INFLUENCE OF FARMING SYSTEMS AND SOIL TILLAGE ON AVAILABLE MOISTURE STOCKS OF TYPICAL BLACK SOIL IN SPRING WHEAT CROPS

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Abstract. Numerous studies by Ukrainian and foreign scientists have shown that one of the limiting factors for obtaining a stable yield of any crop is the reserves of available moisture in the soil, especially in critical periods of plant growth. The article presents the results of research on the impact of three farming systems – industrial (control), ecological and biological and four options for primary soil tillage – plowing by 20–22 cm (control), chiseling by 20–22 cm, disking by 10–12 cm, disking for 6–8 cm on the reserves of productive moisture in the soil for growing spring durum wheat.

The regime of moisture supply of crops depends primarily on the weather conditions of the years of research. For spring durum wheat, it is important to have a sufficient supply of productive moisture during sowing, which is formed mainly due to winter precipitation. The years of research differed in the monthly values of the hydrothermal coefficient (HTC). The beginning of the growing season in 2018 was characterized by unfavorable moisture conditions. In particular, in April of this year the HTC was 0.2, which characterizes the area as a desert, which is a significant deviation from the average long-term values (Ki = - 1.3), and May with an HTC of 0.7 was very arid, which tends to distinguished it from the average long-term values (Ki = - 0.5). On the other hand, June, and July of this year with HTC indicators of 1.8 and 1.4, respectively, can be attributed to excessively and sufficiently humid months. August can be attributed to unfavorable months in terms of humidity (HTC = 0.3), and September with HTC = 1.2 was typical (Ki = - 0.1).

The spring of 2019 differed radically from the previous year in terms of HTC, as April and May with values of 3.1 and 1.9, respectively, were excessively humid, which is not typical for these months (Ki = 1.7 and 0.8). June and August of this year with HTC values of 0.98 and 0.73 were arid, which is typical for this period (Ki = - 0.2). July with an HTC of 1.2 referred to slightly arid months, although it tended to be

more favorable in terms of moisture relative to the average long-term data (Ki = 0.8). Thus, 2019 was characterized by wet spring months and quite limited in terms of moisture for the rest of the growing season.

The vegetation period of 2020 according to the monthly distribution of the HTC indicator was similar to 2019. April and May of this year were excessively moistened with the HTC indicators, respectively, 2.35 and 3.2, which is a significant and extreme deviation from the average long-term indicators (Ki = 0.9 and 2.0). The remaining months of the growing season varied from arid June (HTC 0.78) to very dry July, August and September (HTC, respectively, 0.7, 0.48, 0.58), with the dryness of this period confirmed statistically (Ki = - 0.3, - 0.5 and –0.5).

Thus, the years of research were different in terms of annual HTC indicators. However, it is necessary to highlight some of their common features: tendentious or extreme increase in the sum of active temperatures (> 10 ℃) of the growing season against the background of a typical amount of precipitation; atypical distribution of the main weather elements by months of the growing season.

There was a sufficient amount of available moisture in the soil for the period of sowing of spring wheat - 176.9 mm in the spring of 2018, 164.6 - 2019 and 146.3 mm - 2020 on average according to the experiment. At the same time, moisture reserves were closely related to the amount of precipitation during the autumn-winter period. Thus, during the autumn and winter months of 2017–18, 465 mm of precipitation fell, in 2018–19 - 285 and in 2019–20 - 174 mm. The correlation coefficient between the early spring reserves of available moisture and the amount of precipitation in these periods was r = 0.97.

The effect of tillage on the accumulation of available moisture in the soil was also significant. Chiseling by 20–22 cm, disking by 10–12 cm and disking by 6–8 cm created better conditions for better accumulation of moisture due to the finely lumpy composition and mulching layer formed on the field surface. Chiseling can be considered the most effective option, as it provides a significant increase in the reserves of productive moisture at the time of sowing spring wheat in the range of 10.6-20.1 mm, depending on the year. Options with disking also had a positive effect on control, but it was significantly lower than for chiseling.

However, despite the influence of precipitation, the studied factors - farming systems and basic tillage systems had an effect on the available moisture in the soil. Our results of the impact of agricultural systems on the reserves of available moisture showed that its content in the meter layer in all years of determination, there was an advantage of the ecological and biological systems of agriculture. In particular, in 2018 the advantage of the biological system over the control variant was 9.4 mm, 2019 - 2.8, 2020 - 4.7 mm, which is statistically significant

According to research, it is established that the highest moisture reserves in a meter of soil for the period of sowing wheat was obtained by combining the biological farming system and chisel tillage, which allowed to accumulate in 2018 – 199.1 mm, 2019 – 179.6 and 2020 – 159.9 mm of available moisture in the soil. The use of chisel tillage in combination with industrial and organic farming systems also provides an advantage in all years of observations over plowing combinations and both disking options with these systems.

On average, for three years of research on the ecological system of agriculture, crop yields were 5.0 t / ha, which is 5.8% higher than control. In organic farming, there was a significant decrease in yield, which averaged 44.1% over the years of research. At the same time, this decrease in 2019 and 2020 was more significant - 48.6 and 46.3%, in contrast to 2018, where the yield under this system decreased by 33.2%. In years with excessive moisture in the spring months, such a decrease in the yield of spring wheat can be provoked by a higher degree of weediness of crops and the development of diseases.

Among the variants of the second factor, the highest yield of spring wheat was obtained with the use of chisel cultivation, the increase was 6.6%, which is a significant indicator. Variants with disking by 10–12 and 6–8 cm provided a significant, respectively, 7.7 and 18.4% decrease in yield compared to the control.

During the growing season, against the background of all studied agricultural systems, use chiseling and disking provided the highest reserves of available moisture in the soil. However, the best option should be considered a combination of ecological farming system with chiseling by 20–22 cm, which provided for the flowering period in 2018 – 74.0 mm of moisture, 2019 – 93.7 and 2020 – 90.9 mm, and for the harvest

period culture, these indicators were, respectively, 61.0, 67.7 and 61.6 mm. The grain yield of spring durum wheat in this variant was significantly the highest in the experiment and was, respectively, 4.6, 6.7 and 5.6 t/ha.

Keywords: industrial, ecological, and biological farming systems, plowing, chiseling, disking, hydrothermal coefficient, stocks of available moisture in soil, productivity.