

Influence of Pre-Sowing Irrigation on Seed Generation in Winter Wheat

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Abstract. The effect of pre-sowing irrigation on the germination of wheat seeds was studied during the autumn sowing of varieties from the regional nursery of Central Asia and Kazakhstan. Pre-plant irrigation and seeding on moist soil resulted in stronger seedlings and a larger and deeper root system compared to seeding on dry soil and watering after seeding. The average germination of seeds in the control variants for all varieties sown in three agility on dry soil and row irrigation after sowing was 76.7% or an average of 200 seeds per square meter, and with presowing irrigation it was 83.4% or, on average, 20 seeds more than control. The highest water use efficiency and seed germination were observed when planting on moist soil, suggesting that the combination of preplant irrigation and phosphorus application had a beneficial effect on germination and seed retention of wheat.
Key words: wheat, variety samples, regional nursery, pre-sowing irrigation, germination, soil, seed conservation.

1 Introduction

Wheat is the main food crop with a total area of 1.4 million hectares and an average grain yield of 4.5 t/ha, directly related to food security [1-2]. Consumption of bread and other wheat products in Uzbekistan is one of the highest in the world and exceeds 200 kg per person per year. [3-4]. Wheat requires sufficient soil moisture for normal growth and development at all stages of growth, which is possible through accurate irrigation planning to reduce over-irrigation [5]. Excessive use of water can lead to waterlogging and leaching of nutrients outside the root zone. To improve water use efficiency, a proper irrigation schedule with sufficient water needs to be established, as flooding can lead to a decrease in water use efficiency [6] and sometimes productivity [7-8].

Germination and emergence are the two most important stages in the plant life cycle, determining the efficient use of the nutrient and water resources available to plants [9-10]. Seeds require oxygen, and if stored in a waterlogged state, they can rot. On the other hand, if the soil dries out, the seed will lose all the water it has absorbed and die. Seed germination is known to be affected by environmental factors such as temperature, light, pH, and soil moisture [11]. Temperature plays an important role in determining the frequency of seed germination and species distribution [12].

As a rule, wheat is sown in flat areas, which often negatively affects the yield due to

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excessive irrigation or rainwater [13]. In bed and furrow irrigation, plants are grown in raised beds, which not only use irrigation water more efficiently, but also provide better crop growth in heavy rain conditions due to drainage capabilities [14]. The emergence of raised cropping has traditionally been associated with water management issues, either as an opportunity to reduce the impact of excess water in rainfed conditions or to more efficiently supply irrigation water to highly productive irrigation systems [15]. Moreover, furrow irrigation is well suited for crops, including wheat, that are adversely affected by prolonged flooding [16].

In Uzbekistan, wheat is sown mainly inside growing cotton by spreading a non-specialized mounted fertilizer spreader [NRU] or using cotton cultivators. Before sowing, the soil is loosened with a cultivator, and after sowing again with a cultivator, the seeds are mixed with the soil. At the same time, part of the seeds remains on the surface of the soil, and part of the seeds gets deeper - by 6-7 cm. from the soil surface. When watering after sowing, some of the seeds are washed out, some are flooded, which leads to a significant loss of seeds, which negatively affects the receipt of friendly seedlings.

The purpose of the research was to study the effect of pre - and post-sowing irrigation on the indicators of sowing qualities and to compare the germination of winter wheat seeds in the field.

2 Materials and Methods

The experiments were carried out at the experimental station of the Institute of Genetics and Experimental Plant Biology, not far from Tashkent. The studies used 200 varieties of wheat cultivated in Central Asia, Kazakhstan and varieties originating in Russia, but cultivated in Uzbekistan. Sowing was done manually using a single-row seeder. 200 kg seeds/ha in the last week of October 2020. Nitrogen and phosphorus were applied at 150 and 100 kg/ha respectively. Half of the nitrogen dose and a full dose of phosphorus were applied during presowing preparation, and the remaining half of the nitrogen dose was applied during the first vegetation irrigation.

Experiment Design. Seeds were sown in three speeds and in two variants. In the first variant, the seeds were sown in the usual way in dry soil and watered after sowing, in the second variant, watering was carried out before sowing and the seeds were sown on moist soil. Seeding rates 400 seeds/m², sowing depth 3-5 cm, row spacing - 15 cm.

Statistical processing. The data were analyzed statistically using Fisher's ANOVA and the variance was compared using the Least Significant Difference (LSD) test at a probability level of 5% [17]. When counting seeds, the ImageJ Android programs of the multi-point toll function were used.

3 Results and discussion

A distinctive biological feature of grain crop seeds is that the emergence of seedlings in the field is provided by a coleoptile - a modified primary vaginal leaf that protects the young stalk of the germinated seed from mechanical damage and breaks through the soil with a hard top. After the completion of the growth of the coleoptile in length, the number of shoots that appeared is counted and expressed as a percentage of the number of germinating seeds sown.

The average seed germination in the control variants for all varieties sown in three agility on dry soil and row irrigation after sowing was 76.7% or an average of 200 seeds per square meter. This indicator in the experimental variant, with pre-sowing irrigation, was 83.4%, or an average of 20 seeds more than in the control. Large polymorphism among variety samples was observed in terms of the number of maximum and minimum shoots. At the same time, the maximum number of seedlings in the control was 360 seeds, in the experimental variant

- 398, and the minimum number of seedlings among the variety samples was 85 seeds in the control and 99 seeds in the experimental variant. This shows that not all varieties have the same germination in both cases. However, seed losses are much greater when sown on dry soil.

Comparison of the results obtained by regions showed that in varieties of Russian origin, which are biologically winter, the percentage of germination in the control variant is relatively higher than in the experimental variant with a difference of about 2%. In samples other than TSI, the difference between the variants was about 10%, which shows the advantages of sowing on moist soil during pre-sowing irrigation than sowing seeds on dry soil and watering after sowing.

Analysis of variety samples of Kazakhstan selection showed 100% seed germination during presowing irrigation in varieties Progress, Akdan, Aliya, Anara, Bayandi, Bogarnaya-56, Derbes, Karabalskaya ozimaya, Naz, Sultan, Krasnovodopod, Borlaug, and varieties Batir, Bogarnaya 56, Egemen, Reke, Alatau, Krasnovodopodskaya-210 and Farabi showed high germination in the control variant. Among the varieties of the Uzbek selection, 100% germination during pre-sowing irrigation was observed in the varieties Andijon 4, Jasmina, Mars1, Ok budoy, Pakhlavon and Chillaki, and in the control variant, the varieties Jasmina, Tezpishar, Chillaki, Hosildor, Yaksart, Yanbosh had high germination, and varieties Andijan 4 and Omad had the lowest seed germination - only 50%,

From the Russian selection, high germination in the control variant was observed in the varieties of winter soft wheat Bezostaya 1, Granma and Gratsiya, and the varieties Kuma, Pamyat, Bezostaya 100, in the varieties Moskovskaya 39, Kalim, Petr and Starshina, relatively low germination when sown on moist soil. The same trend was observed among the varieties of the Kyrgyz and Tajik selections.

Table 1. Comparative analysis of the number of seedlings of wheat seeds by region.

Region	Control (watering after sowing seeds)					
	In percents			Number of seedlings		
	M±m	max	min	M±m	max	min
Average for all samples	76,67±13,83	100	40	200,98±52,27	360	85
Kazakhstan	74,66±15,97	100	40	205,15±60,7	360	85
Uzbekistan	78,15±16,42	100	50	187,26±39,31	256	124
Russia	83,33±11,09	100	60	204,82±43,87	300	123
Kyrgyzstan	77,67±8,95	90	60	204,81±56,23	349	116
Tajikistan	73,33±16,58	90	40	189,67±57,33	270	88
TCI	72,27±6,46	80	60	202,73±32,98	250	160
Turkey, Ukraine and Serbia	74,28±12,72	90	50	181,71±30,49	214	140
Experience (pre-sowing watering)						
Average for all samples	83,43±12,07	100	50	220±58,75	398	99
Kazakhstan	82,25±12,8	100	50	225+46±58,98	398	99

Uzbekistan	87,04±9,53	100	70	212,67±50,4	358	124
Russia	81,82±12,36	100	60	203,3±53,64	292	114
Kyrgyzstan	86,28±9,76	100	60	227,8±64,55	394	120
Tajikistan	84,44±15,9	100	50	223,56±79,3	349	110
TCI	75,45±12,93	100	60	211,45±49,85	289	137
Turkey, Ukraine and Serbia	82,86±1,8	100	70	206,57±54,39	280	142

4 Conclusion

Wheat [*Triticum aestivum* L.] is the second largest agricultural crop in the world [18]. Due to current water scarcity issues, it is important to improve the water use efficiency [WEE] of winter wheat while maintaining or potentially increasing grain yields. Determining the appropriate irrigation frequency is an important step in optimizing winter wheat yields and WUE. The frequency of watering can affect plant growth in different ways. In winter wheat, an increase in the frequency of irrigation leads to low evapotranspiration (evapotranspiration) [19]. Han et al. [20] found that with two irrigations during the growing season of winter wheat, grain yield can be increased; however, watering late in the growing season can reduce grain yield. It was found that pre-sowing irrigation and sowing on moist soil favorably affects the germination of wheat seeds during autumn sowing than sowing on dry soil and watering after sowing. The decrease in germination in this case is associated with the washing out of some of the seeds that remained not covered with soil and waterlogging of the seeds at the end of the field. It is recommended in cases of sowing wheat inside growing cotton to carry out watering before preparing the soil for sowing, which will facilitate the loosening of the soil and have a beneficial effect on germination, as well as the preservation of all seeds.

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