]. In this regard, the system for protecting maize from phytophagouses should combine a range of measures, among which organizational and economic as well as agronomic measures play a leading role.

Soil cultivation significantly affects the reduction of pest populations whose life cycle is associated with root-containing soil. Pre-emergence and post-emergence harrowing, inter-row cultivation, and the shredding of post-harvest residues with heavy disc implements followed by their incorporation into the soil to a depth of 27-30 cm can significantly (by 70-80%) reduce the number of larvae of most maize pests [14].

Growing maize in short-rotation crop rotations with soybeans and sunflowers contributes to the accumulation in the soil of pathogens of polyphagous organisms, typical representatives of which include pathogens causing fusarium wilt, white, gray, and charcoal rot. Among the epiphytic diseases, the most common are brown spot disease, flying smut, blister smut, rust, black bundle, etc [15]. As with pest control, an effective crop protection system involves a comprehensive approach based on adherence to crop rotations, optimal sowing dates and planting depths, thorough incorporation of post-harvest residues, and more.

Maize plants have a prolonged herbicidal critical period during which competition with weed vegetation for essential growth factors leads to a significant reduction in crop yield. The most common weed species in maize agrocenosis in the steppe zone include various species of knotweed, American pigweed, white goosefoot, black nightshade, mugwort ragweed, field bindweed, cock's foot millet, creeping couch grass, various thistle species, and sunflower volunteers. Protecting maize crops from undesirable weed vegetation is based on a combination of agronomic and chemical methods for weed control [16].

If the level of weed infestation in a field is high, relying solely on agronomic measures does not provide reliable protection for the crops against weeds. In such cases, various schemes (pre-emergence application, post-emergence application, and their combinations) are used, with the choice of application depending on the type of weed infestation, moisture availability levels, and the economic condition of the farm.

Task Statement. The aim of the experiment is to determine the productivity of maize hybrids depending on soil cultivation measures and herbicide application schemes. The research was conducted in the conditions of the "Aloey" farm, located in the Novoukrainka district of Kirovohrad region.

The soil cover at the research site is represented by ordinary black soil, medium-humus, deep, heavy clay. The humus horizon has a thickness of 35-45 cm, with a humus content of 4.6%, easily hydrolysable nitrogen compounds (according to Kornfield) at 110 mg/kg, and mobile phosphorus and potassium compounds (according to Chirikov) at 129 and 126 mg/kg of soil, respectively. The soil solution reaction is 7.1. The predecessor crop is soybean. The experiment is a three-factor study, set up in four replications using a split-plot method with systematic placement of variants. The total area of the experimental plot is 80 m², and the accounting area is 50 m². The experimental field is leveled, without slopes or erosion formations. The scheme of the experiment is presented in Table 1.

Table 1

Experimental design

Hybrid (factor A)	**Main tillage method (Factor B)**	**Chemical weed control system (Factor C)**
Varkhol	Plowing (plough PON-5-40+1, 30-32 cm)	Fortendo CS, 4.0 l/ha (a)
	Chiselling (chisel-deep ripper, PTS – 7, 30-32 cm)	Mezotrex Ultra MD, 2.0 l/ha (b)*
	Disking (BPD – 4.2 “Fregat”, 22-25 cm)	Fortendo CS, 4.0 l/ha (a)*, Mezotrex Ultra MD, 2.0 l/ha (b)*
Blackrock	Plowing (plough PON-5-40+1, 30-32 cm)	Fortendo CS, 4.0 l/ha (a)
	Chiselling (chisel-deep ripper, PTS – 7, 30-32 cm)	Mezotrex Ultra MD, 2.0 l/ha (b)*
	Disking (BPD – 4.2 “Fregat”, 22-25 cm)	Fortendo CS, 4.0 l/ha (a)*, Mezotrex Ultra MD, 2.0 l/ha (b)*
Miting	Plowing (plough PON-5-40+1, 30-32 cm)	Fortendo CS, 4.0 l/ha (a)
	Chiselling (chisel-deep ripper, PTS – 7, 30-32 cm)	Mezotrex Ultra MD, 2.0 l/ha (b)*
	Disking (BPD – 4.2 “Fregat”, 22-25 cm)	Fortendo CS, 4.0 l/ha (a)*, Mezotrex Ultra MD, 2.0 l/ha (b)*

* Примітка: a – допосівне внесення; b – післясходове внесення.

During the research, the following methods were applied: field methods for observing plant growth and development, weather and climatic conditions of the environment, determining the species composition of phytophagouses and phytopathogens, and the structure of weed infestation in maize agrocenosis; visual methods for establishing phenological phases of maize plants and assessing the state of weed infestation in agrocenosis; measurement and weighing methods for determining biometric parameters of plant growth and development, the quantity and weight of raw and dry mass of weeds, yield structure parameters, and yield; laboratory methods for determining the agro-physical properties of the soil, its moisture content, and NPK levels, as well as quality indicators of grain; mathematical-statistical methods for conducting dispersion analysis and statistical data processing to assess the reliability of the obtained research results; calculation-comparative methods for evaluating the economic efficiency of elements of maize cultivation technology. The technical efficiency of the preparations was calculated using Abbott's formula according to pesticide testing methodology [17]. Statistical processing was carried out using the computer program "Agrostat new".

Presentation of Main Research Material. According to the results of phytosanitary monitoring of crops, it was established that the most common diseases of maize during 2023–2024 were gray mold (*Botryotiana fuckeliana* Whetzel), white mold (*Sclerotinia* *sclerotiorum* de Bary), Fusarium wilt (*Gibberella fujikuroi* Wollenw), charcoal rot (*Macrophomina phaseolina* Goid.), brown spot disease (*Setosphaeria turcica* Leonhardt et Suggs.), and corn smut (*Ustilago zeae* Unger). The structure of the phytopathogenic complex in maize agrocenoses is presented in Fig. 1.

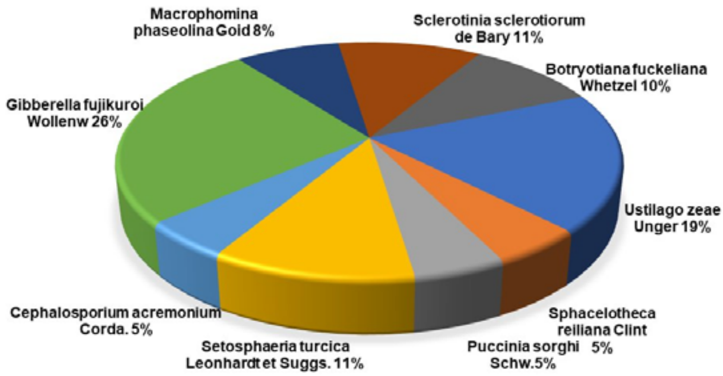

Fig. 1. Structure of the phytopathogenic complex in maize agrocenosis (2023–2024)

The infection levels of the studied maize hybrids by dominant pathogens were practically at the same level and differed slightly by factor A (hybrids), with hybrid Miting being predominant. The spread of diseases in its crops was lower across all variants of factor B (method of primary soil cultivation) compared to hybrids Varkhol and Blackrock. According to the analysis of the spread of pathogens causing white, gray, and charcoal rot, the method of soil cultivation influenced the distribution of pathogens in maize crops. For instance, in the variant with plowing, the spread of white rot in Varkhol hybrid crops was 11.6%, in Blackrock hybrid crops it was 10.4%, while in Miting hybrid plants it was 8.3% (Fig. 2).

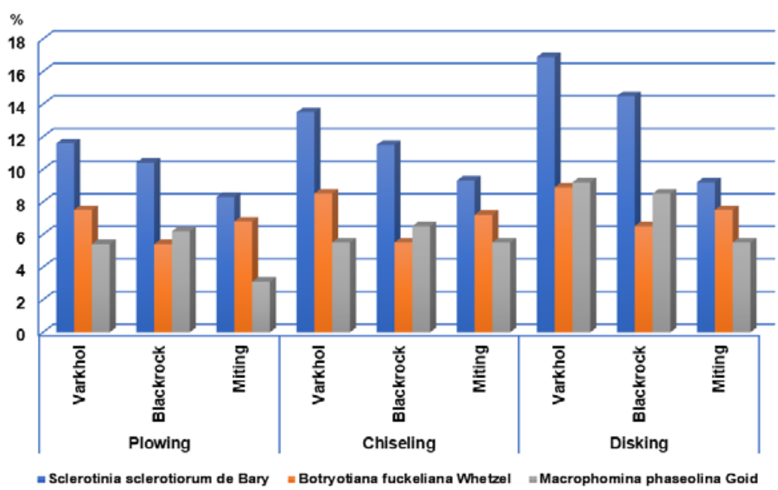

Fig. 2. The influence of soil cultivation methods on the prevalence of plant rot pathogens in maize (2023–2024)

With the use of chiseling, there was no significant increase in disease prevalence, although the levels of sclerotinia were somewhat higher than in the previous variant, amounting to 13.5%, 11.5%, and 9.3% in the crops of hybrids Varkhol, Blackrock, and Miting, respectively. The highest prevalence of white rot was observed in the variant with disc tillage, which can be explained by better preservation of the pathogen's sclerotia due to their shallow incorporation into the soil or a higher percentage of their presence on the surface as a result of the lack of soil turnover. Thus, the prevalence of sclerotinia in the Varkhol hybrid crop was 16.9%, while in the Blackrock hybrid crop it was 14.5%. The prevalence of white rot in the Miting hybrid crop had the same values as in the previous variant, amounting to 9.3%.

Regarding the prevalence of gray mold (*Botryotiana fuckeliana* Whetzel) in maize hybrid crops, this indicator did not change significantly for either factor A (hybrids) or factor B (method of primary soil cultivation), ranging from 5.4% to 8.9% depending on the experimental variant. Charcoal rot (*Macrophomina phaseolina* Goid) also spread moderately in maize hybrid crops. The method of primary soil cultivation and hybrid composition did not have a significant impact on the percentage of disease spread, which ranged from 5.4% to 9.2% depending on the experimental variant.

Despite the numerous phytophagous complex present in maize agrocenosis, five species were dominant, whose development year after year creates problems that require solutions through special population regulation measures. The most common and harmful were wireworms, larvae of the seed corn beetle (*Agriotes sputator* L.), maize weevil (*Pedinus femoralis* L.), corn stalk borer (*Ostrinia nubilalis* Hbn), and the common cereal aphid (*Schizaphis graminum* Rond.) (Fig. 3). Many maize pests spend part of their life cycle in the root layer of the soil, damaging the root system of plants, young sprouts, and maize stems. Since the larvae of such pests develop in the upper layer of the soil and adults lay eggs in plant residues, the method of primary soil cultivation can significantly influence their survival during the autumn-winter period and their harmfulness during plant vegetation.

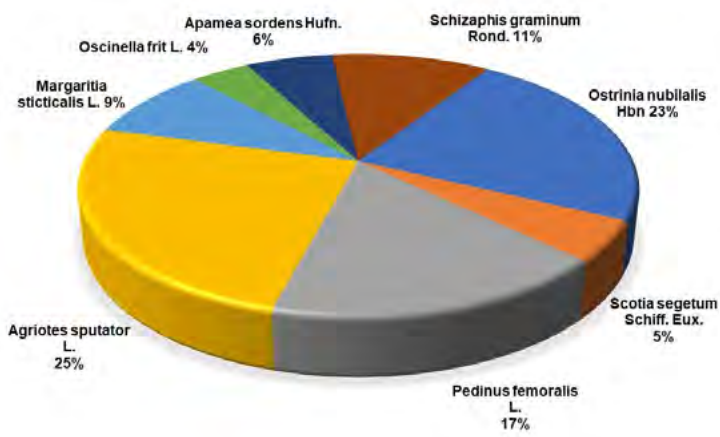

Fig. 3. Structure of the harmful entomological complex in maize agrocenoses (2023–2024)

In our study, the method of primary soil cultivation significantly affected the population density of dominant maize phytophagouses. Thus, the number of pests was lowest with plowing, ranging from 3.5 to 4.0 pests/m² for *Agriotes sputator* L., 1.5-2.0 pests/m² for *Pedinus femoralis* L., 1.5-1.8 pests/plant for *Ostrinia nubilalis* Hbn, and 2.0-2.5 pests/m² for *Scotia segetum* Schiff. Eux. (Fig. 4).

No significant difference in phytophage density was observed depending on the studied hybrids across all variants of factor B (method of primary soil cultivation). However, the use of chiseling led to an increase in pest numbers: *Agriotes sputator* L. – 5.1-5.5 pests/m², *Pedinus femoralis* L. – 2.0-2.5 pests/m², *Ostrinia nubilalis* Hbn – 2.0-2.5 pests/plant, and *Scotia segetum* Schiff. Eux. – 3.5-4.0 pests/m².

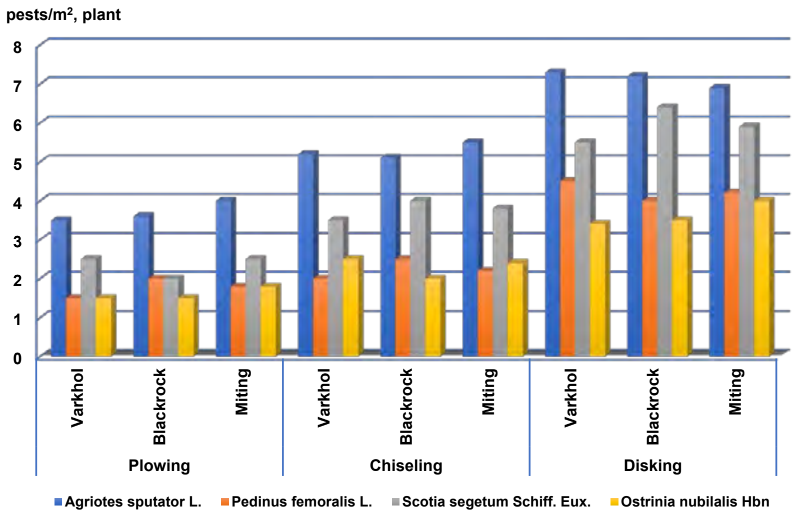

Fig. 4. The influence of soil cultivation methods on the population density of dominant phytophagouses in maize agrocenosis (2023–2024)

The highest population density of phytophagouses was observed with disc tillage. Thus, the density of *Agriotes sputator* L. was 6.9-7.3 pests/m², *Pedinus femoralis* L. – 4.0-4.5 pests/m², *Ostrinia nubilalis* Hbn – 3.4-4.0 pests/plant, and *Scotia segetum* Schiff. Eux. – 5.5-6.4 pests/m².

The most significant impact of soil cultivation measures was observed on weed density. The type of weed infestation in the maize agrocenosis was characterized as annual broadleaf-grass, with a predominance of *Amaranthus retroflexus* L. (22.0%), *Chenopodium album* L. (20.0%), *Echinochloa crus-galli* (L.) P.Beauv. (18%), and *Fallopia convolvulus* (11%) (Fig. 5).

The use of herbicides in crop protection systems, particularly in short-rotation crop rotations, has long been an objective necessity; without it, achieving high productivity from any maize hybrid is impossible. The effectiveness of herbicide application depends on a range of factors that can either enhance the results or lead to reduced efficacy of the products. A scientifically justified method of primary soil cultivation can significantly increase the effectiveness of herbicide protection by lowering the initial level of weed infestation in the field.

In our study, the number of weeds was significantly influenced by both the method of soil cultivation and the scheme of herbicide application. The dry conditions of 2024 negatively affected the effectiveness of the herbicide Fortendo KS (4.0 l/ha) when applied

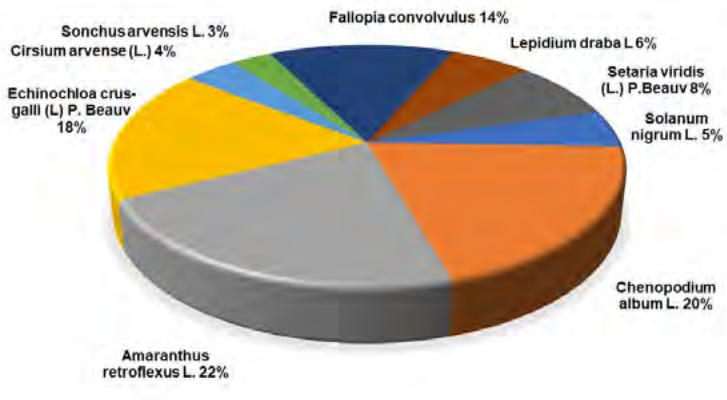

Fig. 5. Structure of the weed flora in the maize agrocenosis (2023–2024)

pre-emergence. In the variant with plowing, the number of weeds under this application was as follows: broadleaf species – 8.2 weeds/m², monocot species – 10.5 weeds/m²; in the chiseling variant, the number of broadleaf species increased to 9.5 weeds/m², and monocot species to 11.3 weeds/m². The highest number of weeds was observed in the variant with disk tillage, reaching 10.5 broadleaf weeds/m² and 12.5 monocot weeds/m² (Fig. 6).

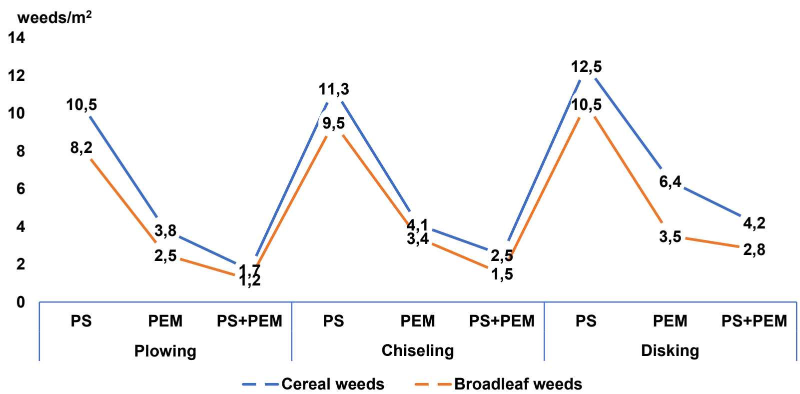

Fig. 6. Weed density in the maize agrocenosis depending on soil cultivation measures and herbicide application schemes (2023–2024)

Weed development was best controlled in variants using the following herbicide application scheme: Fortendo KS, 4.0 l/ha (pre-sowing), Mezotrek Ultra MD, 2.0 l/ha (4-5 leaves in the crop). In this variant, the number of weeds with plowing was 1.2 broadleaf weeds/m² and 1.7 monocot weeds/m². With chiseling, the number of broadleaf weeds was 1.5 weeds/m² and monocot weeds was 2.5 weeds/m²; in the variant with disking, the number of broadleaf species was 2.8 weeds/m² and monocot species was 4.2 weeds/m².

The highest efficiency rates for the herbicides were obtained using a scheme that combined pre-emergence and post-emergence applications of Fortendo KS, 4.0 l/ha and Mezotrek Ultra MD, 2.0 l/ha. The technical efficiency against grassy weeds in the plowing variant was 97.8%, in chiseling – 97.1%, and with disking – 95.9%. A similar trend was observed for broadleaf species, where technical efficiency was 97.0%, 96.7%, and 95.7% respectively (Table 2).

Table 2

Technical efficiency of herbicide application schemes depending on the main tillage methods (2023–2024)

Tillage method	Weed count in control, pcs./m² before harvesting		Technical efficiency of herbicides, %					
	Cereal weeds	Broadleaf weeds	Pre-sowing application		Post-emergence application		Pre-sowing and post-emergence application	
			cw*	brw*	cw	brw	cw	brw
Plowing	78,5±6,5	39,4±4,8	86,2±4,2	79,2±3,8	95,2±4,6	93,7±4,3	97,8±4,0	97,0±3,9
Chiselling	85,9±5,4	45,4±5,1	86,9±4,6	79,1±3,6	95,2±4,5	92,7±3,8	97,1±4,3	96,7±4,1
Disking	102,8±7,9	64,5±6,2	87,8±5,0	83,7±4,1	93,8±4,2	94,6±4,1	95,9±4,1	95,7±4,0

• Note: cw – cereal weeds; brw – broadleaf weeds.

Insufficient technical efficiency of herbicides was observed in the variant with pre-sowing application of Fortendo KS, 4.0 l/ha, as moisture conditions that ensure high efficacy for soil-active products were not met. Technical efficiency in this variant ranged from 86.2% to 87.9%, depending on the primary soil cultivation methods used.

The yield of maize hybrids varied significantly depending on all three studied factors of the experiment. The highest yields were obtained in the variants with plowing and the application of the pre-emergence followed by post-emergence herbicide scheme (Fortendo KS, 4.0 l/ha; Mezotrek Ultra MD, 2.0 l/ha) for the hybrid Miting, which yielded 11.78 t/ha. The yields for the hybrids Varkhol and Blackrock in the aforementioned variant were 10.54 and 11.22 t/ha, respectively. The lowest yield was observed with the use of disking and the application of herbicides according to the scheme: pre-emergence application (Fortendo KS, 4.0 l/ha), where it amounted to 8.56 t/ha for the hybrid Miting and 7.34 and 7.55 t/ha for the hybrids Varkhol and Blackrock, respectively (Table 3).

The use of a post-emergence herbicide application scheme (Mezotrek Ultra MD, 2.0 l/ha) in the plowing variant also ensured a high level of maize yield, which was 10.56 t/ha for the hybrid Miting. For the hybrids Varkhol and Blackrock, the yields were 9.95 and 10.15 t/ha, respectively. In the chiseling variant, the yields of the hybrids were somewhat lower but remained at a fairly high level under this weed control scheme, amounting to 9.54 t/ha for Miting, 9.14 t/ha for Varkhol, and 9.45 t/ha for Blackrock.

According to the results of statistical analysis, factor B (methods of primary soil cultivation) had an influence share of 34% (Fig. 7).

Factor C (herbicide application schemes) had a high impact on maize yield, with an influence share of 33%. Factor A (hybrids) had a lesser effect on the yield levels of the studied hybrids, with an influence share of 25%, according to the results of the statistical analysis.

Table 3

Yield of corn hybrids depending on the main tillage methods and herbicide protection scheme (2023–2024)

Hybrid (factor A)	Tillage method (factor B)	Herbicide application schedule (Factor C)			Average	
		Pre-sowing application	Post-emergence application	Pre-sowing and post-emergence application	B	A
Varkhol	Plowing *	9,46	9,95	10,54	9,98	8,93
	Chiselling *	8,37	9,14	9,85	9,12	
	Disking *	7,34	7,65	8,12	7,70	
Blackrock	Plowing	9,75	10,15	11,22	10,37	9,38
	Chiselling	8,56	9,45	10,37	9,46	
	Disking	7,55	8,12	9,24	8,30	
Miting	Plowing	10,35	10,56	11,78	10,90	9,83
	Chiselling	9,15	9,54	10,25	9,66	
	Disking	8,56	8,95	9,25	8,92	
Average by factor C		8,79	9,28	10,07	Pl 10,42 Ch 9,41 D 8,31	
LSD_{05}, t/ha: A – 0,35; B – 0,49; C – 0,37						

• Note: plowing – to a depth of 30-32 cm; chiselling – to a depth of 30-32 cm; disking – to a depth of 22-25 cm.

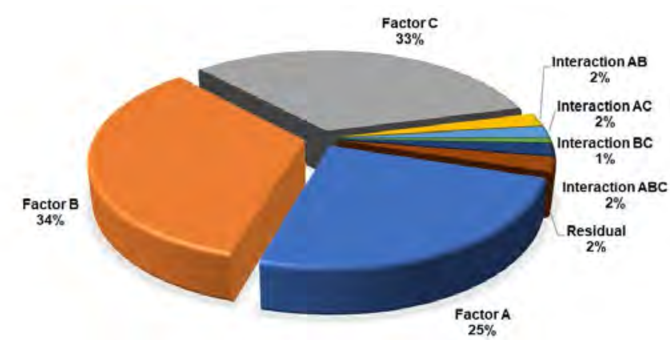

Fig. 7. Influence share of studied factors (A – hybrid; B – method of soil cultivation; C – herbicide application scheme) on maize grain yield, % (average for 2023–2024)

Conclusions. The productivity of maize hybrids in the conditions of the Northern Steppe of Ukraine significantly depends on the methods of primary soil cultivation and herbicide application schemes that allow for maximum control of weed populations during the initial stages of crop development. According to our research, the most effective approach for achieving high maize grain yields when cultivating the hybrids Miting, Varkhol, and Blackrock is the use of plowing to a depth of 32-35 cm combined with the application of herbicides according to the scheme of pre-emergence (Fortendo KS, 4.0 l/ha) and post-emergence (Mezotrek Ultra MD, 2.0 l/ha). This combination not only effectively suppressed the development of dominant harmful organisms but also achieved high technical efficiency of herbicides (95.7-97.0%), resulting in yields ranging from 10.54 to 11.78 t/ha of maize grain.

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