



CULTIVATION OF WINTER WHEAT IN THE CONDITIONS OF NEWLY MAINTAINED DESERT ZONE SOILS BASED ON ECONOMICAL IRRIGATION TECHNOLOGY

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Abstract

This article presents the results of using a highly swelling hydrogel polymer compound, synthesized from local raw materials, as a water-saving irrigation technology. The study focused on the cultivation of the winter wheat variety “Starshina” under different standards in the gray-brown, light sand, non-saline soils of the newly developed desert zone in the Bukhara region. The research also explored the impact of seasonal irrigation standards on winter wheat.

Keywords: Winter wheat, hydrogel, polymer, compound, irrigation, grain, water saver.

Introduction

Today, 2.1 billion tons of grain are produced in the world, of which wheat accounts for 759.6 million tons of the total harvest. The area under wheat cultivation is 243.5 million hectares, including the USA, Germany, China, India, Brazil, Australia, Canada, and Russia, where wheat is grown using modern technologies, and the average grain yield in irrigated conditions around the world is 3.1 tons per hectare, and in rainfed conditions it is 1.5 tons. Scientists emphasize that by 2050, world grain production is expected to reach 3 billion tons.

The application of modern agricultural technologies in the cultivation of winter wheat varieties, along with increasing grain yield, effective use of irrigated land, and improving the technological quality indicators of grain are of great importance today. It is expedient to grow wheat in irrigated conditions, taking into account the



location and regions of each region, which have their own soil and climatic conditions.

Experimental system and methods

Scientific research was carried out in 2019-2023 on newly developed gray-brown, light loamy soils of the "Altin Bashak" farm located in the "Navbahor" rural self-governing agricultural district of the Karavulbazar district of the Bukhara region. In order to implement the research objectives, field experiments were conducted on a single system, in which the effect of the hydrogel polymer compound in various proportions on the use of winter wheat variety "Starshina" in terms of water resources saving and land reclamation was studied through field experiments. Scientific research was carried out in the conditions of newly developed gray-brown soils belonging to the V-hydromodule territory of the "Altin Basak" farm located in the Karavulbazar district of the Bukhara region in accordance with the "Methods of conducting field experiments" (PSUEAITI 2007).

In this field experiment, all variants had a soil moisture content of 70-70-65% relative to the NDMS before irrigation, the fertilization rates were the same, N-250, P-180, K-90 kg/ha, and the field was sown with the elite variety of winter wheat "Starshina". At the same time, as a water-saving technology, in addition to variant 1, a hydrogel polymer compound was introduced into the soil composition at rates of 50 kg/ha in variant 2, 75 kg/ha in variant 3, 100 kg/ha in variant 4, and 125 kg/ha in variant 5.

Results and their analysis

Irrigation regimes of winter wheat play a significant role in obtaining high and high-quality yields of winter wheat in the conditions of the newly developed desert zone of the Bukhara region. During the research, in 2019-2023, the irrigation regimes of winter wheat "Starshina" variety in the conditions of the newly developed desert zone of the gray-brown, light loamy soils of mechanical composition were carried out in all variants of the recommended pre-irrigation soil moisture for light loamy, non-saline soils of the Bukhara region at 70-70-65% relative to the NDMS. Irrigation of winter wheat "Starshina" variety was carried out in the 50 cm layer during the tillering period, and in the 70 cm layer during the tillering and ripening periods.

The following formula [1] by S.N. Rizhov was used to determine the irrigation rate of winter wheat.

$$M = (W_{\text{чднс}} - W_x) \cdot 100 \cdot \gamma \cdot h + K, \quad (\text{m}^3/\text{га}) [1].$$

In the formula given by S.N. Rizhov, $W_{\text{чднс}}$ is the limited field moisture capacity, in %; W_h is the soil moisture before irrigation, in %; γ is the bulk density of the soil, g/cm^3 ; h is the calculated layer thickness, m; K is the amount of water spent on evaporation during irrigation, m^3/ha (in terms of moisture deficit, 10 %).

During the experimental years, the irrigation timing, rates, and irrigation periods of winter wheat varied in the variants where the hydrogel polymer composite was used in the cultivation of winter wheat. The data obtained on the seasonal irrigation rates of winter wheat in 2019-2023 are presented in Table 2. In the experiments conducted in 2019-2023, the irrigation water provided for irrigation of winter wheat was measured using a “Cipoletti” (VCh-75) water meter.

Table 2 Seasonal irrigation rates for winter wheat (2019-2023)

Options	2019-2020 years	2020-2021 years	2021-2022 years	2022-2023 years
Options-1	4626	4583	4561	4538
Options-2	3802	3808	4328	4427
Options-3	3697	3738	4250	4340
Options-4	3123	3144	3272	3853
Options-5	3042	3064	3152	3826

In the newly developed gray-brown soils of the Bukhara region, in the control variant of the experiments on the cultivation of winter wheat using a hydrogel polymer compound in the soil, i.e., in the first variant where the hydrogel polymer compound was not applied to the soil, the seasonal irrigation rates for winter wheat were 4538-4626 m^3/ha over the years, while in the second variant where the hydrogel polymer compound was applied to the soil at a rate of 50 kg/ha , the seasonal irrigation rates for winter wheat were 3802-4427 m^3/ha . In the 3rd-4th year of the experiments, as a result of the decrease in the effect of the hydrogel polymer compound in the soil composition, an increase in the number and rate of irrigations was observed, and in the 3rd-4th year of the studies, the seasonal irrigation rates approached the control variant.

It can also be seen that in the field of the 3rd variant of the research, i.e., in which the hydrogel polymer compound was introduced into the soil at a rate of 75 kg/ha, the seasonal irrigation rate of winter wheat was 3697-4340 m³/ha, which is 198-926 m³/ha less than in the control variant. In this variant, the effect of the hydrogel introduced into the soil composition achieved good efficiency in the first and second years, while in the third and fourth years, we can see that the effect of the hydrogel polymer compound decreased. In the 1st and 2nd years of the experiments, the seasonal irrigation rate of winter wheat was 3697-3738 m³/ha, while in the third and fourth years of the observations, the seasonal irrigation rate was 4250-4340 m³/ha. In winter wheat cultivation, the hydrogel polymer compound was introduced into the soil at a rate of 100 kg/ha and winter wheat was grown in Option 4, in which the seasonal irrigation rates for winter wheat in 2019-2023 were 3123-3853 m³/ha, and in Option 5, the seasonal irrigation rates for winter wheat were 3064-3826 m³/ha. We could see that the effectiveness of the hydrogel polymer compound in winter wheat irrigation was high in 3 years. In these options, it was found that the effectiveness of the hydrogel polymer compound decreased slightly in 4 years of research. In these options, it can be seen that the seasonal irrigation rates for winter wheat in comparison with the control option were 685-1584 m³/ha less water was consumed.

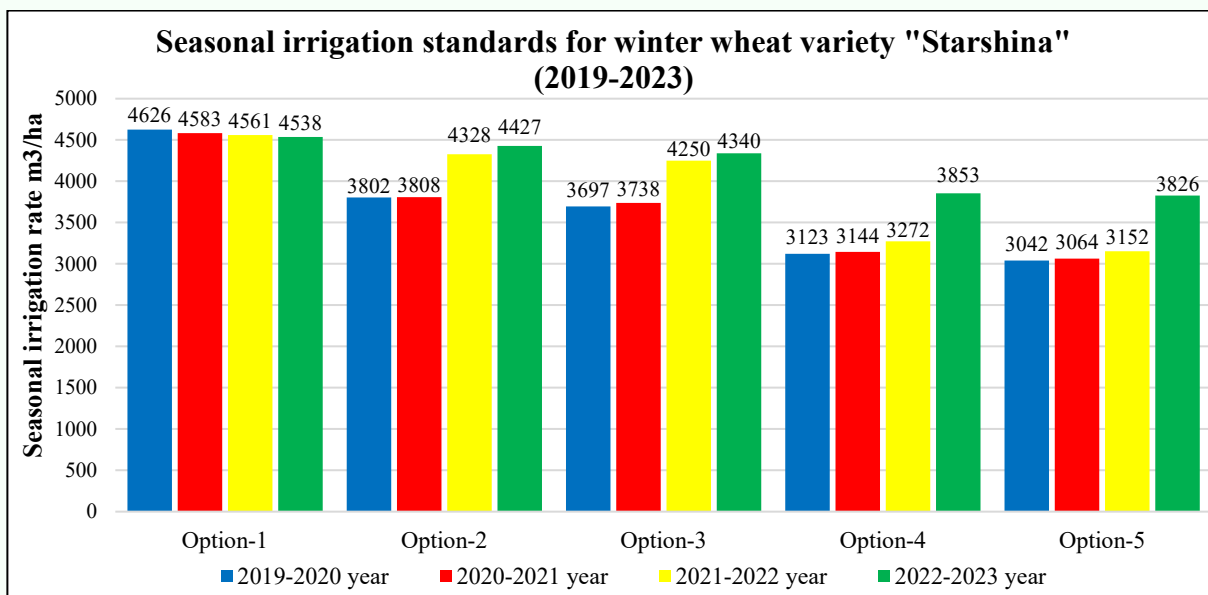


Figure 1. The impact of water-saving irrigation technology on seasonal irrigation rates for winter wheat (2019-2023).

Conclusion

It should be noted that the use of a highly swelling hydrogel polymer compound synthesized from local raw materials as a water-saving irrigation technology at various rates had a positive effect on the cultivation of winter wheat variety "Starshina" in the conditions of gray-brown, light loamy, non-saline soils in the newly developed desert zone of the Bukhara region.

In the experiments conducted in 2019-2023, the average seasonal irrigation rate in Option 4, where 100 kg/ha of a highly swelling hydrogel polymer compound synthesized from local raw materials was used, and the pre-irrigation soil moisture was 70-70-65% relative to the NDMS, was 3348 m³/ha, saving 1229 m³/ha of water resources compared to the control option. In Option 5, where 125 kg/ha of a highly swelling hydrogel polymer compound synthesized from local raw materials was used, the average seasonal irrigation rate was 3271 m³/ha, saving 1306 m³/ha compared to the control option and 77 m³/ha compared to Option 4. It should be noted that, even if 25 kg/ha more hydrogel polymer compound was used in option 5 than in option 4, the seasonal irrigation norms in terms of water saving were close to option 4.

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