



EFFECT OF WATER-SAVING IRRIGATION TECHNOLOGY BASED ON USING HYDROGEL POLYMER COMPOUND ON GERMINATION AND PLANT THICKNESS OF WINTER WHEAT

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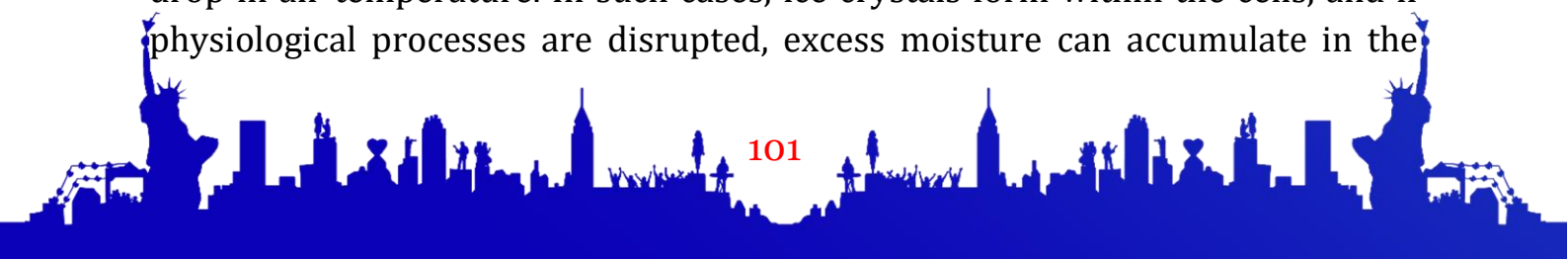
Abstract. The use of a highly swelling hydrogel polymer compound, synthesized from local raw materials, as a water-saving irrigation technology at different rates during the cultivation of the winter wheat variety “Starshina” on gray-brown, light sandy soils with a non-saline profile in the newly developed desert zone of the Bukhara region, affects the germination and seedling density of winter wheat. The results of this effect are presented. In the experimental works, the hydrogel was applied at the following rates: in the 1st option (control), no hydrogel was used; in the 2nd option, 50 kg ha⁻¹; in the 3rd option, 75 kg ha⁻¹; in the 4th option, 100 kg ha⁻¹; and in the 5th option, 125 kg ha⁻¹.

Keywords. Winter wheat, hydrogel, polymer, compound, seedling, seed, tillering, tuber, spiking, flowering, ripening.

Introduction. Wheat is one of the oldest crops on Earth. There is still no clear information about its origin and where it was first cultivated. In some countries in Asia and Africa, wheat was grown 10,000 years ago, coinciding with the advent of agriculture, and it was also cultivated in Iraq 6,500 years later. Wheat was planted in Egypt 6,000 years before our era.

The development cycle of wheat goes through several stages. The stages of winter wheat development are as follows: seed germination, tillering, stem elongation, heading, flowering, and ripening.

One of the unique aspects of winter wheat is its ability to overwinter effectively. Therefore, the autumn-winter and early spring periods are the most critical for this crop. During this time, winter wheat can be damaged by unfavorable conditions, and in some cases, its sprouts may die. In Uzbekistan, winter wheat remains dormant for 3.5 to 5 months. During this period, it is exposed to several adverse conditions, the most significant of which is a sharp drop in air temperature. In such cases, ice crystals form within the cells, and if physiological processes are disrupted, excess moisture can accumulate in the



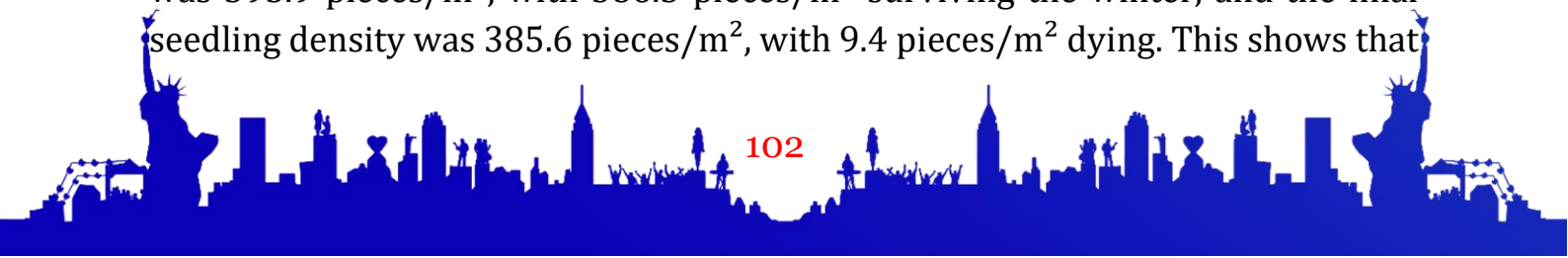


soil due to the slow melting of ice in the spring, leading to the wilting of seeds and grass.

Experimental system and methods of conduct. Scientific research was conducted on the newly cultivated gray-brown, light sandy soils of the “Oltin Boshok” farm, located in Karaulbazar district, Bukhara region.

In this field experiment, pre-irrigation soil moisture was maintained at 70-70-65% compared to the limited soil moisture capacity. The fertilization rates were consistent across all options, with N-250, P-180, and K-90 kg ha⁻¹ applied, and the elite winter wheat variety “Starshina” was planted. The research was conducted using five treatments with three replications, and the experiments were arranged in a single layer. Additionally, as a water-saving technology, hydrogel was applied at different rates: 50 kg ha⁻¹ in the 1st and 2nd options, 75 kg ha⁻¹ in the 3rd, 100 kg ha⁻¹ in the 4th, and 125 kg ha⁻¹ in the 5th.

Results and analysis. Elite seeds of the “Starshina” variety of winter wheat were sown in the experimental field on the soil of the newly developed desert zone between October 13 and October 18 during the years 2019-2022. The crop was managed according to the agrotechnical practices recommended for the area. Three to five days after sowing, the seeds were irrigated lightly for recovery, and full germination was achieved within 9-10 days. It should be noted that in other regions, pre-planting irrigation is typically carried out to moisten the soil. However, due to the specific soil and climatic conditions of the Kaulbazar district - particularly the low moisture retention capacity of the soil—winter wheat seeds are planted and left for 2-3 days before irrigation. This allows the seeds to fully germinate; otherwise, there would not be enough soil moisture for germination. In the experimental field from 2019-2023, the germination of the “Starshina” variety of winter wheat ranged from 393.2 to 395.9 pieces/m², depending on the option. In the control option, where no hydrogel polymer compound was mixed into the soil, the number of seedlings was 393.2 pieces/m², with 379.9 pieces/m² surviving the winter, resulting in 13.3 pieces/m² dying. By the end of the growing season, the seedling density in the control option was 377.2 pieces/m². In the experiments, the seedling count in the 2nd option with hydrogel application at 50 kg ha⁻¹ was 395.1 pieces/m², with 384.0 pieces/m² surviving the winter, and the final seedling density was 383.7 pieces/m², with 11.1 pieces/m² dying. In the third option, where the hydrogel polymer compound was applied at 75 kg ha⁻¹, the initial seedling count was 395.9 pieces/m², with 386.5 pieces/m² surviving the winter, and the final seedling density was 385.6 pieces/m², with 9.4 pieces/m² dying. This shows that





the number of overwintered seedlings was 1.5 pieces/m² higher and the number of dead seedlings was 1.7 pieces/m² lower than in the control option.

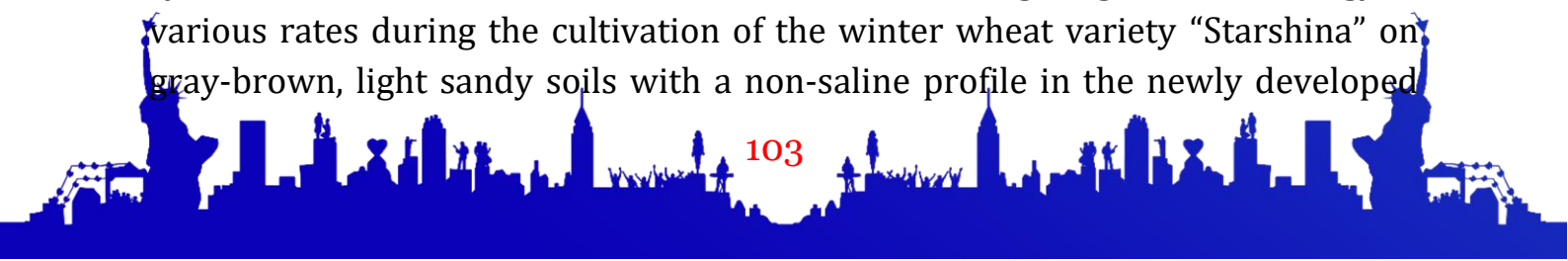
Table 1. Germination and seedling thickness of winter wheat

Options	Pre-irrigation soil moisture. Relative to LSMC, %	The number of sprouted seedlings, pieces/m ²	The number of seedlings that have emerged from the winter, pieces /m ²	Dead plants pieces/m ²	The number of seedlings at the end of the growing season, pieces/m ²
Average in 2019-2023					
1.	70-70-65	393,2	379,9	13,3	377,2
2.		395,1	384,0	11,1	383,7
3.		395,9	386,5	9,4	385,6
4.		396,1	391,0	5,1	390,7
5.		396,2	392,0	4,2	390,4

In the research, in the 4th option, where the hydrogel polymer compound was mixed into the soil at a rate of 100 kg ha⁻¹ and irrigation was carried out, the number of sprouted seedlings in the winter wheat field was 396.1 pieces/m². The number of seedlings that survived the winter was 391.0 pieces/m², and by the end of the growing period, the seedling count was 390.7 pieces/m², with 5.1 pieces/m² having died. Compared to the control option, these values were higher by 2.9, 11.1, and 13.5 pieces/m², respectively, while the number of dead seedlings decreased by 8.2 pieces/m².

In the course of the scientific research, winter wheat was grown with a hydrogel polymer compound mixed into the soil at a rate of 125 kg ha⁻¹ in the 5th option. In this option, the number of sprouted seedlings in the winter wheat field was 396.2 pieces/m², the number of seedlings that survived the winter was 392.0 pieces/m², and the number of dead seedlings was 4.2 pieces/m². By the end of the growing period, the seedling density was 390.4 pieces/m², which was 13.2 pieces/m² higher compared to the control option (Table 1).

Conclusions. The use of a highly swelling hydrogel polymer compound, synthesized from local raw materials, as a water-saving irrigation technology at various rates during the cultivation of the winter wheat variety "Starshina" on gray-brown, light sandy soils with a non-saline profile in the newly developed





desert zone of the Bukhara region impacts both germination and seedling density. Experimental studies demonstrated that increasing the application rate of the hydrogel polymer compound improves soil moisture retention and enhances seedling thickness. Additionally, the use of the hydrogel polymer compound was associated with a reduction in the death of winter wheat plants. By the end of the growing season, the number of seedlings was higher in the options where the hydrogel polymer compound was used compared to the control (option 1). This, in turn, ensures a higher and better-quality harvest of winter wheat.

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