

Dependence of Height, Total Number and Quantity of Productive Stems of Winter Barley Varieties on Different Sowing Date and Mineral Fertilizer Application Rates

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Abstract: This article presents data on the effects of different planting dates and mineral fertilizer application rates on plant height, growth and development, and the number of total and productive stems in winter barley varieties "Ikhtiyor", "Obikor" and "Kizilkurgan".

Keywords: seed, planting time, barley, variety, environmental factors, soil, mineral fertilizer, rate,, plant height, growth, productive and total stems.



INTRODUCTION. Barley (*Hordeum vulgare L.*), a member of the grass family, is a major cereal grain grown in temperate climates globally. It was one of the first cultivated grains, it was domesticated in the Fertile Crescent around 9000 BC, giving it nonshattering spikelets and making it much easier to harvest. Its use then spread throughout Eurasia by 2000 BC. Barley prefers relatively low temperatures and well-drained soil to grow. It is relatively tolerant of drought and soil salinity, but is less winter-hardy than wheat or rye. In 2023, barley was fourth among grains in quantity produced, 146 million tonnes, behind maize, rice, and wheat. Globally, 70% of barley production is used as animal feed, while 30% is used as a source of fermentable material for beer, or further distilled into whisky, and as a component of various foods. It is used in soups and stews and in barley bread of various cultures. Barley grains are commonly made into malt using a traditional and ancient method of preparation. In English folklore, John Barleycorn personifies the grain and the alcoholic beverages made from it. English pub names such as The Barley Mow allude to its role in the production of beer.





Research and methods.

Production. In 2023, world production of barley was 145,8 million tonnes, led by Russia accounting for 14% of the world total (table). Australia, France, and Germany were secondary producers. Worldwide barley production in 2023 was fourth among grains, following maize (1.2 billion tonnes), rice (800 million tonnes), and wheat (799 million tonnes).

1-table

Barley production 2023, millions of tonnes

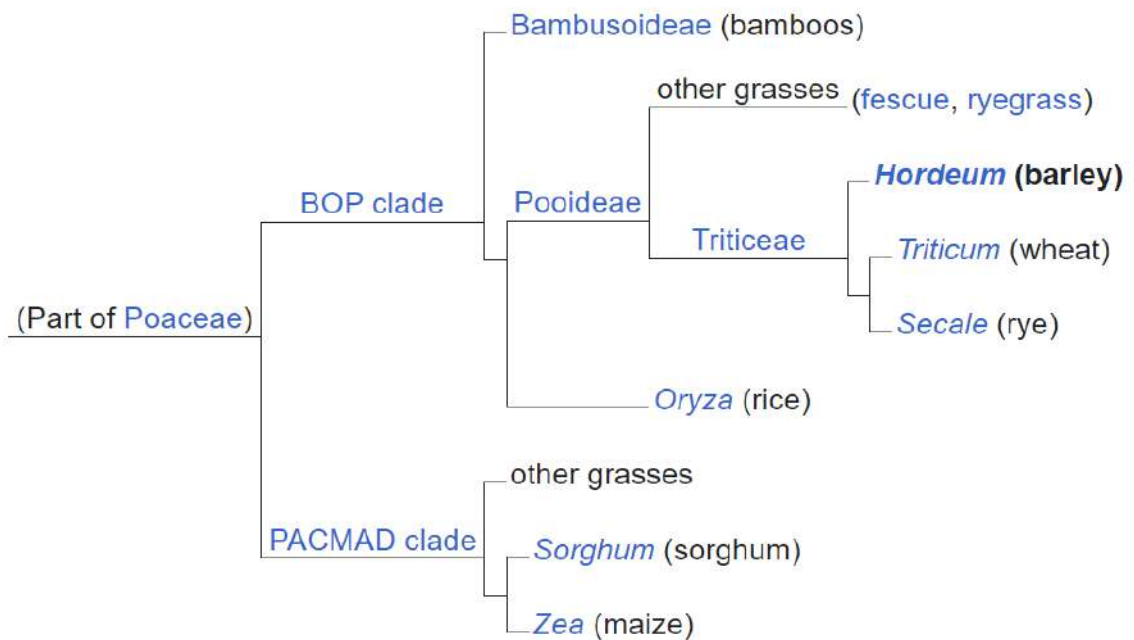
	Russia	20.5
	Australia	13.5

 France	12.1
 Germany	11.0
 Turkey	9.2
 Canada	8.9
World	145.8

Source: FAOSTAT of the United Nations[2024]

External phylogeny. The barley genus *Hordeum* is relatively closely related to wheat and rye within the Triticeae, and more distantly to rice within the BOP clade of grasses (Poaceae). The phylogeny of the Triticeae is complicated by hybridization between species, so there is a network of relationships rather than a simple inheritance-based tree.

2-table



PLACE OF RESEARCH, SOIL - CLIMATIC CONDITIONS. Scientific research work was carried out in 2023-2024 year in the Plant Genetic Resources Scientific Research Institute. The experimental farm is located in the upper reaches of the Chirchik River, at an altitude of 481 m above sea level, at 41°11'N north latitude and 69°03' E east longitude, in Kibray district of Tashkent region.

The soil of the experimental field is a typical gray loam that has been irrigated for a long time. This soil contains 0.8 - 1.0% humus, about 0.058 - 0.089% nitrogen, about 0.141 - 0.184% phosphorus and about 0.154 - 0.148% potassium, which indicates that the nutrients used by the plant during the growing season are very small. The soil is not saline. It differs in soil water permeability, softening complexity.

The main part of atmospheric precipitation occurs in the form of snow in the mountain region, and in the form of rain in the hilly and plain regions. Most of the precipitation falls in the winter and spring months, and a small amount falls in the autumn months. In the summer months, there is almost no rain. In autumn, the warm days last much longer, the air temperature slowly decreases. At the end of October or at the beginning of November, frost falls and the period of field crops stops. During this period, the amount of precipitation increases.

In the experiment, the amount of precipitation was taken into account when implementing irrigation factors. This led to changes in the number and rate of irrigation over the years. In general, by analyzing the climatic conditions of Tashkent region, it is possible to conclude that this area is suitable for growing any type of agricultural crops, and the power of sunlight, the possibilities of artificial irrigation ensure the cultivation of high-quality crops from field crops.

RESULT AND DISCUSSION. Cultivation of high grain yield from autumn grain crops depends on the optimal course of the growth and development process in the plant. Also, the height of the plant is important in ensuring a high yield. Violation of the applied agro-factors (fertilization with mineral fertilizers, irrigation rates and timing, sowing rates, timing, method, etc.) leads to the fact that the plant does not grow normally or becomes excessively stunted. As a result, the grain yield decreases and its quality deteriorates. The above-mentioned negative consequences were not observed in this study. Growth occurs in connection with development, in which the plant increases in size and quantity due to the formation of new cells and tissues. Biological and economic yield is formed due to the accumulation of new organic substances in the plant.

The course of the growth process in a plant is clearly reflected in its main stem height. Therefore, determining the main stem height of a plant is one of the important factors in conducting phenological observations. In the conducted field experiment, the optimal sowing rates of barley varieties and their requirements for mineral fertilizers were determined. It can be seen in the analysis of the data of Table 1 obtained on the plant height and the number of seedlings in the researched experimental options that the planting rates and the use of mineral fertilizers in different rates had a significant effect on the plant height and the number of plant stems.

Planting method and depth. At present, the seed of spiky grain crops in large irrigated areas is SZ-3.6; it is sown using SZU-3.6 and pneumatic precision nesting drills, then furrows are made with 70 or 90 cm between rows. For planting in our field experiments, furrows of 70 cm were first made using KXU-4 model cultivator. Since our field experiments were conducted in small areas, the seed was planted by hand at a depth of 3 - 4 cm at different planting rates.

In the first year of the study (2022-2023), the winter barley variety "Ikhtiyor" was used as a control variety, with seeds of 3.0 million seeds per hectare and mineral fertilizers $N_{150}P_{80}K_{100}$ kg/ha. In the first variant, the plant height was 19.5 cm on the first day of March, 43.4 cm on the first day of April, and 92.5 cm on May 1. In the 2nd option, the seeds of the "Ikhtiyor" variety were sown at a rate of 3.0 million units per hectare and mineral fertilizers $N_{180}P_{110}K_{140}$ kg/ha. In the 2nd option, the plant height was 21.7 cm on the first day of March, 45.7 cm on the first day of April, and 95.4 cm on May 1. It can be seen that due to the increased rates of mineral fertilizers, the plant height in the 2nd option was 2.2-2.9 cm higher.

In the second year of the experiment (2023-2024), the winter barley variety "Ikhtiyor" was studied as a control variety, and in the third variant, where 3.5 million seeds per hectare and mineral fertilizers $N_{150}P_{80}K_{100}$ kg/ha were applied, the plant height was 20.1 cm on the first day of March, 44.5 cm on the first day of April, and 96.5 cm on May 1. In the 4th variant of the experiment, when 3.5 million seeds of the "Ikhtiyor" variety were sown per hectare and mineral fertilizers were applied at a rate of $N_{180}P_{110}K_{140}$ kg/ha, the plant height was 22.2 cm on the first day of March, 46.9 cm on the first day of April, and 99.3 cm on May 1. It can be seen that due to the increased rates of mineral fertilizers, the plant height was 2.1-3.2 cm higher in the 4th variety.

In the first year of the experiment (2022-2023), the winter barley variety "Ikhtiyor", which was studied as a control variety, had the tallest plants in the 6th variant, when seeds were applied at a rate of 4.0 million seeds per hectare and mineral fertilizers $N_{180}P_{110}K_{140}$ kg/ha. The plant height was 23.6 cm on the first day of March, 53.5 cm on the first day of April, and 99.7 cm on May 1. In the experiment, in option 5, when seeds were applied at a rate of 4.0 million seeds per hectare and mineral fertilizers $N_{150}P_{80}K_{100}$ kg/ha, the plant height was 22.9 cm on the first day of March, 51.3 cm on the first day of April, and 97.8 cm on May 1. It can be seen that at a sowing rate of

4.0 million seeds/ha, due to an increase in the rate of mineral fertilizers, the plant height increased by 0.7-2.2-1.9 cm. In the 7th variant, where the seeds of the studied winter barley variety "Obikor" were applied at a rate of 3.0 million seeds per hectare and mineral fertilizers N₁₅₀P₈₀K₁₀₀ kg/ha, the plant height was 23.4 cm on the first day of March, 46.8 cm on the first day of April, and 88.5 cm on May 1. In the 8th variant, in which 3.0 million seeds of the "Obikor" variety were used per hectare and mineral fertilizers N₁₈₀P₁₁₀K₁₄₀ kg/ha were applied, the plant height was 26.2 cm on the first day of March, 49.5 cm on the first day of April, and 92.8 cm on May 1. It can be seen that due to the increase in mineral fertilizer rates, the plant height in the 8th variant was 2.8-2.7-4.3 cm higher. In the second year of the experiment (2023-2024), in variant 9, where seeds of the winter barley variety "Obikor" were applied at a rate of 3.5 million seeds per hectare and mineral fertilizers N₁₅₀P₈₀K₁₀₀ kg/ha, the plant height was 22.4 cm on the first of March, 49.2 cm on the first of April, and 93.4 cm on May 1. In the 10th variant, where 3.5 million seeds of the "Obikor" variety were used per hectare, but mineral fertilizers N₁₈₀P₁₁₀K₁₄₀ kg/ha were applied, the plant height was 25.7 cm on the first of March, 52.4 cm on the first of April, and 97.6 cm on May 1. It can be seen from the obtained data that due to the increase in the rates of applied mineral fertilizers, it was determined that the height of the plant was 3.3-4.5-1.8 cm higher in the 12th option based on the sequence of patterns.

Table-3 The effect of planting dates and mineral fertilizer rates on plant height, total and productive stem number of winter barley varieties (data for 2024)

№	Varieties	Sowing rate, mln.units/ha	Annual rates of mineral fertilizers, kg/ha	Plant height, sm			Total number of stems unit/m ²	From this, the number of productive stems unit/m ²
				1.III	1.IV	1.V		
1	Ikhtiyor (St)	3,0	N ₁₅₀ P ₈₀ K ₁₀₀	17,5	40,2	93,7	435,6	348,2
2		3,0	N ₁₈₀ P ₁₁₀ K ₁₄₀	19,3	43,1	97,2	448,7	357,4
3		3,5	N ₁₅₀ P ₈₀ K ₁₀₀	20,1	44,5	96,5	501,4	416,9
4		3,5	N ₁₈₀ P ₁₁₀ K ₁₄₀	22,2	46,9	99,3	511,5	422,2
5		4,0	N ₁₅₀ P ₈₀ K ₁₀₀	21,3	50,5	102,5	551,1	457,5
6		4,0	N ₁₈₀ P ₁₁₀ K ₁₄₀	22,8	53,2	106,2	560,2	463,8
7	Obikor	3,0	N ₁₅₀ P ₈₀ K ₁₀₀	21,5	47,6	92,5	420,5	328,1
8		3,0	N ₁₈₀ P ₁₁₀ K ₁₄₀	24,1	50,7	95,7	437,6	342,9
9		3,5	N ₁₅₀ P ₈₀ K ₁₀₀	22,4	49,2	93,4	469,1	372,8
10		3,5	N ₁₈₀ P ₁₁₀ K ₁₄₀	25,7	52,4	97,6	497,4	384,3
11		4,0	N ₁₅₀ P ₈₀ K ₁₀₀	23,8	55,3	96,5	539,8	436,1
12		4,0	N ₁₈₀ P ₁₁₀ K ₁₄₀	27,1	59,8	98,3	551,3	445,2
13	Kizilkurgan	3,0	N ₁₅₀ P ₈₀ K ₁₀₀	18,4	43,5	102,1	457,5	385,3
14		3,0	N ₁₈₀ P ₁₁₀ K ₁₄₀	20,6	47,2	105,7	469,2	394,5
15		3,5	N ₁₅₀ P ₈₀ K ₁₀₀	21,3	44,8	106,4	517,6	431,3
16		3,5	N ₁₈₀ P ₁₁₀ K ₁₄₀	23,7	49,3	108,6	531,4	442,2
17		4,0	N ₁₅₀ P ₈₀ K ₁₀₀	22,6	50,9	110,5	563,2	468,5
18		4,0	N ₁₈₀ P ₁₁₀ K ₁₄₀	23,1	54,5	113,7	572,5	476,1

The highest plants of the winter barley variety "Obikor" studied in the experiment were in the 12th variant, when seeds were applied at a rate of 4.0 million seeds per hectare and mineral fertilizers N₁₈₀P₁₁₀K₁₄₀ kg/ha. The plant height was 28.2 cm on the first day of March, 57.4 cm on the first day of April, and 95.6 cm on May 1.

In the 11th variant of the experiment, when seeds were applied at a rate of 4.0 million seeds per hectare and mineral fertilizers N₁₅₀P₈₀K₁₀₀ kg/ha, the plant height was 25.9 cm on the first day of March, 54.2 cm on the first day of April, and 92.1 cm on May 1. In this variety, the above rule was repeated, and it was noted that the height of the plant was 2.3-3.2-3.5 cm high in the 12th option due to the increase in the rate of mineral grass when the planting rate was 4.0 million units/ha.

In the 11th variant of the experiment, when seeds were applied at a rate of 4.0 million seeds per hectare and mineral fertilizers $N_{150}P_{80}K_{100}$ kg/ha, the plant height was 25.9 cm on the first day of March, 54.2 cm on the first day of April, and 92.1 cm on May 1. In this variety, the above rule was repeated, and it was noted that the height of the plant was 2.3-3.2-3.5 cm high in the 12th option due to the increase in the rate of mineral grass when the planting rate was 4.0 million units/ha.

It should be noted that the "Obikor" variety had the tallest plants among the three barley varieties studied, which was observed on March 1, when the initial plant stem height was determined. For example, in the "Obikor" variety, the average plant height was 23.4-28.5 cm in options 7-12, and in the "Ikhtiyar" variety, studied as a control variety, on March 1, the average plant height was 19.5-25.3 cm in options 1-6, that is, it was 3.2-3.5 cm shorter than the "Obikor" variety. In the 13th variant, where the barley variety "Kizilkurgan" was sown at a rate of 3.0 million seeds per hectare and mineral fertilizers $N_{150}P_{80}K_{100}$ kg/ha, the plant height was 21.3 cm on the first day of March, 45.2 cm on the first day of April, and 99.4 cm on May 1. In the 14th variant, where the seeds of the "Kyzylkurgan" variety were sown at a rate of 3.0 million units per hectare and mineral fertilizers $N_{180}P_{110}K_{140}$ kg/ha were applied, the plant height was 23.7 cm on the first day of March, 48.6 cm on the first day of April, and 102.5 cm on May 1. It can be seen that due to the increased rates of mineral fertilizers, the plant height in the 13th variant was 2.4-3.5-3.1 cm higher.

The tallest plants of the winter barley variety "Kyzilkorgon" were in the 17th variant, when seeds were applied at a rate of 4.0 million seeds per hectare and mineral fertilizers $N_{180}P_{110}K_{140}$ kg/ha. The plant height was 24.6 cm on the first day of March, 56.8 cm on the first day of April, and 108.7 cm on May 1. In the 17th variety of the experiment, when seeds were applied at a lower rate of 4.0 million seeds per hectare and mineral fertilizers $N_{150}P_{80}K_{100}$ kg/ha, the plant height was 22.8 cm on the first day of March, 53.3 cm on the first day of April, and 105.6 cm on May 1. In this variety, the above rule was repeated, and when the planting rate was 4.0 million units/ha, it was noted that as a result of the use of mineral grasses at a higher rate than in the 17th option, the plant height was 1.8-3.5-3.1 cm high in the 18th variety.

CONCLUSION. It was found that planting rates and application of mineral fertilizers in different rates affect the height of barley plant. On March 1, the plant height of the "Obikor" variety was 3.9-4.6 cm higher than the control "Ikhtiyor" variety and 2.1-3.6 cm higher than the "Kizilkurgan" variety. However, by May 1, the highest plant height of the "Kizilkurgan" variety was 99.4-108.7 cm, which was 6.9-9.0 cm higher than the "Ikhtiyor" variety and 10.9-13.1 cm higher than the "Obikor" variety.

Germination is a phase of fermentation, which requires different biological factors in all grain crops, and the botanical differences in germination are also different, and even this phase lasts for a different period of time. For all grain crops, this phase is considered an important developmental phase that determines the yield, therefore, all agrotechnical measures must be carried out qualitatively to ensure good conditions for harvesting. The total number of stalks produced by a grain crop during the phase of accumulation is called total accumulation. The more moisture in the soil, the more fertile it is, the stronger the soil is. If the crop is sown thickly, there is a lack of cover and nutrients, and the strength of the plant is reduced. In addition to general accumulation, there is also productive accumulation. Productive or productive accumulation refers to the accumulation of grains on the stalk.

From the above data, it can be seen that the yield is one of the main indicators that determine the grain yield. Taking into account the above circumstances, in the research work, observational and analytical studies were carried out in the field of variants in order to determine the impact of agrotechnical measures applied to winter rye varieties on the height of the crop, total and productive area.

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