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AGROECOLOGICAL SUBSTITUTION OF PESTS AND THE INFLUENCE OF EXTRAROOT FEEDING ON THE PRODUCTIVITY OF CORN FOR GRAIN IN THE TRAINING OF HIGHER EDUCATION STUDENTS

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The article presents the results of studying the influence of microelements in top dressing in different phases on yield and resistance to stem borer. The research was conducted during 2023-2024 in the conditions of LLC "Organic-D" on gray forest soils, light loamy mechanical composition.

It was established that the use of foliar top dressing significantly affects the productivity of corn hybrids, morphological characteristics of corn plants, immunological state and productivity of the studied hybrids.

In addition, no dependence was established between the introduction of microelements in top dressing in the phase of 5-7 and 10-12 leaves of corn and the starch content. This indicator depended to a greater extent on the individual characteristics of the hybrid and the weather and climatic features of a particular year of research.

The duration of the growing season is one of the most valuable characteristics of corn hybrids, which allows for the effective use of the agroclimatic potential of the territory and determines the possibility of growing hybrids in different soil and climatic zones. Corn hybrids differed significantly in the duration of the growing season. Thus, in particular, in the group of early-ripening hybrids it was 115-116 days, in the group of medium-early - 121-126 days, and medium-ripening - 136-141 days. The use of microfertilizers Rosalik and Black Jack contributes to the extension of the growing season by 1-3 days compared to the control options without foliar feeding. The use of foliar feeding with microfertilizers Rosalik and Black Jack contributes to the reduction of the number of plants damaged by the stem corn borer and increased resistance to stem lodging.

In the control, the yield of hybrids of the early ripening group was at the level of DKC 3247 - 5.17 t/ha and DKC 3805 - 6.31 t/ha, of the medium-early group - DKC 3402 - 8.53 t/ha and DKC 3796 - 7.92 t/ha, and of the medium-ripening group DKC 3969 - 8.64 t/ha and DKC 3972 - 8.81 t/ha. That is, with an increase in the duration of the growing season, the grain productivity of the studied hybrids also increased. The use of foliar feeding allows you to significantly increase the level of productivity of corn hybrids of different ripening groups and does not affect the starch content, but the increase in yield affects the overall starch yield.

Keywords: *corn, grain, microelements, foliar feeding, fertilizer system, plant height, cob attachment height, silage, yield, phytophagous, lodging, elements of crop structure, crop care.*

Table 6. Ref. 15.

Research problem statement. In recent years, the rapid pace of global warming has already affected the state of agriculture in many parts of the globe, and in the future its consequences will only intensify. Numerous facts indicate the predominance of negative results of this impact: an increase in temperature indicators and their increased variability, changes in the amount and frequency of precipitation, an increase in dry periods and droughts, an increase in the intensity of extreme weather events, salinization of arable land and fresh water [2].

Reliable provision of the country's population with food products is of strategic importance in the context of the global world, financial and economic crisis. Due to the expected increase in air temperature in the Northern Hemisphere, Ukraine's food security will largely depend on how effectively agriculture adapts to future climate change [1, 2, 5, 7].

In solving the problem of food security, a special role belongs to corn as the most important and socially significant crop in all soil and climatic zones of Ukraine. This is due to its high ield, the absence of significant problems in growing it, and high demand in industry, animal husbandry, and medicine [2, 4, 9, 14].

The use of microelements is an integral part of measures to increase the yield of agricultural crops, including corn, since the use of only mineral and organic fertilizers is insufficient for the normal development of the plant organism. The role of microelements (zinc (Zn), manganese (Mn), iron (Fe), copper (Cu), molybdenum (Mo), boron (B)) in the mineral nutrition of plants is difficult to overestimate; they are indispensable [6, 8, 10].

In plants, the content of trace elements (metals and non-metals) is calculated from 0.01 to 0.001% and even less [1, 2, 11, 13]. Fe, Mn, Cu, Zn activate enzymes and perform specific functions in the protective mechanisms of drought resistance of corn. The use of trace elements is a source of increasing yield and product quality [1, 2, 12]. Meeting the needs of corn in trace elements in conditions of highly productive agrocenoses requires the use of appropriate doses and forms of microfertilizers capable of providing plants with trace elements in critical phases of growth [2, 6]. Therefore, fertilizers containing trace elements are becoming increasingly relevant [1, 9].

Analysis of recent research and publications. At this stage of development of agricultural intensification, one of the ways to increase crop yields is the use of microfertilizers and plant nutrition with them, especially those containing the necessary microelements in accordance with the needs of plants in the form of chelates [2].

The current situation is associated with the low level of material and technical support of the production process, as well as with insufficient scientific substantiation of technological operations regarding the morphobiological features of hybrids and the conditions of a specific soil and climatic zone [1].

Corn plants absorb a significant amount of microelements and are quite sensitive to their deficiency at certain stages of growth and development. In order to provide corn plants with manganese, zinc, molybdenum and sulfur, a large number of microfertilizers are used [1, 8].

Corn is characterized by a large adaptive potential, which allows hybrids to be grown in all natural and climatic zones of Ukraine. It responds positively to fertilizer application and effectively uses nutrients. The realization of the yield potential of corn depends significantly on soil and climatic conditions, but the application of micronutrients in foliar (foliar) top dressing is no less important in modern agricultural technologies.

Micronutrients applied in the form of foliar top dressing are absorbed by approximately 80-90%, while with root top dressing - only by 20-30%. When applying micronutrients to vegetative plants, micronutrients, getting on the surface of the leaf,

penetrate into its tissues and are included in the biochemical reactions of metabolism in the plant [6, 10]. During foliar top dressing, macro- and micronutrients easily penetrate into plants, are well absorbed, quickly included in the synthesis of organic substances in leaf blades or are transferred to other plant organs and used in metabolism [2, 11, 15].

Material and research methodology. The research was conducted during 2023-2024 in the conditions of LLC "Organic-D" on gray forest soils of light loamy mechanical composition. The climatic conditions of the research area are generally quite favorable for growing all agricultural crops. In 2023, spring was prolonged with not high temperature indicators, which affected the use of early corn sowing dates. An unfavorable weather factor was a sharp decrease in temperature, which became a limiting factor for the development of corn. In 2024, conditions with high temperature indicators and uneven distribution of precipitation were observed. In 2024, a significant deviation of the temperature regime and precipitation indicators from the average multi-year value of these indicators was noticeable. Moisture deficiency and excessive temperature negatively affected the formation of corn productivity.

Presentation of the main research material. The growing season is one of the most valuable features of corn hybrids, which allows for the effective use of the agroclimatic potential of the territory and determines the possibility of growing hybrids in different soil and climatic zones.

The growing season and the growing season are different concepts. The latter term means a biological concept, as it determines the development period of a particular corn hybrid. That is, the growing season from mass seed germination to ripening. It is the growing season that determines the ripeness group - early, mid-ripening or late.

In turn, the growing season provides for a time interval in the year during which the development and growth of plants are possible under the climatic conditions of a particular area. It is obvious that the growing season is a meteorological concept, and, therefore, refers to all plants grown in the specified area.

The growing season of grain corn is a variable value, that is, it can change depending on external factors and characteristics of the variety. This means that vegetation, or rather its terms, can vary from several days to three months. So, if a plant lacks nutrition or heat, then compared to optimal conditions, the vegetation period can increase threefold.

The concept of vegetation is inextricably linked with growth and development. And in this case, the essence of the terms is different. Growth is called quantitative changes that are associated with the formation of cells, parts or organs. It is growth that is the cause of an increase in the size and mass of plants. And development is invisible outwardly qualitative changes that occur at the points of growth. They lead to the appearance of organs, as well as to flowering and subsequent fruiting.

Both growth and development in the organism always occur simultaneously. They are related, but the intensity and pace of these processes can sometimes differ noticeably. Usually, both heredity and the environment affect this.

The duration of the growing season in corn hybrids can vary from 75 to 180 days or more. According to the length of the growing season, 7 groups are distinguished:

1) very early-ripening - growing season up to 90 days, the sum of active temperatures 1800-2100°C; 2) early-ripening - 91-105 days, the sum of active temperatures 2100°C; 3) medium-early - 106-120 days, 2200°C; 4) medium-ripening - 121-130 days, 2400°C; 5) medium-late - 131-140 days, 2600°C; 6) late-ripening - 141-150 days, 2800°C; 7) very late-ripening - > 150 days, > 3000°C.

In the territory of Tulchyn district, where the farms are located, hybrids of the early and mid-season groups are grown for grain purposes.

The results of our research have shown that the use of foliar feeding extends the duration of the growing season (Table 1).

Table 1

The duration of the growing season of corn hybrids depending on foliar feeding, days (average for 2023-2024)

№	Hybrid name	Control	Rosalik		Black Jack	
			5-7 leaves	5-7+10-12 leaves	5-7 leaves	5-7+10-12 leaves
Early-ripening group						
1.	DKC 3247	116	117	117	116	117
2.	DKC 3805	115	117	118	116	117
Middle -ripening group						
3.	DKC 3402	126	128	129	127	128
4.	DKC 3796	121	122	123	121	122
Mid-season group						
5.	DKC 3969	136	138	139	137	138
6.	DKC 3972	141	142	144	141	143

The source: was formed based on our own research results

From the data in Table 1 it is clear that the corn hybrids differed significantly in the duration of the growing season. Thus, in particular, in the group of early-ripening hybrids it was 116-117 days, in the group of medium-early - 121-126 days, medium-ripening - 136-141 days. The application of microfertilizers Rosalik and Black Jack in the phase of 5-7 leaves provided an increase in the duration of the growing season by 1-2 days and 1 day, compared with the control.

Two-time application of these microfertilizers in the phase of 5-7 and 10-12 leaves of corn contributed to an increase in the duration of the growing season of the studied corn hybrids by 1-3 and 1-2 days, respectively.

Thus, the use of microfertilizers Rosalik and Black Jack contributes to the extension of the growing season by 1-3 days compared with the control variants without foliar feeding.

One of the most important characteristics is the height of corn plants, which determines the suitability of a hybrid or variety for mechanized cultivation. The following requirements are imposed on cultivated grain corn hybrids: high productivity, resistance to diseases, plant height of 179-249 cm and the height of cob attachment of 67-111 cm. In

such a situation, knowledge of the patterns of variability of plant height and cob establishment depending on the use of foliar feeding is of great agrotechnical importance in growing grain corn, in conditions of intensive cultivation technologies and timeliness of mechanized harvesting.

The phenomena of growth and development are an indicator of all metabolic processes occurring in plants. The results of many studies have shown that there is a close relationship between the level of yield and the mass of the vegetative apparatus of any agricultural crops. This issue is of particular importance in the conditions of southern Ukraine, where by the period of full ripeness in most cultivated crops a significant part of the leaf apparatus dies off.

The growth rates of the aboveground mass of plants clearly demonstrate the internal processes occurring in their organism. It is by the growth rates of the aboveground mass that one can judge the influence of a particular factor on the plant. The growth rates of plants in height, both in absolute and relative terms, vary significantly depending on the conditions of the external environment. But there are also a number of regularities. In the first 10-14 days after the emergence of seedlings, the average daily growth in height is relatively intense (1.2-1.4 cm). In the next one or two weeks, the growth of plants in height stops and is only about 0.2 cm per day. This is due to the fact that during this period, nodular roots are formed in corn and growth in height slows down. Subsequently, the growth rates in height gradually increase and reach a maximum, as a rule, 7-10 days before the panicles are thrown out. In some years, under favorable conditions, two maxima are observed in the rate of plant height growth: the first - 22-24 days of vegetation, the second - 7-10 days before panicle ejection. Often, at the first maximum, the absolute increase in height is greater than at the second. At the end of the panicle ejection phase, the rate of plant growth decreases sharply.

Among the various factors that affect plant height growth, the decisive place belongs to the level of mineral nutrition. Mineral fertilizers contribute to faster growth and development of plants in the initial period, stimulate much more intensive development of the root system. Plants on fertilized areas bush better, have a greater number of nodal roots, a greater linear height and leaf surface area.

In our studies, we set the goal of investigating changes in the height of corn hybrid plants depending on foliar feeding with microfertilizers Rosalik and Black Jack in different phases of development (Table 2).

Our research results over the years of research have shown that the height of corn plants varied significantly depending on the maturity group, in particular in the group of early-ripening hybrids it was: DKC 3247 - 256.6 cm, DKC 3805 - 236.5 cm, medium-early: DKC 3402 - 285.7 cm, DKC 3796 - 266.6 cm, medium-ripening: DKC 3969- 267.0 and DKC 3972 - 260.1 cm.

When foliar feeding with Rozalik microfertilizer in the 5-7 leaf phase of corn, the plant height was: DKC 3247 - 260.8 cm, DKC 3805 - 246.5 cm, DKC 3402 - 286.5 cm, DKC 3796 - 277.3 cm, DKC 3969 - 285.8 and DKC 3972 - 280.7 cm, and with a double application of this microfertilizer in the 5-7 and 10-12 leaf phases, the plant height of the

Table 2

Plant height depending on foliar feeding with microfertilizers, cm (average for 2023-2024)

Hybrid name	Control	Rosalik		Black Jack	
		5-7 leaves	5-7+10-12 leaves	5-7 leaves	5-7+10-12 leaves
Early-ripening group					
DKC 3805	236,5	246,5	246,7	247,2	255,5
DKC 3247	256,6	260,8	267,9	264,5	266,3
Middle -ripening group					
DKC 3796	266,6	277,3	278,7	274,7	275,0
DKC 3402	285,7	286,5	292,5	286,9	287,8
Mid-season group					
DKC 3972	260,1	280,7	285,6	279,1	285,6
DKC 3969	267,0	285,8	286,0	283,4	289,5

The source: was formed based on our own research results

studied hybrids was: DKC 3247 - 267.9 cm, DKC 3805 - 246.7 cm, DKC 3402 - 292.5 cm, DKC 3796 - 278.7 cm, DKC 3969 - 286.0 and DKC 3972 - 285.6 cm. The use of microfertilizer Black Jack in the 5-7 leaf phase also provided an increase in plant height by 1.2-19.0 cm. Double application of microfertilizer Black Jack in the 5-7 and 10-12 leaf phases increased plant height by 2.0-24.4 cm compared to the control.

As the results of our research over two years have shown, the maximum increase in corn plant height was recorded in the variants where these microfertilizers were applied twice. It should be noted that from the first days of vegetation, we observed the superiority of plant growth indicators in areas fertilized with microfertilizers.

Also, we noted the relationship between plant height and the height of attachment of cobs. The effect of foliar feeding with microfertilizers Rozalik and Black Jack is given in Table. 3.

Table 3

The effect of foliar top dressing on the height of the cobs, cm (average for 2023-2024)

Hybrid name	Control	Black Jack		Rosalik	
		5-7 leaves	5-7+10-12 leaves	5-7 leaves	5-7+10-12 leaves
Early-ripening group					
DKC 3247	84,6	85,4	86,5	88,7	91,0
DKC 3805	73,8	91,7	92,4	86,1	87,2
Middle -ripening group					
DKC 3402	102,6	103,7	105,6	108,0	108,0
DKC 3796	98,5	100,8	101,4	101,6	103,8
Mid-season group					
DKC 3969	95,2	103,8	112,1	108,4	110,8
DKC 3972	95,3	104,4	111,6	108,8	110,1

The source: was formed based on our own research results

An important condition for the formation of a high yield is the accumulation of a large vegetative mass of plants, starting from the first phases of development. The absolute increase in the above-ground mass of corn plants (green mass and dry matter) largely depends on the temperature regime and moisture conditions. However, the nature of the increase in the above-ground mass, regardless of weather conditions, is approximately the same.

With the extension of the duration of the growing season, the height of the cobs also increases: DKC 3247 - 84.6 cm, DKC 3805 - 73.8 cm, DKC 3402 102.6 cm, DKC 3796 - 98.5 cm, DKC 3969 - 95.2 cm and DKC 3972 - 95.3 cm.

When applying microfertilizers Rosalik and Black Jack, a similar trend was observed, as in the height of plants.

Thus, foliar feeding with microfertilizers provides an increase in the linear dimensions of plants and increases the height of the cobs on the plant.

In Ukraine, the zone of significant damage covers the forest-steppe and northern steppe zones. The caterpillar damages corn, hemp, millet, hops, sunflower, develops on thick-stemmed weeds.

Appearance. The butterfly is 25-31 mm in size, the male's front wings are brownish-brown with a wide light serrated stripe along the outer edge and a dark spot near the middle of the front edge; the female's front wings are lighter, white-yellow or light brown. The caterpillar is 19-24 mm, gray-yellow with a red tint and a longitudinal stripe on the back; the head and scutellum are brown. The pupa is 17-19 mm long, yellow-brown with four hooked spines on the cremaster.

The combination of resistance to lodging, diseases and pests, and growth intensity in one genotype allows obtaining hybrids that will be grown using environmentally friendly technologies, because they do not require chemical protection [1, 6, 12].

The corn stem borer is a hygrophilous and polymorphic pest, it causes the greatest damage in years with sufficient moisture. In addition to corn, it damages more than 150 plant species. Favorable conditions for the development of the butterfly are in areas with temperatures in June-August above 20ºC and precipitation during this period of 200 mm or more.

The number of fallen plants increases in years of mass development of the stem borer. Damage caused by the pest (corn stem borer) contributes to lodging of the stem, broken cobs and stems - as a result of feeding the pest caterpillars, are one of the causes of additional crop losses.

This pest in Ukraine develops in one generation. The flight of butterflies begins from June to the end of July (the total sum of temperatures required for the development of one generation is 711 ºC). Increasing the saturation of the crop rotation with corn to 40% and monocultural cultivation of this crop leads to an increase in the harmfulness of the stem borer.

The characteristics of the resistance of corn hybrids to damage by the stem borer and lodging depending on foliar feeding with micronutrients are given in Table 4.

Table 4

The influence of foliar feeding on the resistance of corn hybrids to the stem borer and lodging (average for 2023-2024)

№	Hybrid name	Control (without fertilizers)	Rosalik		Black Jack	
			5-7 leaves	5-7+10-12 leaves	5-7 leaves	5-7+10-12 leaves
Number of plants damaged by corn stem borer, %						
Early-ripening group						
1.	DKC 3805	8,9	5,4	7,4	9,9	8,0
2.	DKC 3247	17,6	9,9	4,9	11,4	5,4
Middle -ripening group						
3.	DKC 3402	26,9	24,9	24,1	17,5	19,9
4.	DKC 3796	17,1	12,0	14,6	6,9	3,4
Mid-season group						
5.	DKC 3969	18,2	6,2	4,4	1,9	5,9
6.	DKC 3972	10,1	3,9	9,9	0,1	1,9
Mid-season group,*%*						
Early-ripening group						
1.	DKC 3805	6,9	4,9	6,6	7,4	6,9
2.	DKC 3247	23,9	19,9	2,4	10,4	4,9
Middle -ripening group						
3.	DKC 3402	0,0	14,6	14,9	11,3	16,6
4.	DKC 3796	7,1	9,9	10,2	6,6	3,2
Mid-season group						
5.	DKC 3969	6,3	1,9	4,1	0,0	5,4
6.	DKC 3972	2,2	1,9	1,9	0,0	1,5

The source: was formed based on our own research results

The main reason for lodging and drooping of corn hybrids in 2023-2024 was their damage by the stem borer.

The yield of corn is influenced by such characteristics as: the number of rows of grains, the number of grains in a row, the weight of 1000 grains, the yield of grain per cob and the number of plants per unit area.

The data of the conducted studies revealed the dependence of the yield structure of corn hybrids of different maturity groups on foliar feeding with microfertilizers Rozalik and Black Jack in different phases of corn growth and development.

The characteristics of the yield structure depending on foliar feeding in the studied corn hybrids are presented in Table 5.

As the results of our data in Table 5 showed, the number of rows of grains in the studied hybrids in the control ranged from 12.6 to 16.4 pcs., when foliar feeding with Rosalik microfertilizer in the 5-7 leaf phase, the number of rows of grains was 13.2-16.8 pcs., and with a double application of this microfertilizer - 13.8-16.4 pcs.

The use of Black Jack microfertilizer in the 5-7 leaf phase provided the value of the number of rows of grains at the level of 12.6-16.6 pcs., and with a double application of this microfertilizer - 12.8-16.5 pcs.

Table 5

Characteristics of the elements of the yield structure depending on foliar feeding, for 2023-2024.

№	Hybrid name	Control	Rosalik		Black Jack	
			5-7 leaves	5-7+10-12 leaves	5-7 leaves	5-7+10-12 leaves
NRG*, number						
Early-ripening group						
1.	DKC 3805	14,7	15,2	14,9	14,9	14,9
2.	DKC 3247	12,6	13,2	13,8	12,6	12,8
Middle -ripening group						
3.	DKC 3402	16,3	15,4	15,4	15,6	16,3
4.	DKC 3796	16,0	16,7	15,5	15,6	15,8
Mid-season group						
5.	DKC 3969	16,3	19,9	15,5	15,9	15,8
6.	DKC 3972	16,4	16,8	16,4	16,6	16,5
NGR**, number						
Early-ripening group						
1.	DKC 3247	39,9	45,7	43,5	41,6	41,7
2.	DKC 3805	39,6	39,6	42,6	40,9	41,2
Middle -ripening group						
3.	DKC 3402	40,2	43,2	43,3	42,5	41,9
4.	DKC 3796	40,1	44,2	45,2	47,9	46,8
Mid-season group						
5.	DKC 3969	41,2	41,4	42,6	41,2	41,3
6.	DKC 3972	38,9	43,9	42,6	42,5	42,3
Маса 1000 зерен, г						
Early-ripening group						
1.	DKC 3247	220,9	231,2	234,6	226,3	229,2
2.	DKC 3805	203,3	213,8	217,9	220,2	224,8
Middle -ripening group						
3.	DKC 3402	230,5	257,9	265,8	251,5	269,4
4.	DKC 3796	229,7	256,3	265,3	251,4	261,5
Mid-season group						
5.	DKC 3969	247,9	270,5	276,7	280,1	283,8
6.	DKC 3972	235,6	244,2	242,9	243,1	239,6

*Note: *NRG – number of rows of grains on the ear; **NGR – number of grains in a row.*
The source: was formed based on our own research results

The weight of 1000 grains in the studied hybrids ranged from 203.3-247.9 g.

For the hybrid DKC 3247 in the control, the weight of 1000 seeds was, on average over the years of the study, 220.9 g, with the application of the Black Jack microfertilizer in the 5-7 leaf phase - 226.3 g, with a double application of Black Jack in the 5-7 and 10-12 leaf phase of corn - 229.2 g. The use of the Ecolist mono zinc microfertilizer in the 5-7 leaf phase of corn increased the weight of 1000 seeds compared to the control by 9.2 g, and with a double application - by 13.6 g. This trend also applies to other studied corn

hybrids. When applying the Black Jack microfertilizer in the phase of 5-7 leaves of corn, the number of grains in a row in the hybrid DKC 3796 was 47.9 pcs., and with a double application - 46.8 pcs., with the application of the Rozalik microfertilizer - 44.2 and 45.2 pcs.

Therefore, it can be concluded that the use of foliar feeding with microfertilizers of corn crops significantly affects the value of the elements of the crop structure. Such characteristics as the mass of 1000 seeds and the number of grains in a row increased when applying microfertilizers.

As for the number of rows of grains, the studied corn hybrids reacted ambiguously by changing this indicator when applying different microfertilizers.

Foliar feeding is an effective and efficient way to provide plants with the necessary nutrients and reduce the negative impact of stresses throughout the growing season. When used correctly, foliar fertilization can be a more accurate tool for eliminating deficiencies compared to soil fertilization, since nutrients will flow directly to the plant tissue at critical stages of development.

However, it is worth remembering that foliar fertilization does not replace soil fertilization, but can effectively supplement the main nutrition program to improve crop yield and quality.

Foliar fertilization with fertilizers and biostimulants is usually used to:

Eliminate deficiencies caused by limited nutrient absorption by the root system as a result of soil and climatic factors or the lack of appropriate nutrients in the soil.

Reduce the negative effects of stress in case of damage and slowing down growth processes or to increase stress resistance.

Optimize the nutrition system to provide plants with nutrients during critical peak periods of nutrient demand to achieve maximum productivity and improve crop quality in intensive crop growing technologies.

Foliar fertilization allows you to control the growth and development of plants and their productivity. For example, applying microfertilizers Rosalik and Black Jack in the 5-7 and 10-12 leaf phase on corn hybrids of different maturity groups allows you to increase the indicators of crop structure elements, which ultimately affects the yield.

One of the main indicators in crop production is productivity, or the average yield of one plant and the crop as a whole. Based on the productivity data of one plant, it is not difficult to calculate the yield per hectare, knowing the sowing density.

Corn productivity has its own components and includes: the number of stems per 1 ha, the number of rows of grains (NGR), the number of grains in a row (NRG), the average number of grains per ear, the number of normally developed ears and the mass of 1000 grains.

There are genetic correlations between the components of the crop, and selection by components is selection for the yield itself.

Corn hybrids have a grain yield index of over 40%, while for varieties of this crop it is about 25%.

When determining the yield, we paid attention to the grain moisture, which also

changed depending on the sowing dates. The harvesting grain moisture determines the energy costs for bringing corn to standard moisture.

The characteristics of hybrids in terms of grain yield and grain moisture depending on foliar feeding are given in Table 6.

Table 6

Grain yield of corn hybrids depending on foliar feeding, (for 2023-2024)

№	Hybrid name	Control (without fertilizing)	Rosalik		Black Jack	
			5-7 leaves	5-7+10-12 leaves	5-7 leaves	5-7+10-12 leaves
Yield, t/he						
Early-ripening group						
1.	DKC 3247	5,17	6,20	6,31	6,2	6,60
2.	DKC 3805	6,31	6,74	6,87	6,88	6,98
Middle -ripening group						
3.	DKC 3402	8,53	8,92	9,02	8,82	9,34
4.	DKC 3796	7,92	8,90	8,76	8,13	8,43
Mid-season group						
5.	DKC 3969	8,64	8,81	9,24	8,74	8,91
6.	DKC 3972	8,81	8,92	8,98	8,85	8,86
HIP_{05}, t/he. A			*0,15*		*0,17*	
B			*0,07*		*0,08*	
AB			*0,16*		*0,18*	
Pre-harvest grain moisture, %						
Early-ripening group						
1.	DKC 3247	19,0	21,8	22,5	20,5	20,1
2.	DKC 3805	20,9	21,9	20,9	21,3	21,4
Middle -ripening group						
3.	DKC 3402	24,4	25,3	25,0	24,5	24,8
4.	DKC 3796	23,3	23,4	23,9	23,4	23,3
Mid-season group						
5.	DKC 3969	26,4	26,5	27,3	26,8	27,1
6.	DKC 3972	26,8	26,9	27,0	27,2	27,7

The source: was formed based on our own research results

The yield of hybrids (in the control) of the early-ripening group was at the level of DKC 3247 - 5.17 t/ha and DKC 3805 - 6.31 t/ha, of the medium-early group - DKC 3402 - 8.53 t/ha and DKC 3796 - 7.92 t/ha, and of the medium-ripening group - DKC 3969 - 8.64 t/ha and DKC 3972 - 8.81 t/ha. That is, with an increase in the duration of the growing season, the grain productivity of the studied hybrids also increased.

The best yield for the hybrid DKC 3247 was the variant with the application of microfertilizer Black Jack in the phase of 5-7 and 10-12 leaves of corn, while the yield was 6.60 t/ha, which is 1.42 t/ha more compared to the control, for the hybrid DKC 3969 the best yield (9.24 t/ha) was obtained with the application of microfertilizer Rozalik in the phase of 5-7 and 10-12 leaves.

Thus, the application of foliar top dressing allows to significantly increase the level of productivity of corn hybrids of different maturity groups.

Conclusions and prospects for further research. Domestic scientists do not have a common opinion on the influence of microfertilizers on the manifestation of the morphological structure of the crop, the growth and development of plants and the productivity of corn hybrids of different maturity groups.

The duration of the growing season is one of the most valuable characteristics of corn hybrids, which allows for the effective use of the agroclimatic potential of the territory and determines the possibility of growing hybrids in different soil and climatic zones. Corn hybrids differed significantly in the duration of the growing season. Thus, in particular, in the group of early-ripening hybrids it was 115-116 days, in the group of medium-early - 121-126 days, and medium-ripening - 136-141 days. The use of microfertilizers Rosalik and Black Jack contributes to the extension of the growing season by 1-3 days compared to the control variants without foliar feeding.

The height of corn plants varied significantly depending on the maturity group, in particular in the group of early-ripening hybrids it was: DKC 3247 - 257.6 cm, DKC 3805 - 237.5 cm, medium-early: DKC 3402 - 286.7 cm, DKC 3796 - 267.6 cm, medium-ripening: DKC 3969 - 268.0 and DKC 3972 - 261.1 cm.

With the extension of the growing season, the height of the ear planting also increases: DKC 3247 - 85.6 cm, DKC 3805 - 74.8 cm, DKC 3402 - 103.6 cm, DKC 3796 - 99.5 cm, DKC 3969 - 96.2 cm and DKC 3972 - 96.3 cm. Foliar fertilization with microfertilizers ensures an increase in the linear dimensions of plants and increases the height of the ear planting on the plant.

The use of foliar fertilization with Rosalik and Black Jack microfertilizers helps to reduce the number of plants damaged by the corn stem borer and increase resistance to stem lodging.

The use of foliar fertilization with microfertilizers of corn crops significantly affects the value of the elements of the crop structure. Such signs as the weight of 1000 seeds and the number of grains in a row increased when applying microfertilizers. The studied corn hybrids reacted ambiguously to the change in the number of grain rows when applying microfertilizers Rosalik and Black Jack.

In the control, the yield of hybrids of the early-ripening group was at the level of DKC 3247 - 5.17 t/ha and DKC 3805 - 6.31 t/ha, of the medium-early group - DKC 3402 - 8.53 t/ha and DKC 3796 - 7.92 t/ha, and of the medium-ripening DKC 3969 - 8.64 t/ha and DKC 3972 - 8.81 t/ha. That is, with an increase in the duration of the growing season, the grain productivity of the studied hybrids also increased. The use of foliar feeding allows you to significantly increase the productivity of corn hybrids of different maturity groups and does not affect the starch content, but the increase in yield affects the overall starch yield.

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АНОТАЦІЯ

АГРОЕКОЛОГІЧНЕ ОБГРУНТУВАННЯ ШКОДОЧИННИХ ОРГАНІЗМІВ ТА ВПЛИВ ПОЗАКОРЕНЕВИХ ПІДЖИВЛЕНЬ НА ПРОДУКТИВНІСТЬ КУКУРУДЗИ НА ЗЕРНО ПРИ ПІДГОТОВЦІ ЗДОБУВАЧІВ ВИЩОЇ ОСВІТИ

У статі наведені результати вивчення впливу внесення мікроелементів у підживлення кукурудзи у різні фази на показники урожайності та стійкості до стеблового метелика. Дослідження проводились впродовж 2023-2024 рр. в умовах ТОВ «Органік-Д» на сірих лісових ґрунтах, легкосуглинкового механічного складу.

Встановлено, що застосування позакореневих підживлень відіграють важливу роль у всіх важливих процесах життєдіяльності рослин у поділі клітин та синтезі білків, підвищують активність ферментів, є важливою складовою клітинної оболонки, допомагають накопичувати хлорофіл у рослинах та істотно впливає на продуктивність гібридів кукурудзи, морфологічні ознаки рослин кукурудзи, імунологічний стан та продуктивність досліджуваних гібридів.

Крім того, не встановлено залежності між внесенням мікроелементів у підживлення в фазі 5-7 листків та 10-12 листків кукурудзи та вмістом крохмалю. Цей показник більшою мірою залежав від індивідуальної характеристики гібриду та погодно-кліматичних особливостей

конкретного року досліджень. Тривалість вегетаційного періоду - це одна із найбільш цінних ознак у гібридів кукурудзи, яка дозволяє ефективно використовувати агрокліматичний потенціал території і визначає можливість вирощування гібридів у різних ґрунтово-кліматичних зонах. Гібриди кукурудзи істотно відрізнялися за тривалістю вегетаційного періоду. Так, зокрема у групі ранньостиглих гібридів він становив 115-116 днів, у групі середньоранніх – 121-126 днів, середньостиглих - 136-141 дні. Застосування мікродобрив Розалік та Блек Джек сприяє подовженню вегетаційного періоду на 1-3 дні порівняно із контрольними варіантами без позакореневих підживлень.

Застосування позакореневих підживлень мікродобривами Розалік та Блек Джек сприяє зменшенню кількості пошкоджених рослин стебловим кукурудзяним метеликом і підвищенню стійкості до стеблового вилягання.

На контролі урожайність гібридів ранньостиглої групи знаходилась на рівні ДКС 3247 - 5,17 т/га та ДКС 3805 - 6,31 т/га, середньоранньої групи - ДКС 3402 - 8,53 т/га та ДКС 3796 – 7,92 т/га, а середньостиглої ДКС 3969 - 8,64 т/га та ДКС 3972 - 8,81 т/га. Тобто при збільшенні тривалості вегетаційного періоду збільшувалася і зернова продуктивність досліджуваних гібридів. Отже, внесення позакореневих підживлень у складі сучасних добрив Розалік та Блек Джек дозволяє суттєво збільшувати рівень продуктивності гібридів кукурудзи різних груп стиглості та не впливає на вміст крохмалю, але збільшення урожайності позначається на загальному показнику виходу крохмалю.

Ключові слова: *кукурудза, зерно, мікроелементи, позакореневі підживлення, система удобрення, висота рослин, висота кріплення качанів, силос, урожайність, фітофаги, вилягання, елементи структури врожаю, догляд за посівами.*

Табл.6. Літ. 15.

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