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Influence of previous crops and soil tillage on the available moisture reserves in typical chernozem for spring barley cultivation

Abstract. The unstable yield of agricultural crops arises due to insufficient soil moisture supply at crucial moments of plant emergence and growth, complicating agriculture and exposing it to the risk of crop losses. The purpose of the study is to determine the impact of the soil tillage system and previous crops on the productivity of spring barley plants. This was a long-term stationary experiment (2021-2023) with the application of statistical data processing. The influence of four previous crops was investigated – grain maize (control), soybeans, winter rapeseed, and sunflower – and three main soil tillage methods. It is established that the highest significant moisture reserves in the 0-100 cm soil layer at the sowing period were formed when spring barley was placed after soybeans, exceeding the control variant (grain maize) by 3.2 mm in 2021, 3.6 mm in 2022, and 3.4 mm in 2023, and after winter rapeseed by 8.5 mm, 6 mm, and 5.7 mm, respectively, over the years. The use of shallow no-till cultivation provided an advantage over the control (ploughing) in all years of observation: by 2.2 mm in 2021, 1.8 mm in 2022, and 8.8 mm in 2023. During the sowing period of the studied crop, the control surpassed only surface no-till cultivation by 2.7 mm in 2022. The optimal option should be considered the combination of soybeans as a previous crop with shallow no-till soil cultivation at 14-16 cm, which ensured moisture reserves during the earing period of the crop in 2021 – 75.1 mm, in 2022 – 93.2 mm, and in 2023 – 92.2 mm, and at the time of harvest, these indicators were 60.7 mm, 67.3 mm, and 60.0 mm, respectively. The grain yield of spring barley under this option was the highest in the experiment, averaging 7.26 t/ha, which is 27.3% higher than the

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control. The results of the study can be used to realise the genetic potential of spring barley plants to form stable productivity

Keywords: agricultural crops; yield, no-till cultivation; conventional tillage; hydrothermal coefficient; available soil moisture reserves

INTRODUCTION

Moisture availability for agricultural crops depends on many factors that interact with each other. Firstly, the amount of precipitation in the form of rain or snow over the years of research, soil permeability, and air temperature. Moreover, previous crops and soil tillage methods are important elements in retaining soil moisture to achieve high and stable yields of spring barley, as their influence undoubtedly affects the final yield of this crop.

Soil moisture plays a very important role in the cultivation of spring barley. Particularly important is the availability of moisture during sowing and at the initial growth stages, when the seeds germinate and the root system develops. On the other hand, excessive moisture can also be harmful to plants. Excess moisture can lead to the development of fungal diseases and the suffocation of the root system, which can result in plant death, as noted in the studies by M.T. Abi Saab *et al.* (2019).

Proper placement of the crop in the crop rotation is key to high yield and success in agriculture. Crop rotation reduces weed infestation and damage to plants by pests and diseases and improves soil quality. V.V. Hamaiunova & T.O. Kasatkina (2018) established that primary tillage systems particularly affect the yield of agricultural crops, productivity, economic and energy efficiency of crop rotation.

M. Unkovich *et al.* (2023) in their studies indicate that improper soil tillage deteriorates the agrophysical indicators of its fertility, which leads to reduced tillering and root growth, and decreased water availability in the soil, nutrient uptake by the plant, which in turn reflects in the deterioration of grain quality and reduction of crop yield.

According to A. Panfilova *et al.* (2020), the main factors reducing spring barley yield in Ukraine are annual changes in climatic conditions, planting the crop after a previous crop such as sunflower, and the imperfection of the depth and method in the soil tillage system, which causes negative erosion processes and worsens the water regime and dehumification of chernozems. D. Cammarano *et al.* (2019) note that barley yield depends primarily on the amount of precipitation and soil water.

Soil tillage has a significant impact on the available soil moisture reserves, which affect soil structure, water permeability, and water distribution within it. Therefore, M.A. Porodko (2023) emphasises that the choice of soil tillage method can be crucial for preserving available moisture reserves and optimising the soil's water-physical properties for plants. However, moisture accumulation in the meter layer of chernozem during the winter period does not depend on the soil tillage method.

The study by V. Kyryliuk *et al.* (2019), conducted on medium loamy chernozems in the Right-Bank Forest-Steppe of Ukraine, has shown that disk tillage leads to a 31% decrease in profitability compared to chisel ploughing. The authors also highlight the importance of applying organo-mineral fertilisers and leaving straw in the field to increase yield. According to S.V. Usyk (2020), placing spring barley after grain corn provides the best results because the soil does not compact, and inter-row cultivation in corn growing technology helps clear the field of weeds.

The impact of previous crops on the available soil moisture reserves for spring barley can be significant. Some crops, after harvest, can leave a larger amount of plant residues in the soil, which leads to increased moisture in it. This can be beneficial for the subsequent sowing, as the increased soil moisture reserve can positively affect the growth of the next crop (Tsyliuryk *et al.*, 2020; Poliovyi *et al.*, 2023).

The purpose of the study is to establish the changes in accumulation and dynamics of soil moisture in spring barley yields depending on the primary soil tillage method and previous spring barley crops.

MATERIALS AND METHODS

The research was conducted during 2021-2023 in a stationary study of the Department of Agriculture and Herbology, established at the Separate Unit of the National University of Life and Environmental Sciences of Ukraine "Agronomic Research Station". Spring barley was grown after various previous crops (factor A): 1) grain corn (control); 2) soybeans; 3) winter rapeseed; 4) sunflower. The main tillage systems were also examined (factor B): 1) conventional tillage (control), which included ploughing to a depth of 23-25 cm; no-till shallow cultivation – disking to a depth of 14-16 cm; and no-till surface cultivation – disking to a depth of 6-8 cm. The sowing area was 250 m^2 (10 m × 25.0 m), with an accounting area of 180 m^2 (9 m × 20 m), the experiment was repeated four times, and the plot layout was systematic.

The soil of the research field is typical chernozem of the middle loamy type. The humus content in the plow layer of the soil is 4.05-4.38%, the pH of the salt extract is 6.9-7.3, and the cation exchange capacity is 32 mg-equiv. per 100 g of soil. The humus reserve in the meter layer is 387-405 t/ha. This soil type is typical for the Forest-Steppe zone, occupying 54.6% of its territory. Groundwater is located at a depth of 5-6 m.

To assess the moisture level, parameters such as precipitation, soil moisture, water regime, and hydrothermal indicators were analysed. The adequacy of the hydrothermal coefficient (HTC) to long-term data was assessed using the significance coefficient (SC). According to the scale, Ki values within 0 ÷ ± 0.3 are considered optimal; tendentiously elevated within + 0.4-1; tendentiously reduced within -0.4-1; significantly elevated within +1-2; significantly reduced within -1-2; extremely elevated > +2 and extremely reduced for K_i > -2.

The thermogravimetric method, following the standard DSTU ISO 16586:2005 (2008), was used to determine the total and plant-available soil moisture reserves at a depth of 0-100 cm. Soil samples were taken with an auger from the following layers: 0-10, 10-20, 20-30, 30-50, 50-70, 70-100 cm. For each variant, the total and plant-available moisture reserves were calculated. The water consumption coefficient for spring barley was determined by the calculated method based on the determination of soil moisture.

At the full maturity stage of spring barley, grain yield accounting was conducted by complete harvesting from the accounting areas in each variant of the experiment. This process included harvesting grains from different plots located in all repetitions of the experiment. During harvesting, grain purity and moisture were considered and standardised to 100%. This approach ensured an accurate determination of spring barley yield in each experimental variant and guaranteed the objectivity of the results.

Sowing of the Sebastian barley variety was performed at a temperature of the sowing layer of 2-3°C and upon reaching the physical maturity of the soil. The seeding rate was 4 million viable seeds/ha, the seeding depth was 3-4 cm, and the row spacing was 15 cm. The study was conducted in accordance with the Convention on Biological Diversity (1992) and the Convention on the Trade in Endangered Species of Wild Fauna and Flora (1973). Statistical analysis of the experimental data was performed using Excel from MS Office 365 and Statistica 10 software.

RESULTS AND DISCUSSION

The observations showed that the water regime of the soil in spring barley crops, along with previous crops and main tillage methods, has its own characteristics each year. The amount of moisture accumulated in the winter period is of great importance for the growth and development of spring barley as it provides favourable conditions for the plants at the early stages of vegetation. Analysing the data over the years of the study, it should be noted that the HTC indicators differed from each other by monthly values (Fig. 1).

In 2021, the beginning of the growing season was characterised by favourable moisture conditions. April and May of that year were excessively wet, with HTC indicators of 3.89 and 2.47, which are significant deviations from the long-term averages (K_i = 1.16 and 0.60). All subsequent months of 2021 had an HTC indicator not exceeding 1.0 and were dry, which is typical for this period (K_i = -0,27, 0,08, 0,02, -0,28) (Table 1).

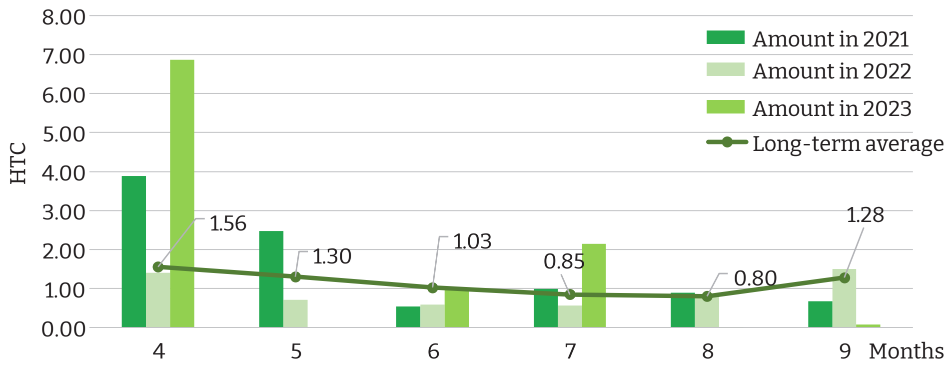

Figure 1. Monthly distribution of HTC (2021-2023)

Source: compiled by the authors

Table 1. Adequacy coefficient (K_i) of HTC indicator compared to the long-term norm

Years of the study	Vegetation period						For the growing season
	April	May	June	July	August	September	
2021	1.16	0.60	-0.27	0.08	0.02	-0.28	-0.09
2022	-0.17	-0.61	-0.49	-0.66	-0.01	0.13	-0.64
2023	5.37	-1.32	-0.02	2.95	-1.03	-0.70	-0.64

Source: compiled by the authors

The conditions of the 2022 growing season varied from dry in May and August (HTC 1.04, 1.50) to very dry in April, June, July, and August (HTC 0.7, 0.59, 0.56, 0.79, respectively), which is statistically confirmed by the significance coefficient of deviations (K_i = -0.61, -0.49, -0.66, and -0.05, respectively). The beginning of the 2023 growing season (April) was markedly different from other months in terms of HTC. According to HTC indicators, April was excessively wet at 6.87, which is statistically confirmed by a significant deviation from the long-term values, K_i = 5.37 – extremely high. In May, August, and September of the 2023 growing season, HTC was 0.0, 0.1, 0.8 respectively, characterising the area as arid, with significant deviations from long-term values (K_i = -1.3, -1.03, -1.70). June, with an HTC of 1.1, was slightly dry, but relative to long-term data, it was extremely high (K_i=2.95). July can be considered excessively wet with an HTC of 2.14, which is atypical for this period (K_i=2.95).

Thus, the 2023 growing season was characterised by variability in moisture levels across the months but overall was similar to the 2022 growing season for spring barley (Fig. 1, Table 1). M. Daničić *et al.* (2019) noted that analysing the impact of climate change will allow for forecasting barley production and adjusting current cultivation practices to enhance efficiency.

Since spring barley requires optimal conditions for the growth and development of the root system, which significantly contributes to high yields, it is essential to consider soil conditions that can be regulated through the selection of previous crops and soil tillage systems (Netis & Onufran, 2012; Romaniuk, 2019).

An analysis of the study results on moisture reserves in the 0-100 cm soil layer, depending on the factors studied, showed that at the time of sowing, the impact of previous crops on the accumulation of available moisture in the soil was statistically significant compared to the control (corn for grain) after soybeans in 2021 – 3.2 mm, in 2022 – 3.6 mm, in 2023 – 3.4 mm, and after winter rapeseed – 8.5 mm, 6 mm, 5.7 mm respectively by year. When spring barley was planted after sunflowers, moisture reserves in the 0-100 cm soil layer decreased by 2.6 mm in 2021 and 0.2 mm in 2022 and 2023 compared to the control (Table 2).

Table 2. Change in available moisture reserves
in the 0-100 cm soil layer, depending on previous crops and primary soil tillage systems

Cropping system (A)	Soil tillage system (B)	Moisture reserves								
		before sowing			earing			before harvesting		
		2021	2022	2023	2021	2022	2023	2021	2022	2023
Corn for grain (c)	Conventional tillage (c)	173.6	160.6	134.5	71.7	81.7	79.8	55.1	61.1	60.6
	Shallow no-till	173.9	164.2	140.1	74.7	95.1	90.4	56.5	62.8	63.8
	Surface no-till	174.4	155.0	149.0	73.4	93.0	91.0	53.7	59.6	62.0
Soybean	Conventional tillage (c)	175.9	160.6	136.6	72.6	82.2	79.2	57.2	63.4	59.8
	Shallow no-till	176.9	164.9	146.9	75.1	93.2	92.2	60.7	67.3	63.0
	Surface no-till	178.8	154.8	150.4	72.8	93.9	90.2	58.1	64.5	64.4
Winter rapeseed	Conventional tillage (c)	180.1	167.5	141.9	73.9	82.2	87.0	59.3	65.8	61.1
	Shallow no-till	182.8	167.5	149.2	74.8	93.2	90.4	62.4	69.2	63.8
	Surface no-till	184.6	162.6	149.6	74.8	94.6	91.8	63.0	69.9	63.2
Sunflower	Conventional tillage (c)	171.2	158.3	134.9	69.4	72.6	70.4	55.1	60.9	57.7
	Shallow no-till	171.3	157.4	146.9	69.5	75.2	73.0	56.5	62.0	61.3
	Surface no-till	171.8	163.5	150.4	69.6	74.1	71.9	53.8	59.6	58.7
HiP05 (AB)		**2.0**	**4.1**	**6.8**	**1.7**	**2.3**	**2.5**	**3.0**	**3.2**	**2.6**
Average for previous crops										
Corn for grain		174.0	159.9	141.2	73.3	89.9	87.0	55.1	61.2	62.1
Soybean		177.2	160.1	144.6	73.5	89.7	87.2	58.7	65.1	62.4
Winter rapeseed		182.5	165.9	146.9	74.5	90.0	89.7	61.5	68.3	62.7
Sunflower		171.4	159.7	144.0	69.5	74.0	71.8	55.2	60.8	59.2
HiP05 (A)		**1.0**	**2.0**	**3.4**	**0.9**	**1.1**	**1.2**	**1.5**	**1.6**	**1.3**
Average for basic tillage systems										
Conventional tillage (c)		175.2	161.7	137.0	71.9	79.7	79.1	56.6	62.8	59.8
Shallow no-till		176.2	163.5	145.8	73.5	89.2	86.5	59.0	65.3	63.0
Surface no-till		177.4	159.0	149.8	72.7	88.9	86.2	57.2	63.4	62.1
HiP05 (B)		**1.2**	**2.4**	**3.9**	**1.0**	**1.3**	**1.4**	**1.7**	**1.8**	**1.5**

Note: c – control
Source: compiled by the authors

The analysis of available soil moisture reserves in the one-meter soil layer, depending on the main tillage system, showed that shallow and surface no-till cultivation in 2021 and 2023 were at the same level and had an advantage over conventional tillage (control). In 2021, surface no-till cultivation surpassed the control variant (conventional tillage) by 2.2 mm, and in 2023 by 12.8 mm. In turn, shallow no-till cultivation had an advantage over conventional tillage by 1 mm in 2021 and by 8.8 mm in 2023, which is statistically significant. These results are confirmed by the studies of O.I. Tsilyuryk & V.P. Shapka (2014), where the advantage in moisture accumulation during the autumn-winter period by 18.1 mm (181 t/ha) was noted for chisel tillage compared to conventional ploughing. Furthermore, O.V. Pikovska (2012) proves that ploughing can lead to moisture loss due to decreased soil permeability, resulting from the destruction of soil structure and the formation of a hardpan after some previous crops. On the other hand, surface tillage (such as mulching) can help retain moisture in the soil by reducing evaporation and protecting it from wind and sunlight.

During the growing season, soil moisture was predominantly consumed for crop formation by barley plants and partly evaporated from the soil surface. During the heading phase and at the time of harvest, a decrease in moisture reserves in the one-meter soil layer was observed, and its trend depended on the studied factors.

Research by V.V. Gamayunova & A.V. Panfilova (2019) established that different soil moisture reserves and their usage intensity are determined by the amount of precipitation, temperature, and humidity. However, the general moisture dynamics in barley crops in all years of research followed the same pattern, with the main amount of moisture accumulating in the autumn-winter period and reaching its peak at the time of sowing, after which the crops gradually consumed it until the end of the growing period.

On average, over the years of research, the placement of spring barley after soybeans and winter rapeseed created the best conditions for the accumulation and preservation of soil moisture. The most effective tillage options were shallow no-till and surface no-till cultivation.

One of the indicators of effective water use by grain crops to achieve yield is the water consumption coefficient, which is determined by dividing the total water expenditure by the yield of the entire biomass or the main product. According to V.P. Kirilyuk & M.V. Shemyakin (2017), water supply during the growing season significantly affects soil moisture reserves and water consumption by spring barley. Specifically, during moderately dry growing periods, the total water consumption by barley plants ranged from 2030 to 2610 m^3/ha, during dry growing periods from 2015 to 2572 m^3/ha, and during very dry growing periods from 2099 to 2264 m^3/ha.

Research on the efficiency of water use by spring barley plants, depending on the tillage system and previous crop, showed that barley used water most efficiently when placed after soybeans and winter rapeseed, with water consumption coefficients of 26.9 m^3/t and 29.2 m^3/t, respectively. In absolute terms, this was 10.5 mm/t and 8.2 mm/t less compared to the control variant (corn for grain). The water consumption coefficient for barley plants placed after sunflower was 4.5 mm/t lower compared to their placement after corn for grain (Table 3).

Table 3. Water consumption of spring barley depending on the previous crop and tillage

Cropping system	Soil tillage system	Water consumption indicators					
		Wn	Wk	O	S	Y	K
Corn for grain	Conventional tillage (c)	156.2	58.9	218.9	316.2	9.7	344
	Shallow no-till	159.4	61.0	218.9	317.3	9.2	365
	Surface no-till	159.5	58.4	218.9	319.9	7.9	413
Soybean	Conventional tillage (c)	157.7	60.1	218.9	316.4	12.5	258
	Shallow no-till	162.9	63.7	218.9	318.1	12.3	266
	Surface no-till	161.3	62.3	218.9	317.8	11.4	284
Winter rapeseed	Conventional tillage (c)	163.2	62.1	218.9	320.0	11.7	284
	Shallow no-till	166.5	65.1	218.9	320.3	11.6	288
	Surface no-till	165.6	65.4	218.9	319.1	11.0	303
Sunflower	Conventional tillage (c)	154.8	57.9	218.9	315.8	10.3	322
	Shallow no-till	158.5	59.9	218.9	317.4	10.5	315
	Surface no-till	161.9	57.4	218.9	323.4	9.7	351
Average for previous crops							
Corn for grain		158.4	59.5	218.9	317.8	8.9	374
Soybean		160.6	62.0	218.9	317.5	12.1	269
Winter rapeseed		165.1	64.2	218.9	319.8	11.4	292
Sunflower		158.4	58.4	218.9	318.9	10.2	329
Average for basic tillage systems							
Conventional tillage (c)		158.0	59.8	218.9	317.1	11.0	302
Shallow no-till		161.8	62.4	218.9	318.3	10.9	308
Surface no-till		162.1	60.9	218.9	320.1	10.0	338

Note: c – control; W_p – soil moisture reserves at the beginning of the growing season, mm; W_k – productive moisture reserves in the soil at the end of the growing season, mm; O – amount of precipitation during the spring barley growing season, mm; S – total water consumption, mm; Y – yield, t/ha; K – water consumption coefficient, m^3/t
Source: compiled by the authors

According to the calculated water consumption coefficients, spring barley plants optimally utilized water per unit yield with the use of conventional ploughing at 302 m³/t. The water consumption coefficient increased by 6.0 and 36 m³/t respectively with the use of shallow and surface no-till cultivation. Thus, the application of shallow and surface no-till cultivation led to an increase in water consumption by barley plants per unit yield and inefficient use of water throughout the crop's growing season. These results are confirmed by the studies of O.I. Tsyliuryk *et al.* (2020), which found that the inclusion of disk tillage in the technology for growing spring barley significantly reduced grain yield and increased the water consumption coefficient by 1.1-1.2 times.

V. Bogužas *et al.* (2018) established that tillage methods of varying intensities did not significantly affect the moisture content in the upper soil layers, but in a dry year, the highest moisture content was recorded with no-till cultivation, while in a wet year, the differences were negligible.

The level of crop yield is the integral indicator of the effectiveness of the studied factors in cultivation technology. Statistical analysis of the obtained data indicates that the studied factors had a significant impact on the grain yield of spring barley. Over the years of research, it was found that the highest crop yield was formed after previous crops with the lowest water consumption coefficient, i.e., after soybeans – 7.12 t/ha, which is 35.4% higher than the control, where this indicator was 5.25 t/ha. The low yield after sunflower – 6.0 t/ha – is explained by insufficient reserves of productive moisture and the negative impact of volunteer plants from the previous crop. After winter rapeseed, the crop yield was 6.72 t/ha, which is significantly higher than after sunflower and corn for grain, but lower than after soybeans (Table 4).

Table 4. Spring barley yield depending on the studied factors, average for 2021-2023, t/ha

Previous crops (A)	Tillage systems (B)	Average yields, t / ha					
		AB	±, %, to control	A	±, %, to control	B	±, %, to control
Corn for grain	Conventional tillage (c)	5.70	-	5.26	-	-	-
	Shallow no-till	5.43	-4.82				
	Surface no-till	4.65	-18.42				
Soybean	Conventional tillage (c)	7.38	29.39	7.12	35.39		
	Shallow no-till	7.26	27.34				
	Surface no-till	6.73	17.98				
Winter rapeseed	Conventional tillage (c)	6.86	20.32	6.72	27.73		
	Shallow no-till	6.84	20.03				
	Surface no-till	6.45	13.16				
Sunflower	Conventional tillage (c)	6.05	6.14	5.99	14.00		
	Shallow no-till	6.20	8.77				
	Surface no-till	5.73	0.58				
HiP_{05}, t/ha, %		0.49	8.12	0.28	4.69	0.25	4.06
Average by tillage	Conventional tillage (c)	-				6.50	-
	Shallow no-till					6.43	-0.99
	Surface no-till					5.89	-9.33

Note: c – control
Source: compiled by the authors

The analysis of the averaged data for the primary soil tillage options indicates a 9.3% reduction in spring barley yield compared to the control when using surface no-till cultivation at 6-8 cm. However, increasing the depth of no-till cultivation to 14-16 cm in the second variant only slightly reduced the crop yield by 0.99% relative to the control The results of the study are confirmed by the data obtained by V. Kyryliuk *et al.* (2019), who established that the use of no-till cultivation reduced the yield of spring barley grain by 0.15-0.46 t/ha compared to conventional tillage (ploughing).

Analysing the impact of primary tillage for spring barley after each previous crop individually, the greatest yield reduction was observed after corn for grain with surface disking (-1.05 t/ha). In contrast, using shallow no-till cultivation after this crop resulted in a minor yield reduction of only -0.27 t/ha compared to the control. Conducting primary shallow no-till cultivation did not reduce the crop yield when placed after soybeans and winter rapeseed. When sunflower was used as the predecessor for this crop with shallow no-till cultivation, the spring barley yield was significantly higher (+8.8% t/ha).

Therefore, selecting the previous crop and optimising the depth and method of soil tillage for spring barley are crucial issues. The conducted study identified a previous crop for spring barley that, with an optimal primary soil tillage system, ensures consistently high crop productivity, especially in years with unfavourable climatic conditions.

CONCLUSIONS

Studies have confirmed the positive impact of the primary soil tillage system and previous crops on managing soil water properties and developing the productivity of spring barley plants on typical black soil of the Right-Bank Forest-Steppe. It was established that during the period of spring barley sowing, a high level of available moisture was ensured by combining shallow no-till cultivation at 14-16 cm depth and soy as the predecessor, with moisture levels of 176.9 mm in 2021, 164.9 mm in 2022, and 146.9 mm in 2023, which is significantly higher than the control.

The lowest levels of available moisture were ensured by conventional tillage, ranging from 137.0 mm to 175.2 mm, and sunflower, ranging from 144.0 mm to 171.4 mm. This explains the low yield of spring barley, which was 6.0 t/ha. Spring barley plants used water most efficiently during the growing season when conventional tillage was used (302 m^3/t) and when soy was the previous crop (269 m^3/t). The most inefficient water use was observed with the combination of corn as the previous crop and surface no-till cultivation (413 m^3/t), where the yield of the studied crop was the lowest at 4.65 t/ha. The highest crop yield was achieved after previous crops with the lowest water consumption coefficient, namely soy – 7.12 t/ha, which is 35.4% higher than the control, where this indicator was 5.25 t/ha.

Future research could focus on developing and testing environmentally sustainable agricultural systems that promote soil resource conservation and reduce the impact of agricultural activities on the environment. Additional studies could also explore the potential of agroecological methods that help restore and improve soil quality, particularly by stimulating microbiological activity and supporting healthy soil flora and fauna. Furthermore, innovative technologies that allow farmers to use resources more efficiently and reduce negative environmental impacts could be refined. It is also necessary to begin exploring the impact of different agricultural practices on the physical and chemical properties of the soil, such as structure, fluidity, acidity, and more. This can help determine optimal methods of soil tillage and care to preserve its fertility.

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CONFLICT OF INTEREST

None.

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Вплив попередників та обробітку ґрунту на запаси доступної вологи чорнозему типового за вирощування ячменю ярого

Анотація. Нестабільна врожайність сільськогосподарських культур виникає через недостатнє забезпечення вологою ґрунту у ключові моменти сходів та росту рослин, що ускладнює сільське господарство і піддає його ризику втрат врожаю. Метою досліджень було встановлення впливу системи обробітку ґрунту та попередників на формування продуктивності рослин ячменю ярого. Це був довготривалий стаціонарний дослід (2021-2023 рр.) із застосуванням статистичної обробки даних. Досліджувався вплив чотирьох попередників – кукурудза на зерно (контроль), соя, ріпак озимий, соняшник та трьох основних обробітків ґрунту. Встановлено, що достовірно найвищі запаси вологи в 0-100 см шарі ґрунту на період сівби формувалися за розміщення ячменю ярого після сої, у 2021 році на 3,2 мм, 2022 році на 3,6 мм, 2023 році на 3,4 мм більше порівняно з контрольним варіантом (кукурудза на зерно) та після ріпаку озимого, на 8,5 мм, 6 мм, 5,7 мм відповідно рокам. Використання безполицевого мілкого обробітку ґрунту забезпечує перевагу в усі роки спостережень над контролем (оранка) у 2021 – на 2,2 мм, у 2022 – на 1,8 мм, та у 2023 – на 8,8 мм. На період сівби досліджуваної культури контроль переважав лише над безполицевим поверхневим обробітком у 2022 року на 2,7 мм. Оптимальним варіантом слід вважати поєднання сої як попередника з мілким безполицевим обробітком ґрунту на 14-16 см, що забезпечує на період колосіння культури в 2021 році – 75,1 мм, 2022 – 93,2 мм, 2023 – 92,2 мм, а на час збирання культури ці показники становили, відповідно 60,7 мм, 67,3 мм., 60,0 мм. Урожайність зерна ячменю ярого за цього варіанту була суттєво найвищою в досліді й в середньому становила 7,26 т/га, що на 27,3 % вище контролю. Результати дослідження можуть бути використані для реалізації генетичного потенціалу рослин ячменю ярого з метою формування стабільної його продуктивності

Ключові слова: сільськогосподарські культури; урожайність; безполицевий обробіток; полицевий обробіток; гідротермічний коефіцієнт; запаси доступної вологи в ґрунті