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BIOTECHNOLOGICAL PRACTICES FOR GROWING CORN FOR GRAIN UNDER DIFFERENT PREDECESSORS IN THE CONDITIONS OF THE UKRAINIAN STEPPE

Abstract

An important factor that determines the grain yield and productivity of corn is the previous crop. In the conditions of insufficient moisture in the Steppe region of Ukraine, the significance of the predecessor is determined by the accumulated moisture reserves. It is believed that the best predecessors for corn in the Steppe conditions are winter wheat and leguminous crops, while satisfactory ones are corn and barley, with sunflower considered a poorer predecessor. Corn can be grown in both repeated plantings and monoculture, but the agronomic practices affecting crop productivity in such crop rotations have not been studied sufficiently.

A stationary study was established in 2005 at the Institute of Agriculture of the Steppe NAAS, with soil and climatic conditions corresponding to the Northern Steppe zone of Ukraine. A simple modified mid-ripening hybrid DK Veles was sown in the study. Seed inoculation was carried out with the biopreparation Mycofriend.

The research results indicate that the predecessor was a significant factor influencing the formation of grain yield and productivity indicators of corn. When growing corn after soybeans, the average grain yield was 5.31 t/ha, after sunflower and corn predecessors it was 3.03 t/ha and 3.25 t/ha respectively, with no significant difference in yield between sunflower and corn predecessors. There was no significant increase in corn grain yield due to the action of the biopreparation factor, with a yield increase ranging from 0.01–0.06 t/ha, but a more active effect of the biopreparation was noted with the sunflower predecessor. Higher productivity indicators for grain units yield, feed units yield, and digestible protein units were achieved when growing corn after soybeans – 6.43 t/ha, 9.65 t/ha, and 0.573 t/ha

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respectively. There was no significant difference in productivity indicators between the sunflower predecessor and repeated corn cultivation. The highest indicators for grain units yield, feed units yield, and digestible protein units were obtained under the condition of seed inoculation with the biopreparation after the soybean predecessor – 6.44 t/ha, 9.68 t/ha, and 0.575 t/ha respectively.

Key words: *corn, yield, productivity, grain units yield, feed units yield, digestible protein units.*

Introduction. Corn is one of the most widespread agricultural crops in global agriculture. It is a crop with high productivity and genetic potential, characterized by high geographical adaptability, which contributes to its spread. Corn holds a strategic position in the world's grain production. In Ukraine, corn occupies leading areas and is one of the most profitable crops. [1; 3; 6; 8; 11].

An important factor that determines the yield level and productivity of corn, and which is equally important, does not affect the cost level of its cultivation, is the previous crop. In conditions of insufficient moisture in the Ukrainian Steppe, the importance of the predecessor is determined by accumulated moisture reserves, nutrient content in the soil, and microflora activity [13].

The results of many studies indicate that the best predecessors for corn in the Steppe are winter wheat and leguminous crops, while corn and barley are satisfactory predecessors. Sunflower is considered a poorer predecessor [7].

In recent years, the areas of economically attractive crops have significantly increased, with a significant portion being corn and sunflower [12].

The place of corn in modern crop rotations is determined not only by the crop's reaction to the predecessor but also by the structure of the crop rotation [9].

Scientific research has established that corn can be grown in re-repeated crops and in monoculture, but the elements of agronomy that affect the productivity of the crop in such crop rotations are insufficiently studied [7; 10].

It should be noted that corn, as a deep-rooted crop, has significant agronomic importance. Adherence to agronomy in corn cultivation helps reduce weed populations, increase soil aeration and porosity. A crucial element of crop rotation is burying the leaf-stem mass during harvesting to leave only the corn grain in the field. Corn is a good predecessor for leguminous and spring grain crops.

The interaction of fertilizers with microbial preparations and their influence on plant productivity plays an important role in forming crop yields. The effectiveness of using bio-preparations depends on their compatibility with plant physiology in specific soil-climatic conditions [14; 17].

The application of bio-preparations increases plant nutrient uptake from the soil and fertilizers, provides plants with available forms of nitrogen, phosphorus, potassium, biologically active substances, enhances plant resistance to biotic and abiotic stress factors and disease agents, stimulates active plant growth and development, and increases yields [2; 4; 5; 16].

Considering the importance of corn as a food and feed crop, its high economic efficiency and agronomic value, the availability of quality seed material on the agricultural market, and the overall concept of biological farming, there is a trend towards increasing the share of corn in short rotation crop rotations in recent years. This requires additional research and study of specific elements of corn cultivation technology in the conditions of the northern Ukrainian Steppe.

The aim of the research. To determine the yield level and productivity of corn for grain depending on the previous crop and seed treatment with a bio-preparation.

Research methodology. A stationary experiment was established in 2005 on plots after spring barley with similar natural fertility and relief. The degree of soil pollution at the agricultural laboratory station where field experiments were conducted is high, corresponding to the conditions of the northern part of the Ukrainian Steppe.

The technology of growing corn in crop rotations is generally accepted for the zone, with some practices under study.

In the study, a simple modified mid-ripening hybrid DK Veles with a well-developed leaf apparatus and remontantness was sown, making it versatile for use as grain and silage, especially in the Steppe zone. The DK Veles hybrid is characterized by high cold and drought resistance. It is resistant to downy mildew, lodging, and vegetative wilting. The originator is the Institute of Agriculture of the Steppe, National Academy of Agrarian Sciences of Ukraine. The year of state registration of intellectual property rights for distribution was 2016. FAO – 270. Intended use – grain, silage. Growing zones – Steppe, Forest-Steppe, Polissya.

Corn for grain was sown at a rate of 75 thousand seeds/ha, and at the 4–5 leaf stage, plant density was adjusted to 60–65 thousand plants/ha across all predecessors.

Seed inoculation was carried out with the Mycofriend preparation, the main advantages of which include: increasing the area of nutrient and moisture absorption by the root system, protecting plants from root rot pathogens and seed mold, and increasing yield.

Weather conditions during the years of the research were not favorable for obtaining high corn grain yields.

The formation of crop productivity during 2019–2020 occurred under dry conditions. The hydrothermal coefficient from May to September 2019 was 0.67, and in 2020 it was 0.75. Due to uneven rainfall distribution in the summer months, the hydrothermal coefficients ranged from 0.26 to 0.84 in 2019 and from 0.13 to 0.52 in 2020. The average air temperature exceeded the norm by 4.2 °C, reaching 21.8 °C, with a sum of effective air temperatures above +10 °C totaling 1802 °C and a sum of active (above +10 °C) temperatures reaching 3332 °C, which was 637 °C higher than the norm.

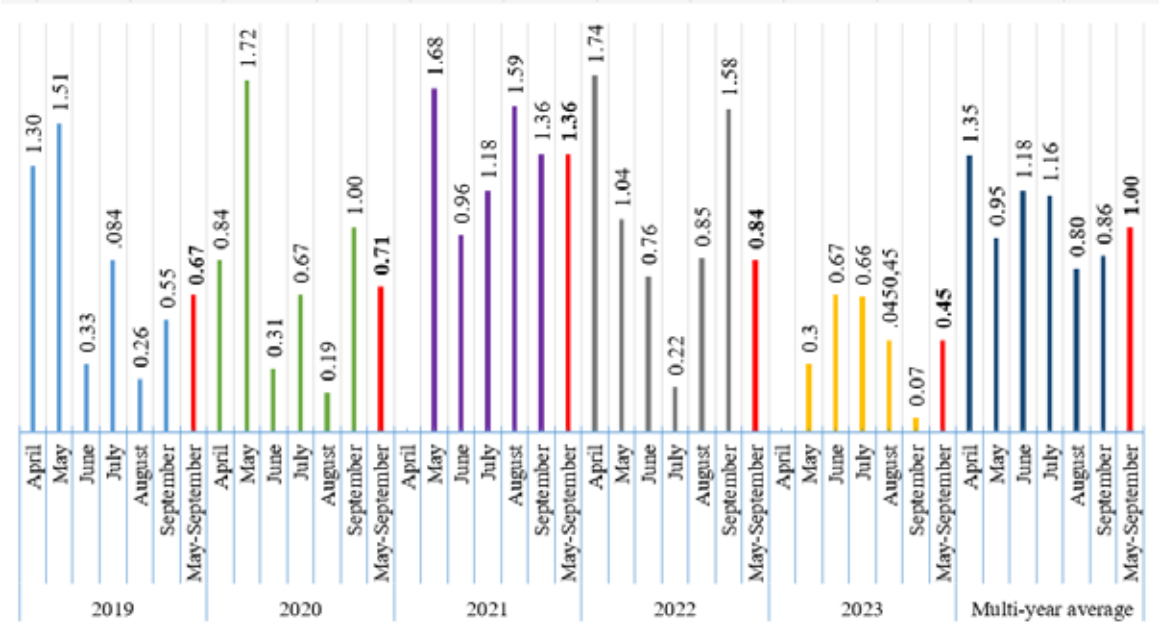

Fig. 1. Hydrometeorological indicators of the late spring crops' vegetation period, 2019–2023 (based on the data from the meteorological station of the Institute of Agriculture of the Steppe NAAS)

The most favorable weather conditions (based on the hydrothermal coefficient) were in 2021. In May and June, the coefficient was 1.68, in August – 1.18, and in September – 1.59. The period from May to September had a coefficient of 1.37, which was 0.37 higher than the norm.

The hydrothermal coefficient for the late spring crops in 2022 during the vegetation period was 0.84 (with a norm of 1.0). The weather conditions in 2023 were generally dry and not conducive to achieving high yields and productivity.

Therefore, weather conditions during the years of the research were not sufficiently favorable for obtaining high corn productivity.

The presentation of the main material of the research. The results of the impact of seed inoculation of corn with the Mycofriend biopreparation on the yield level of the DK Veles hybrid depending on the predecessors sunflower, corn, soybean are presented in Table 1.

Table 1. Corn grain yield depending on the biopreparation and predecessor, average 2019–2023

Biopreparation (factor A)	Predecessor (factor B)	Grain yield, t/ha	Difference			
			for factor A		for factor B	
			t/ha	%	t/ha	%
Without inoculation	Sunflower	3.03	–	–	–	–
	Corn	3.25	–	–	0.22	7.3
	Soybean	5.31	–	–	2.28	75.1
Seed inoculation	Sunflower	3.09	0.06	2.0	–	–
	Corn	3.27	0.02	0.6	0.18	5.7
	Soybean	5.32	0.01	0.2	2.23	72.0
LSD05, t/ha	Factor A = 0.45; Factor B = 0,55; Factors AB = 0,78					

It was found that when growing corn after soybean, the grain yield level was the highest at 5.31 t/ha. In this variant, the highest grain yield increase was obtained, +2.28 t/ha (75.1%) compared to the variant where sunflower was the previous crop, exceeding the significant difference according to LSD05 by factor B = 0.55 t/ha. There was no significant difference in grain yield between growing corn after sunflower and corn as predecessors (0.22 t/ha). Seed treatment with a biopreparation in our studies did not significantly affect the increase in corn yield of the DK Veles variety. The highest yield was recorded in the variant where corn was grown after soybeans, at 5.32 t/ha, but the effect of the biopreparation was within 0.01 t/ha (LSD05 = 0.45 t/ha). It should be noted that a significant increase in corn grain yield was not obtained with other predecessors, but after sunflower as a predecessor combined with the biological preparation Mycofriend provided an increase in yield at the level of 0.06 t/ha of grain (+0.02 t/ha by corn as a predecessor and +0.01 t/ha by soybeans).

The effectiveness of the predecessor factor decreased slightly under the influence of the biopreparation factor. With seed inoculation, the increase in grain yield per corn predecessor was 0.18 t/ha, and per soybean predecessor was 2.23 t/ha (without using the biopreparation +0.22 t/ha and +2.28 t/ha respectively).

Thus, the predecessor factor had a significant impact on corn grain yield, with a yield of 5.31 t/ha obtained when growing corn after soybeans, which was 2.06 t/ha and 2.28 t/ha higher than with corn and sunflower predecessors. The difference in yield indicators was not significant for seed treatment with the biopreparation.

One of the main factors for the objective assessment of crop production is the level of productivity.

Analysis of recent research and publications on the impact of predecessors on corn productivity shows that repeated crops corn has the lowest productivity. Our research has shown that yield of grain units from growing corn with sunflower and corn as predecessors was within a significant difference (Table 2). Furthermore, planting corn crops in the same field repeatedly contributed to slightly higher crop productivity in terms of grain units yield compared to growing corn after sunflowers, at 3.93 t/ha and 3.67 t/ha respectively.

Table 2. Grain units yield when growing corn for grain depending on the biopreparation and predecessor, average 2019–2023

Biopreparation (factor A)	Predecessor (factor B)	Grain units yield, t/ha	Difference			
			for factor A		for factor B	
			t/ha	%	t/ha	%
Without inoculation	Sunflower	3.67	–	–	–	–
	Corn	3.93	–	–	0.27	7.3
	Soybean	6.43	–	–	2.76	75.1
Seed inoculation	Sunflower	3.74	0.08	2.0	–	–
	Corn	3.96	0.02	0.6	0.21	5.7
	Soybean	6.44	0.01	0.2	2.70	72.0
LSD05, t/ha	Factor A = 0.54; Factor B = 0,66; Factors AB = 0,94					

The best predecessor for achieving higher productivity in our studies was soybeans. Without the use of the biopreparation, we obtained 6.43 t/ha of grain units. Seed inoculation did not provide a significant increase in producivity units, with the effectiveness of the biopreparation factor being 0.01 t/ha (LSD05 = 0.54 t/ha). Sunflower and corn predecessors yielded 3.74 t/ha and 3.96 t/ha of grain units, respectively, but the biopreparation Mycofriend was more effective with the sunflower predecessor, resulting in a yield increase of 0.08 t/ha or 2.0% (compared to the corn predecessor +0.02 t/ha or 0.06%, and soybean predecessor – 0.01 t/ha or 0.02%).

In our research, there was a trend towards forming corn productivity based on other indicators. Feed units yield was higher when corn was grown after soybeans, 9.65 t/ha (Table 3).

The choice of this predecessor increased productivity by 4.14 t/ha or 75.1% compared to the variant where sunflowers were the previous crop and by 3.74 t/ha in repeated corn plantings.

There was no significant increase in corn productivity in terms of feed unit yield after using the biopreparation.

Table 3. Feed units yield when growing corn for grain depending on the biopreparation and predecessor, average 2019–2023

Biopreparation (factor A)	Predecessor (factor B)	Feed units yield, t/ha	Difference			
			for factor A		for factor B	
			t/ha	%	t/ha	%
Without inoculation	Sunflower	5.51	–	–	–	–
	Corn	5.91	–	–	0.40	7.3
	Soybean	9.65	–	–	4.14	75.1
Seed inoculation	Sunflower	5.62	0.11	2.0	–	–
	Corn	5.94	0.03	0.6	0.32	5.7
	Soybean	9.68	0.02	0.2	4.05	72.0
LSD05, t/ha	Factor A = 0.81; Factor B = 1.00; Factors AB = 1.41					

The highest feed units yield from the main corn production was achieved with a combination of the biopreparation and predecessor factors – 9.68 t/ha. Despite the fact that the increase in feed units yield due to the biopreparation factor was within a significant difference, the preparation worked more effectively with the sunflower predecessor, resulting in an increase of 0.11 t/ha or 2.0%.

Among grain crops, corn grain has the highest nutritional value. It contains a high amount of carbohydrates, mainly starch (up to 70% or more), fat (up to 6% or more), but the lowest protein content for grain crops (6–7%). Due to its low protein content, corn grain is not suitable for feeding young animals, lactating cows.

In our research, the indicators of yield of digestible protein ranged from 0.327–0.575 t/ha (Table 4). Choosing a previous crop for growing corn can almost double the protein content in the grain. For example, with soybeans as a predecessor, the yield of digestible protein was at 0.573 t/ha, and after seed inoculation of corn, this indicator remained almost unchanged at 0.575 t/ha (LSD05 = 0.048 t/ha).

However, it should be noted that in crop rotations where corn was grown after sunflower and for repeated cultivation on the same field, a significant decrease digestible protein yield was observed, 0.327 t/ha and 0.351 t/ha respectively.

Table 4. Digestible protein yield when growing corn for grain depending on the biopreparation and predecessor, average 2019–2023

Biopreparation (factor A)	Predecessor (factor B)	Digestible protein yield, t/ha	Difference			
			for factor A		for factor B	
			t/ha	%	t/ha	%
Without inoculation	Sunflower	0.327	–	–	–	–
	Corn	0.351	–	–	0.024	7.3
	Soybean	0.573	–	–	0.246	75.1
Seed inoculation	Sunflower	0.334	0.007	2.0	–	–
	Corn	0.353	0.002	0.6	0.019	5.7
	Soybean	0.575	0.001	0.2	0.241	72.0
LSD05, t/ha	Factor A = 0.048; Factor B = 0.059; Factors AB = 0.084					

The use of the biopreparation in the corn cultivation technology did not significantly affect its productivity in terms of digestible protein yield across all predecessors, but the highest increase was observed with the sunflower predecessor, 0.007 t/ha, which amounted to +2.0% compared to the control variant without seed inoculation.

Conclusions and prospects for further research. The results of five years of research on the impact of the biopreparation Mycofriend on corn cultivation with different predecessors allow the following conclusions to be drawn:

The predecessor was a significant factor influencing the yield formation and productivity indicators of the corn hybrid DK Veles. The average grain yield of corn after soybeans was 5.31 t/ha, after sunflower and corn predecessors 3.03 t/ha and 3.25 t/ha respectively, with no significant difference in yield between them.

There was no significant increase in corn grain yield due to the action of the biopreparation factor, with a yield increase ranging from 0.01-0.06 t/ha. However, the biopreparation showed more active effects with the sunflower predecessor.

Higher yield indicators for grain units, feed units, and digestible protein units were achieved when growing corn after a soybean predecessor – 6.43 t/ha, 9.65 t/ha, and 0.575 t/ha respectively. There was no significant difference in productivity indicators between the sunflower predecessor and repeated corn cultivation.

The highest indicators for grain units yield, feed units yield, and digestible protein units were obtained under the condition of seed inoculation with the biopreparation after the soybean predecessor – 6.44 t/ha, 9.68 t/ha, and 0.575 t/ha respectively, but the effect of the biopreparation factor was not significant.

References

1. Amons, S. (2023). Productivity of corn hybrids depends on growing technological methods. *Agriculture and forestry*. (28). 25–45. https://doi.org/10.37128/2707-5826-2023-1-3.

2. Desiatnyk, L.M., Shevchenko, M.S., Shvets, N.V., & Khyzhniak, A.A. (2019). Systemni faktory rehuliuvannia zernovoi produktyvnosti kukurudzy v riznorotatsiinykh sivozminakh Stepovoi zony [Systemic factors regulating corn grain productivity in different rotations of the Steppe zone]. *Zernovi kultury*. Tom 3, № 1. 37–44. https://doi.org/10.31867/2523-4544/0058 [in Ukrainian].

3. Joop C., van Lenteren, Karel Bolckmans, Ju¨rgen Ko¨hl, Willem J. Ravensberg, & Alberto Urbaneja. (2018). Biological control using invertebrates and microorganisms: plenty of new opportunities. *BioControl*. V. 63. P. 39–59. https://doi.org/10.1007/s10526-017-9801-4.

4. Kalenska, S.M., & Hovenko, R.V. (2020). Produktyvnist kukurudzy zalezhno vid zabezpechennia teplovymy odynytsiamy ta zhyvlennia riznymy vydamy azotnykh dobryv [Productivity of corn depending on the supply of thermal units and nutrition with different types of nitrogen fertilizers]. *Naukovi pratsi Instytutu bioenerhetychnykh kultur i tsukrovykh buriakiv*, (30), 33–43. https://doi.org/10.47414/np.30.2022.268943 [in Ukrainian].

5. Kokhan, A., Hlushchenko, L., Len, O., Olepir, R., & Samoilenko O. (2019). Produktyvnist sortiv i hibrydiv kukurudzy za riznykh system udobrennia ta bezzminnoho yikh vyroshchuvannia [Productivity of grades and hybrids of corn at different fertilizer systems and their permanent growing]. *Visnyk ahrarnoi nauky*. № 10 (799). 18–23. https://doi.org/10.31073/agrovisnyk201910-03 [in Ukrainian].

6. Marcelo S., de Farias, Ravel F., Dagios, Antônio L., Santi, & Maurício R., Cherubin (2020). Productivity of corn hybrids in relation to sowing overlap. *Scientific Paper, Agricultural Machinery Management***.** Eng. agríc. (Online) 40 (4). Jul-Aug. https://doi.org/10.1590/1809-4430-Eng.Agric.v40n4p489-494/2020.

7. Marcos da Silva Brum, Vinícius Dos Santos Cunha, éssica Deolinda Leivas Stecca, uiz Fernando Teleken Grando, Thomas Newton Martin. (2016). Componentes do rendimento da cultura do milho sob inoculação de Azospirillum brasilense em sistema de integração lavoura-pecuária. *Acta Scientiarum*. *Agronomy*, vol. 38, No. 4, pp. 485–492, https://doi.org/10.4025/actasciagron.v38i4.30664.

8. Marenych, M.M., Kaplenko, V.O., Koba, K.V., & Holub, O.R. (2019). Osoblyvosti upravlinnia vrozhainistiu kukurudzy v umovakh nestiikoho zvolozhennia [Peculiarities of corn yield management under unstable moistening]. *Visnyk Poltavskoi derzhavnoi ahrarnoi akademii*. № 4. 43–50. https://doi.org/10.31210/visnyk2019.04.05 [in Ukrainian].

9. Mashchenko, Yu.V., & Sokolovska, I.M. (2023). Produktyvnist kukurudzy zalezhno vid yii chastky v sivozmini ta udobrennia [Corn productivity depending on its share in crop rotation and fertilization]. *Ahrarni innovatsii*. № 21 *Melioratsiia, zemlerobstvo, roslynnytstvo*. 57–63. https://doi.org/10.32848/agrar.innov.2023.21.8 [in Ukrainian].

10. Pustovyi, S.I., Yakunin, O.P., & Dudka, M.I. (2020). Vplyv poperednyka mineralnoho zhyvlennia na formuvannia urozhainosti zerna hibrydiv kukurudzy [The influence of the forecrop, mineral nutrition on grain yield formation in corn hybrids]. *Tavriiskyi naukovyi visnyk*. № 116. Chastyna 2. 68–73. https://doi.org/10.32851/2226-0099.2020.116.2.10 [in Ukrainian].

11. Pustovyi, S.I., Yakunin, O.P., & Dudka, M.I. (2021). Ahroekonomichna efektyvnist vyroshchuvannia zerna hibrydiv kukurudzy zalezhno vid poperednyka i mineralnoho udobrennia [Agro-economic efficiency of grain cultivation of corn hybrids depending on the precursor and mineral fertilizer]. *Tavriiskyi naukovyi visnyk*. № 117. 142–148. https://doi.org/10.32851/2226-0099.2021.117.19 [in Ukrainian].

12. Sherstoboieva, O.V., Bunas, A.A., & Demianiuk, O.S. (2020). Vplyv poperednykiv ta peredposivnoi inokuliatsii nasinnia shtamom *Azotobacter Vinelandii 12m* na vrozhainist kukurudzy i aktyvnist protsesu azotfiksatsii [The effect of preprevious and presuspended inoculation of seeds by azotobacter vinelandii 12m on maize productivity and activity of nitrogen fixation process]. *Ahronomiia*. № 1/2020. 120–126. https://doi.org/10.33730/2310-4678.1.2020.203941 [in Ukrainian].

13. Shevchenko, M.S., Desiatnyk, L.M., Derevenets-Shevchenko, K.A., & Shvets, N.V. (2020). Suchasni systemy zemlerobstva i nove traktuvannia sivozminnoi tsinnosti silskohospodarskykh kultur [Modern farming systems and a new interpretation of the crop rotation value of agricultural crops]. *Zernovi kultury*. T. 4, № 2. 319–329. https://doi.org/10.31867/2523-4544/0141 [in Ukrainian].

14. Shuvar, I., Shuvar, B., Kostiuk, B., Kolesnyk, N., & Hnydiuk, V. (2016). Biolohizatsiia zemlerobstva v Ukraini, realii ta perspektyvy. Symfoniia forte. 2016. 138 s. https://www.yakaboo.ua/ua/biologizacija-zemlerobstva-v-ukraini-realii-ta-perspektivi.html [in Ukrainian].

15. Sokolovska, I.M., & Mashchenko, Yu.V. (2023). Biotekhnolohichni pryiomy vyroshchuvannia hrechky za riznoho udobrennia [Biotechnological methods of growing buckwheat with different fertilizers]. *Tavriiskyi naukovyi visnyk*. Vyp. 130. 240–246. https://doi.org/10.32851/2226-0099.2023.130.35 [in Ukrainian].

16. Sokolovska Iryna, & Maschenko Yuriy. (2023). Biotechnological methods of growing sunflower in different fertilizer systems. *Journal HELIA*., Walter de Gruyter GmbH, Berlin/Boston, 2023-11-22. T. 46. № 79. 233–243. https://doi.org/10.1515/helia-2023-0011 [in Ukrainian].

17. Voloshchuk, O.P., Hlyva, V.V., & Pashchak, M.O. (2020). Produktyvnist hibrydiv kukurudzy zalezhno vid riznykh norm vnesennia mineralnykh dobryv u zakhidnomu Lisostepu Ukrainy [Productivity of corn hybrids depending on different rates of mineral fertilizer application in the western forest-steppe of Ukraine]. *Peredhirne ta hirske zemlerobstvo i tvarynnytstvo*. Vyp. 68 (I). 51–66. https://doi.org/10.32636/01308521.2020-(68)-1-4 [in Ukrainian].

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БІОТЕХНОЛОГІЧНІ ПРИЙОМИ ВИРОЩУВАННЯ КУКУРУДЗИ НА ЗЕРНО ПО РІЗНИМ ПОПЕРЕДНИКАМ В УМОВАХ СТЕПУ УКРАЇНИ

Анотація

Важливим фактором, який визначає рівень врожайності зерна та продуктивності кукурудзи, є попередня культура. В умовах недостатнього зволоження Степу України значення попередника визначається накопиченими запасами вологи. Існує думка, що кращими попередниками для кукурудзи в умовах Степу є пшениця озима, зернобобові культури, задовільними – кукурудза, ячмінь, а соняшник належить до гірших попередників. Кукурудзу допустимо вирощувати і в повторних

посівах та в монокультурі, але елементи агротехніки, які впливають на продуктивність культури в таких сівозмінах вивчені недостатньо.

Стаціонарний дослід був закладений у 2005 році на базі Інституту сільського господарства Степу НААН, ґрунтово-кліматичні умови місця проведення досліджень відповідають зоні Північного Степу України. У досліді висівали простий модифікований середньоранній гібрид ДК Велес. Інокуляцію насіння проводили препаратом Мікофренд.

Результати досліджень свідчать про те, що фактором, який істотно впливав на формування врожайності та показників продуктивності кукурудзи, був попередник. За вирощування кукурудзи після сої середня врожайність зерна була на рівні 5,31 т/га, по попередниках соняшнику та кукурудзі 3,03 т/га та 3,25 т/га відповідно, різниця врожайності по попередниках соняшнику та кукурудзі була неістотною. Не було встановлено суттєвого підвищення врожайності зерна кукурудзи за рахунок дії фактору біопрепарату, прибавка врожаю була в межах 0,01–0,06 т/га, але більш активною дія біопрепарату відмічалася за попередником соняшник. Вищі показники продуктивності за збором зернових, кормових одиниць та перетравного протеїну були за вирощування кукурудзи після сої – 6,43 т/га, 9,65 т/га та 0,573 т/га відповідно. Не спостерігали істотної різниці між показниками продуктивності по попереднику соняшник та за повторного вирощування кукурудзи. Вищі показники збору зернових, кормових одиниць та перетравного протеїну отримали за умови інокуляції насіння біопрепаратом по попереднику соя – 6,44 т/га, 9,68 т/га та 0,575 т/га відповідно.

Ключові слова: *кукурудза, урожайність, продуктивність, зернові одиниці, кормові одиниці, вихід перетравного протеїну.*

Список використаних джерел

1. Amons S. Productivity of corn hybrids depends on growing technological methods. *Agriculture and forestry*. 2023. № 28. P. 25–45. https://doi.org/10.37128/2707-5826-2023-1-3.

2. Joop C. van Lenteren, Karel Bolckmans, Ju¨rgen Ko¨hl, Willem J. Ravensberg, Alberto Urbaneja. Biological control using invertebrates and microorganisms: plenty of new opportunities. *BioControl*. 2018. V. 63. P. 39–59. https://doi.org/10.1007/s10526-017-9801-4.

3. Marcelo S. de Farias, Ravel F. Dagios, Antônio L. Santi, Maurício R. Cherubin. Productivity of corn hybrids in relation to sowing overlap. *Scientific Paper, Agricultural Machinery Management***.** Eng. agríc. (Online) 2020. № 40 (4). Jul – Aug. https://doi.org/10.1590/1809-4430-Eng.Agric.v40n4p489-494/2020.

4. Marcos da Silva Brum, Vinícius Dos Santos Cunha, éssica Deolinda Leivas Stecca, uiz Fernando Teleken Grando, Thomas Newton Martin. Componentes do rendimento da cultura do milho sob inoculação de Azospirillum brasilense em sistema de integração lavoura-pecuária. *Acta Scientiarum. Agronomy*. 2016. Vol. 38. № 4. P. 485–492. https://doi.org/10.4025/actasciagron.v38i4.30664.

5. Sokolovska I., Maschenko Yu. Biotechnological methods of growing sunflower in different fertilizer systems. *Journal HELIA*. Walter de Gruyter GmbH, Berlin/Boston, 2023-11-22. Т. 46. № 79. С. 233–243. https://doi.org/10.1515/helia-2023-0011.

6. Волощук О.П., Глива В.В., Пащак М.О. Продуктивність гібридів кукурудзи залежно від різних норм внесення мінеральних добрив у західному Лісостепу України. *Передгірне та гірське землеробство і тваринництво*. 2020. Вип. 68 (I). С. 51–66. https://doi.org/10.32636/01308521.2020-(68)-1-4.

7. Системні фактори регулювання зернової продуктивності кукурудзи в різноротаційних сівозмінах степової зони / Л.М. Десятник, М.С. Шевченко, Н.В. Швець, А.А. Хижняк. *Зернові культури.* 2019. Т. 3. № 1. 37–44. https://doi.org/10.31867/2523-4544/0058.

8. Каленська С.М., Говенько Р.В. Продуктивність кукурудзи залежно від забезпечення тепловими одиницями та живлення різними видами азотних добрив. *Наукові праці Інституту біоенергетичних культур і цукрових буряків*. 2020. № 30. С. 33–43. https://doi.org/10.47414/np.30.2022.268943.

9. Продуктивність сортів і гібридів кукурудзи за різних систем удобрення та беззмінного їх вирощування / А. Кохан, Л. Глущенко, О. Лень, Р. Олепір, О. Самойленко. *Вісник аграрної науки*. 2019. № 10 (799). С. 18–23. https://doi.org/10.31073/agrovisnyk201910-03.

10. Особливості управління врожайністю кукурудзи в умовах нестійкого зволоження / М.М. Маренич, В.О. Капленко, К.В. Коба, О.Р. Голуб. *Вісник Полтавської державної аграрної академії*. 2019. № 4. С. 43–50. https://doi.org/10.31210/visnyk2019.04.05.

11. Мащенко Ю.В., Соколовська І.М. Продуктивність кукурудзи залежно від її частки в сівозміні та удобрення. *Аграрні інновації. Серія «Меліорація, землеробство, рослинництво».* 2023. № 21. С. 57–63. https://doi.org/10.32848/agrar.innov.2023.21.8.

12. Пустовий С.І., Якунін О.П., Дудка М.І. Агроекономічна ефективність вирощування зерна гібридів кукурудзи залежно від попередника і мінерального удобрення. *Таврійський науковий вісник*. 2021. № 117. С. 142–148. https://doi.org/10.32851/2226-0099.2021.117.19.

13. Пустовий С.І., Якунін О.П., Дудка М.І. Вплив попередника, мінерального живлення на формування урожайності зерна гібридів кукурудзи. *Таврійський науковий вісник.* 2020. № 116. Частина 2. С. 68–73. https://doi.org/10.32851/2226-0099.2020.116.2.10.

14. Соколовська І.М., Мащенко Ю.В. Біотехнологічні прийоми вирощування гречки за різного удобрення. *Таврійський науковий вісник*. 2023. Вип. 130. С. 240–246. https://doi.org/10.32851/2226-0099.2023.130.35.

15. Сучасні системи землеробства і нове трактування сівозмінної цінності сільськогосподарських культур / М.С. Шевченко, Л.М. Десятник, К.А. Деревенець-Шевченко, Н.В. Швець. *Зернові культури*. 2020. Т. 4, № 2. С. 319–329. https://doi.org/10.31867/2523-4544/0141.

16. Шерстобоєва О.В., Бунас А.А., Дем'янюк О.С. Вплив попередників та передпосівної інокуляції насіння штамом *Azotobacter Vinelandii 12m* на врожайність кукурудзи і активність процесу азотфіксації. *Агрономія*. 2020. № 1. С. 120–126. https://doi.org/10.33730/2310-4678.1.2020.203941.

17. Біологізація землеробства в Україні, реалії та перспективи / І. Шувар, Б. Шувар, Б. Костюк, Н. Колесник, В. Гнидюк. *Симфонія форте*. 2016. 138 с. https://www.yakaboo.ua/ua/biologizacija-zemlerobstva-v-ukraini-realii-ta-perspektivi.html.