Chapter 9

MORPHOLOGICAL PARAMETERS OF CORN HYBRIDS FROM DIFFERENT FAO GROUPS DEPENDING ON TECHNOLOGICAL ELEMENTS UNDER DRIP IRRIGATION

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INTRODUCTION

The rapid growth in corn production is attributed to its high feed, food, and technical qualities, as well as an exceptionally positive response to modern technological developments, including the use of precision irrigation. Key elements of the cultivation technology for different maturity group hybrids of corn include plant density and the use of cutting-edge growth-regulating agents, allowing for the most effective utilization of the agroecological potential of southern Ukraine[1].

Southern Ukraine is a unique region where the effectiveness of any agricultural intervention is influenced by the level of moisture supply. Unpredictable responses of different corn hybrids are possible due to the region's climate peculiarities, necessitating adjustments in the cultivation technology in the required direction[2].

1. Biometric indicators of corn hybrids of different FAO groups depend on the elements of technology

The productivity of cultivating agricultural crops, including corn, significantly depends on adhering to the fundamental element of technology –

[1] Гадзало Я. М., Вожегова Р. А., Коковіхін С. В., Біляєва І. М., Дробітько А. В. Наукове обґрунтування технологій вирощування кукурудзи на зрошуваних землях із урахуванням гідротермічних чинників і змін клімату. *Зрошуване землеробство: збірник наукових праць*. 2020. № 73. С. 21–26. DOI: https://doi.org/10.32848/0135-2369.2020.73.3

[2] Коковіхін С. В., Писаренко П. В., Біднина І. О., Шарій В. О., Бойценюк Х. І. Науково-практичні аспекти планування та оперативного управління режимами зрошення сільськогосподарських культур із використанням інформаційних технологій. *Зрошуване землеробство:* збірник наукових праць. 2020. № 73. С. 43–49. DOI: https://doi.org/10.32848/0135-2369.2020.73.8

planting density. Plant density affects the supply of corn plants with the essential factors of life, namely, heat and moisture, and consequently, their growth and development. The formation of optimal linear dimensions of plants is not only about suitability for mechanized cultivation and harvesting but also a component of the photosynthetic system, which determines the amount of organic matter produced during photosynthesis[3].

It is known that for suitability for mechanized harvesting, the height of corn plants and the height of ear attachment play a role[4]. Studies have demonstrated that the height of ear attachment is in a strong positive correlation with the height of plants[5, 6]. Plant height and ear attachment in corn are integral features of the biological characteristics of hybrids and are always in certain proportions with other morphological features characteristic of a specific genotype group of hybrids. These are essential indicators of plant response to cultivation conditions[7, 8]. These features affect the quality of harvesting, its speed, and energy consumption. The taller the plants, the higher the harvesting costs. Therefore, it's important for grain-type hybrids to have shorter plant heights (250–275 cm) and optimal (not less than 50 cm) ear attachment[9].

Plant height and ear attachment height depend on the biological characteristics of plants and the conditions of their cultivation. The absence of

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[3] Vozhehova Raisa, Marchenko Tetiana, Lavrynenko Yurii, Piliarska Olena, Sharii Viktor, Borovik Vira, Tyshchenko Andrii, Kobyzieva Liubov, Gorlachova Olga, Mishchenko Serhii. Models of quantitative assessment of the influence of elements of technology on seed yield of parental components of maize hybrids under irrigation conditions. *Scientific Papers. Series A. Agronomy*, 2023 Vol. LXVI, No. 1, 623–630. ISSN 2285-5785. URL: https:// agronomyjournal.usamv.ro/pdf/2023/issue_1/vol2023_1.pdf

[4] Зозуля О. Л., Паламарчук В. Д., Мазур В. А. Кукурудза, створення та вирощування гібридів. Вінниця : ФОП Данилюк, 2009. 199 с.

[5] Паламарчук В. Д., Паламарчук О. Д., Колісник О. М. Селекція та створення гібридів кукурудзи, придатних до механізованого вирощування та виробництва альтернативних джерел енергії. *Хранение и переработка зерна. Научно-практический журнал*. № 2 (128). 2010. С. 23–25.

[6] Паламарчук В. Д., Поліщук І. С., Каленська С. М., Єрмакова Л. М. Біологія та екологія сільськогосподарських рослин. Вінниця, 2013. 636 с.

[7] Каменщук Б. Д. Агроекологічний вплив умов вирощування на зернову продуктивність гібридів кукурудзи різних груп стиглості. *Стан та перспективи розвитку рослинницької галузі в умовах змін клімату* : тези доповідей 4 Міжнар. наук.-практ. конф. молодих вчених (1–3 липня 2009 р.). Харків, ІР ім. В. Я. Юр'єва УААН, 2009. С. 125–126.

[8] Сіроха О. Л. Вплив удобрення на біометричні показники та показники вирівняності рослин кукурудзи різної групи стиглості. *Збірник наукових праць Вінницького національного аграрного університету. Серія: Сільськогосподарські науки*. Вінниця. 2014. Вип. 5 (82). С. 37–47.

[9] Marchenko T. Yu. Innovative elements of cultivation technology of corn hybrids of different FAO groups in the conditions of irrigation. *Natural sciences and modern technological solutions: knowledge integration in the XXI century: collective monograph* Lviv – Torun : Liha-Pres, 2019. P. 137–153. DOI: doi.org/10.36059/978-966-397-154-4/135-152.

moisture in the soil and high temperatures reduce both plant height and ear attachment height[10].

Additionally, plant height and ear attachment height have a significant impact on the resistance of corn plants to lodging. Plant height has a reverse correlation with the degree of stem rot infection (although it's relatively low). However, a positive correlation has been established between plant lodging and ear attachment height. These factors need to be considered when developing an optimal hybrid model. Clearly, shifting the center of gravity of plants higher above the ground in genotypes with higher ear placement reduces the mechanical stem breakage due to diseases and damage. Therefore, ear attachment height should have certain limitations, but optimal parameters for ear placement need to be determined for specific genotype groups and, primarily, for hybrids with different vegetation periods. Plant height and ear attachment height depend on the biological characteristics of plants and the conditions of their cultivation[11].

Research on the Changes in Morphological Indicators and Yield of Corn Hybrids Depending on Planting Density and the Use of Bio-Preparations is essential and relevant. It especially demands studying the correlation between morphological indicators and grain yield of innovative corn hybrids under the conditions of a new irrigation method – drip irrigation.

The research results have established a significant relationship between the linear dimensions of plants, genetic features of the hybrid, plant density, and the application of bio-preparations (Table 1).

According to the consolidated research data, it has been established that the height of corn hybrids significantly depends on the duration of their vegetation period. For instance, in early-maturing corn hybrid "Stepoviy", the average plant height over three years was 229.2 cm, in the mid-maturing hybrid "Kakhovskiy", it was 267.7 cm, and in the group of mid-late hybrids, "Chongar" and "Arabat", it was 280.2 cm and 279.3 cm, respectively. This trend shows that the extension of the vegetation period increases the plant height in corn hybrids.

Plant height is significantly influenced by the application of bio-preparations in corn hybrids. The maximum plant height was obtained through the application of bio-preparations. Over three years, the plant height for "Khelaft kombi" treatment averaged 265.6 cm, and for "Bio-gel" treatment, it

[10] Сікалова О. В., Івлева Т. В., Деркач І. Б., Чернобай Л. М. Новий вихідний матеріал кукурудзи з комплексом цінних селекційних ознак та властивостей. *Генетичні ресурси рослин.* 2011. № 9. С. 131–137.

[11] Лавриненко Ю. О., Плоткін С. Я. та ін. Адаптивна характеристика нових гібридів кукурудзи. *Таврійський науковий вісник* : збірник наукових праць ХДАУ. Херсон : Айлант, 2007. Вип. 52. С. 76–82.

was 264.1 cm. The height increment compared to the control variant was 2.9 cm and 1.4 cm, respectively.

Table 1

Plant height of corn hybrids depending on plant density and the action of biological preparations, cm (average for 2018–2020)

Hybrid (Factor A)	Plant Density thousands of plants/ha (Factor B)	Treatment with Preparations (Factor C)			Average for Factor	
		Control, no treatment	Bio-Gel	Helafit Combi	A	B
Stepovyi (FAO 190)	70	223,9	224,2	225,6	229,2	224,6
	80	228,9	230,7	232,8		230,8
	90	230,8	232,5	233,7		232,3
Average		**227,9**	**229,1**	**230,7**		
Kakhovskyi (FAO 380)	70	263,5	265,4	266,8	267,7	265,2
	80	264,8	266,4	267,7		266,3
	90	270,7	271,2	272,9		271,6
Average		**266,3**	**267,7**	**269,1**		
Chongar (FAO 420)	70	272,2	275,8	276,7	280,2	274,9
	80	277,7	278,5	280,7		279,0
	90	284,8	286,5	286,4		285,6
Average		**278,2**	**280,3**	**281,9**		
Arabat (FAO 430)	70	270,5	271,1	272,3	279,3	271,3
	80	279,3	280,4	281,6		280,4
	90	284,9	286,3	287,8		286,3
Average		**278,3**	**279,3**	**280,6**		
Average for Factor C		**262,7**	**264,1**	**265,6**		
Significance Assessment of Partial Differences						
HIP_{05}, см		A=6,52–6,73; B=2,12–2,59; C=1,12–1,19				

Regarding plant height at different planting densities, higher plant density leads to increased linear plant height, with the maximum height observed at a density of 90,000 plants per hectare.

The maximum plant height of 287.8 cm was observed in the hybrid “Arabat” at a planting density of 90,000 plants per hectare and with the treatment of the “Khelaft kombi” preparation.

Analyzing previous studies on the line-parent components of the hybrids being researched, it is possible to make a comparison between the lines and the hybrids created based on them. In the parent component lines, plant height depended on the plant's genotype rather than the vegetation period's duration. In the hybrids created using these lines, plant height increased with a longer vegetation period. The application of bio-preparations increased plant height in both the parent components and the hybrids. Higher plant density leads to increased linear plant height in both the parent components and the hybrids.

In our research, there was a clear pattern of increased attachment height of the upper (productive) ear on the plant with increased planting density from 70,000 to 90,000 plants per hectare (Table 2).

Table 2

Height of attachment of the upper (productive) ear of corn hybrids depending on plant density and the action of biological preparations, cm (average for 2018–2020)

Hybrid (Factor A)	Plant Density thousands of plants/ha (Factor B)	Treatment with Preparations (Factor C)			Average for Factor	
		Control, no treatment	Bio-Gel	Helafit Combi	A	B
Stepovyi (FAO 190)	70	95,1	96,1	96,5	97,1	95,9
	80	95,8	96,3	96,7		96,3
	90	98,1	99,7	99,9		99,2
Average		**96,3**	**97,4**	**97,7**		
Kakhovskyi (FAO 380)	70	106,4	107,3	107,9	108,1	107,2
	80	107,6	108,3	108,5		108,1
	90	108,7	108,9	109,5		109,0
Average		**107,6**	**108,2**	**108,6**		
Chongar (FAO 420)	70	118,7	119,1	119,8	120,4	119,2
	80	119,9	120,5	121,6		120,7
	90	120,5	121,3	122,4		121,4
Average		**119,7**	**120,3**	**121,3**		
Arabat (FAO 430)	70	119,9	120,2	121,5	122,9	120,5
	80	122,6	123,7	124,6		123,6
	90	123,5	124,6	125,4		124,5
Average		**122,0**	**122,8**	**123,8**		
Average for Factor C		**111,4**	**112,2**	**112,9**		
Significance Assessment of Partial Differences						
HIP_{05}, см		A=4,52–4,73; B=1,06–1,19; C=0,17–0,25				

In the average for the years of research, the hybrid “Stepoviy” (FAO 190) showed a 3.4 % increase in ear attachment height, indicating a stronger response to higher planting density in early-maturing hybrids. The mid-maturing hybrid “Kakhovskiy” and the mid-late hybrids “Chongar” displayed an ear attachment height increase of 1.6 % to 1.8 % with increased plant density from 70,000 to 90,000 plants per hectare, indicating a minor response to higher density for these hybrids.

Among the studied hybrids, the tallest ear attachment height was observed in the mid-late hybrid “Arabat”, with an average of 122.9 cm, while the shortest height was observed in the hybrid “Stepoviy” at 97.1 cm.

On average in the study, the application of bio-preparations influenced the height of ear attachment: in the control variant – 111.4 cm, “Bio-gel” increased ear attachment height by 0.8 cm or 0.7 %, and “Khelaft kombi” increased it by 1.5 cm or 1.3 %.

The height of ear attachment changed in both the parent components and the hybrids created based on them. In dense plantings, ears were positioned higher on the plant stems than in sparse variants. The application of bio-preparations increased the height of ear attachment in both the parent components and the hybrids. However, unlike the parent components, where ear attachment height was not dependent on the FAO group, in the hybrids created based on them, ear attachment height was influenced by the duration of the vegetation period.

We conducted the identification of hybrids based on the characteristic: “plant: ratio of ear attachment height to plant height”. The index for the studied hybrids ranged from 0.402 to 0.446 (Table 3).

In order to investigate the correlation between the morphological parameters of maize hybrid plants, coefficients of correlation were determined between the height of the plants, the height at which the cobs were attached, and the index of their relationship.

According to the literature sources[12, 13, 14] there is a positive correlation between the height of the plant and the height at which the cobs are attached in maize hybrids, but it is not stable over the years and varies within the range of 0.270–0.880. In the studies conducted by V. Yu. Cherchel, V. A. Marochko, and M. M. Tagantsova, a high level of reliability revealed a

[12] Чучмій И. П., Моргун В. В. Генетичні основи та методи селекції скоростиглих гібридів кукурудзи. Київ : Наукова думка, 1990. 284 с.

[13] Домашнєв П. П., Дзюбецький Б. В., Костюченко В. И. Селекція кукурудзи. Київ : Агропром, 1992. 208 с.

[14] Вожегова Р. А., Лавриненко Ю. О., Марченко Т. Ю., Забара П. П., Пілярська О. О. Морфологічні показники гібридів кукурудзи різних груп ФАО залежно від елементів технології за умов зрошення. *Аграрні інновації.* 2021. № 8. С. 91–99. https://doi.org/10.32848/agrar.innov.2021.8.14

correlation between these parameters (r = 0.602). The growing conditions do not lead to significant changes in these relationships[15].

Table 3

Index of the ratio of ear attachment height to plant height in corn hybrids depending on plant density and the action of biological preparations (average for 2018–2020)

Hybrid (Factor A)	Plant Density thousands of plants/ha (Factor B)	Treatment with Preparations (Factor C)			Average for Factor	
		Control, no treatment	Bio-Gel	Helafit Combi	A	B
Stepovyi (FAO 190)	70	0,425	0,429	0,428	0,423	0,427
	80	0,419	0,417	0,415		0,417
	90	0,425	0,429	0,427		0,427
Average		**0,423**	**0,425**	**0,423**		
Kakhovskyi (FAO 380)	70	0,404	0,404	0,404	0,403	0,404
	80	0,406	0,407	0,405		0,406
	90	0,402	0,402	0,401		0,401
Average		**0,404**	**0,404**	**0,403**		
Chongar (FAO 420)	70	0,436	0,432	0,433	0,429	0,433
	80	0,432	0,433	0,433		0,432
	90	0,423	0,423	0,424		0,423
Average		**0,430**	**0,429**	**0,430**		
Arabat (FAO 430)	70	0,443	0,443	0,446	0,440	0,444
	80	0,439	0,441	0,442		0,440
	90	0,433	0,435	0,436		0,434
Average		**0,438**	**0,440**	**0,441**		
Average for Factor C		**0,424**	**0,425**	**0,424**		
Significance Assessment of Partial Differences						
HIP_{05}		A=0,009–0,0012; B=0,0023–0,0029; C=0,002–0,005				

The analysis of the relationship between the biometric parameters of the plant and the 'index of the attachment height of the cobs to the plant height' showed that the formation of this index depends on the height at which the cobs are attached, with a correlation coefficient of r = 0.513. The height of the

[15] Черчель В. Ю., Марочко В. А., Таганцова М. М. Обґрунтування індексу співвідношення висоти прикріплення верхнього качана до висоти рослини гібридів кукурудзи (*Zea mays* L.). *Сортовивчення та охорона прав на сорти рослин.* 2014. № 2. С. 40–44. https://doi.org/10.21498/2518-1017.2 (23).2014.56127

plants with the 'index of attachment' provided an unstable level of dependency, characterized by a low coefficient of r = 0.199.

The correlation coefficient between the height of the plants and the height at which the cobs are attached is sufficiently high and stable, which is a predictable phenomenon (r = 0.937). There is also a sufficiently high correlation between the 'index of the attachment height of the cobs to the plant height' and the grain yield of maize hybrids (r = 0.687). Therefore, the 'index of attachment height of the cobs to the plant height' can be used not only for conducting expertise on the distinctiveness, uniformity, and stability of maize hybrids but also as an indicative feature for selecting for high grain yield.

The range of variation for the "attachment index" in maize hybrids over the years of study ranged from 0.401 (hybrid Kakhovsky with a plant density of 90,000 plants/ha and treatment with Helafit Combi) to 0.436 (hybrid Arabat with a plant density of 90,000 plants/ha and treatment with Helafit Combi). The largest fluctuations of this parameter over the years of research were observed in the Steppe hybrid (FAO 190) with a range of 0.014. The hybrid Kakhovsky showed the smallest fluctuations with a range of 0.006.

It should be noted that all hybrids exhibited a sufficiently stable expression of this trait. In other words, the ratio of cob attachment height to plant height is a genetically determined trait that can be easily identified in corn samples and can be used for describing and characterizing new materials.

2. Grain yield of maize hybrids of different FAO groups under irrigation conditions

The observations conducted indicate that grain yield is influenced by the hybrid's genotype, plant density, and the application of biological agents. It has been established that the highest grain yield was achieved by the mid-late maturity hybrid Arabat, with an average yield of 17.65 tons per hectare (t/ha) (Table 4).

The highest grain yield, on average, was observed in mid-late maturity hybrids Chongar and Arabat, ranging from 16.48 to 16.53 tons per hectare (t/ha). The application of biopreparations significantly influenced the grain yield increase compared to untreated control. The grain yield increase in Chongar and Arabat hybrids was in the range of 0.25 to 0.44 t/ha and 0.42 to 0.73 t/ha, respectively.

Among the tested preparations, Helaphyte Combo proved to be the most effective. For instance, the early-maturing hybrid Stepovyi showed the highest grain yield when using this preparation, reaching 11.53 t/ha, with a yield increase of 1.04 t/ha or 9.9 %. The mid-late maturity hybrid Kahovskyy demonstrated a grain yield of 12.77 t/ha when using Helaphyte Combo,

resulting in a yield increase of 1.14 t/ha or 9.8 %. Chongar, a mid-late maturity hybrid, achieved a grain yield of 16.71 t/ha with the use of Helaphyte Combo, representing a yield increase of 0.44 t/ha or 2.63 %. Arabat, another mid-late maturity hybrid, obtained a grain yield of 16.91 t/ha using Helaphyte Combo, with a yield increase of 0.73 t/ha or 4.31 %.

Table 4

Grain Yield of Maize Hybrids as Dependent on Plant Density and the Application of Biological Agents, t/ha (average for 2018–2020)

Hybrid (Factor A)	**Plant Density thousands of plants/ha (Factor B)**	**Treatment with Preparations (Factor C)**			**Average for Factor**	
					A	B
		Control, no treatment	**Bio-Gel**	**Helafit Combi**		
Stepovyi (FAO 190)	70	10,41	10,95	11,16	11,06	10,79
	80	10,54	11,35	11,78		11,05
	90	10,69	11,57	11,87		**11,36**
Average		**10,49**	**11,19**	**11,53**		
Kakhovskyi (FAO 380)	70	11,26	12,35	12,48	12,28	12,03
	80	11,96	12,55	12,89		**12,47**
	90	11,68	12,41	12,94		12,34
Average		**11,63**	**12,44**	**12,77**		
Chongar (FAO 420)	70	16,84	16,94	17,57	16,48	**17,20**
	80	16,81	17,18	17,36		16,97
	90	15,15	15,84	16,15		15,26
Average		**16,27**	**16,46**	**16,71**		
Arabat (FAO 430)	70	17,08	17,16	17,65	**16,53**	**17,31**
	80	16,31	16,76	17,21		16,76
	90	15,15	15,54	15,88		15,52
Average		**16,18**	**16,49**	**16,91**		
Average for Factor C		**13,64**	**14,15**	**14,48**		
Significance Assessment of Partial Differences						
$НІР_{05}$, т/га		A=2,18–2,25; B=1,17–1,19; C=0,23–0,32				

Plant density had a notable impact on the grain yield of hybrids. Optimal plant density for achieving maximum yield was determined for hybrids of different maturity groups.

The early-maturing hybrid Stepovyi achieved maximum yield at a plant density of 90,000 plants/ha, with a yield of 11.36 t/ha. Reducing plant density to 80,000 plants/ha resulted in a yield decrease of 2.72 %, and further

decreasing the density to 70,000 plants/ha led to a grain yield reduction of 5.02 %.

The mid-late maturity hybrid Kahovskyy achieved its maximum grain yield of 12.47 t/ha at a plant density of 80,000 plants/ha. Reducing the plant density to 70,000 plants/ha resulted in a yield decrease of 3.52 %, while increasing the density to 90,000 plants/ha led to a yield reduction of 1.04 %.

The mid-late maturity hybrids Chongar and Arabat attained their maximum grain yields at a plant density of 70,000 plants/ha, producing 17.20 t/ha and 17.31 t/ha, respectively. Increasing the plant density to 80,000 plants/ha caused a tendency for the grain yield of these hybrids to decrease by 1.33 % to 3.18 %. A further increase in plant density to 90,000 plants/ha resulted in a significant yield drop of 10.34 % to 11.27 % compared to the 70,000 plants/ha density.

In the study, the hybrid Arabat (FAO 420) showed its maximum grain yield at a plant density of 70,000 plants/ha with treatment using the Helaphyte Combo preparation, reaching 17.65 t/ha.

CONCLUSIONS

1. Plant growth processes in corn are significant for the formation of aboveground biomass and maximum productivity. The architecture of corn plants serves as an indicative feature of hybrid potential productivity and provides an informative foundation for assessing the effect of individual technological elements.

2. It has been established that the height of plants is significantly influenced by the duration of the plant's vegetative period. For instance, in the early-maturing corn hybrid Stepovyy, the average plant height over three years was 229.2 cm, while in the mid-early hybrid Kahovskyy, it was 267.7 cm. In the mid-late hybrids Chongar and Arabat, it reached 280.2 and 279.3 cm, respectively. This trend indicates that extending the vegetative period leads to increased plant height in corn hybrids. Additionally, it was found that plant height was significantly affected by the application of biopreparations to corn hybrids. Over the three years, the maximum plant height was achieved by treating with the Helaphyte Combo preparation, resulting in plant heights of 265.6 cm, compared to 264.1 cm for the Bio-Gel treatment. This represented an increase of 2.9 cm and 1.4 cm, respectively, compared to the control variant.

3. The height of attachment of the upper (productive) cob was influenced by the application of biopreparations. In the control variant, the attachment height was 111.4 cm. Treatment with Bio-Gel increased the attachment height by 0.8 cm or 0.7 %, while Helaphyte Combo raised it by 1.5 cm or 1.3 %.

4. The relationship between the height of cob attachment and plant height is genetically determined and provides an effective means of identifying corn samples for describing and characterizing new materials.

5. It was determined that mid-late hybrids are negatively affected by increased plant density. These hybrids achieve their maximum yields at a plant density of 70,000 plants/ha, producing 17.20–17.31 t/ha, but their yield sharply declines to 15.26–15.52 t/ha at higher planting densities. Mid-early hybrids reach maximum yields at a density of 80,000 plants/ha, producing 12.47 t/ha, while early-maturing hybrids achieve maximum yields at a density of 90,000 plants/ha, resulting in yields of 11.36 t/ha.

6. Among the biopreparations, Helaphyte Combo proved to be the most effective. For example, the early-maturing hybrid Stepovyy displayed the highest grain yield with its use, reaching 11.53 t/ha, which represented a 9.9 % increase over the control. The mid-early hybrid Kahovskyy achieved a yield of 12.77 t/ha with the application of Helaphyte Combo, an increase of 9.8 %. The mid-early hybrid Chongar reached a yield of 16.71 t/ha with the application of Helaphyte Combo, an increase of 2.63 %. The mid-early hybrid Arabat achieved a yield of 16.91 t/ha with the application of Helaphyte Combo, an increase of 4.31 %.

SUMMARY

The architecture of corn plants serves as an indicative feature of hybrid potential productivity and provides an informative foundation for assessing the effect of individual technological elements. Research on the morphological changes and yields of innovative corn hybrids under different planting densities and biopreparation treatments is essential and relevant. Particularly, the study of the relationship between morphological indicators and grain yields of innovative corn hybrids under drip surface irrigation is crucial.

It has been determined that mid-late hybrids respond negatively to increased planting densities. Mid-late hybrids achieve maximum yields at a plant density of 70,000 plants/ha, producing 17.20–17.31 t/ha, and their yields sharply decrease to 15.26–15.52 t/ha at higher planting densities. Mid-early hybrids reach their maximum yields at a density of 80,000 plants/ha, resulting in yields of 12.47 t/ha, while early-maturing hybrids achieve maximum yields at a density of 90,000 plants/ha, producing 11.36 t/ha.

Among the biopreparations, Helaphyte Combo has proven to be the most effective. For example, the early-maturing hybrid Stepovyy achieved the highest grain yield with its use, reaching 11.53 t/ha, which represented a 9.9 % increase over the control. The mid-early hybrid Kahovskyy achieved a yield of 12.77 t/ha with the application of Helaphyte Combo, resulting in a yield

increase of 9.8 %. The mid-early hybrid Chongar reached a yield of 16.71 t/ha with the application of Helaphyte Combo, achieving a yield increase of 2.63 %. The mid-early hybrid Arabat achieved a yield of 16.91 t/ha with the application of Helaphyte Combo, resulting in a yield increase of 4.31 %.

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