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THE EFFECT OF SEEDING RATES ON FIELD GERMINATION AND GROWTH–DEVELOPMENT OF SEEDS OF THE NEW "SHUKRONA" VARIETY OF AUTUMN SOFT WHEAT

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Abstract. This article describes the optimal seeding rate for growing the new local winter soft wheat variety "Shukrona" in the southern region of the republic. It is noted that in the light gray soils of the Kashkadarya region, the field germination of seeds of the newly developed winter soft wheat variety "Shukrona" is directly proportional to the seeding rate. Although no difference in the duration of seed germination was observed when the "Shukrona" variety was sown at the optimal time, field germination varied between 82 and 88 percent depending on the seeding rate. The growing season of the "Shukrona" variety was found to vary from 224 to 228 days depending on the seeding rate, with the longest growing season observed when planting 4.0 million seeds per hectare.

Key words: Winter wheat, seeds, variety, Shukrona, seeding rate, fertility, development phases, vegetation period.

Annotatsiya. Maqolada Respublikaning janubiy mintaqasi sharoitida mahalliy kuzgi yumshoq bug'doyning yangi "Shukrona" navini yetishtirishda maqbul ekish me'yori yoritilgan. Qashqadaryo viloyatining och tusli bo'z tuproqlari sharoitida yangi yaratilgan kuzgi yumshoq bug'doyning Shukrona navi urug'larining dala unuvchanligi bevosita ekish me'yorlariga bog'liq holda o'zgarib borganligi qayd qilingan. Kuzgi yumshoq bug'doyning Shukrona navi optimal muddatda turli me'yorlarda ekilganda urug'larining unib chiqishi davomiyligi orasida farq kuzatilmagan bo'lsada, urug'larning dala unuvchanligi ekish me'yoriga bog'liq holda 82-88 foiz oralig'ida o'zgarib borgan. Shukrona navining vegetatsiya davri ekish me'yorlariga bog'liq holda 224 kundan 228 kungacha bo'lishi aniqlanib, gektariga 4,0 mln.dona unuvchan urug' hisobida ekilganda eng uzun vegetatsiya davri kuzatilgan.

Kalit so'zlar: kuzgi bug'doy, urug', nav, Shukrona, ekish me'yori, unuvchanlik, rivojlanish fazalari, vegetatsiya davri.

Аннотатця. В статье описана оптимальная норма высева для выращивания нового местного сорта озимой мягкой пшеницы «Шукрона» в условиях южного

региона республики. Отмечено, что в условиях светло-серых почв Кашкадарьинской области полевая всхожесть семян нового выведенного сорта озимой мягкой пшеницы «Шукрона» прямо пропорциональна норме высева. Хотя разницы в продолжительности прорастания семян при посеве сорта «Шукрона» в оптимальные сроки не наблюдалось, полевая всхожесть семян варьировала в пределах 82-88 процентов в зависимости от нормы высева. Установлено, что вегетатsionный период сорта «Шукрона» варьирует от 224 до 228 дней в зависимости от нормы высева, а самый длительный вегетатsionный период наблюдался при высадке 4,0 млн единиц семян на гектар.

Ключевые слова: озимая пшеница, семена, сорт, Шукрона, норма высева, плодородие, фазы развития, вегетатsionный период.

Introduction. At present, cereal crops are cultivated on approximately 340 million hectares worldwide. Each year, more than 90–100 million tons of wheat grain are exported to international markets, of which 10–15% accounts for spring wheat. Therefore, considering the soil and climatic conditions of each region, determining the effects of different seeding rates and the selection of high-yielding wheat varieties on productivity and grain quality, as well as developing economically efficient agronomic practices during the cultivation process, represents one of the most pressing and relevant challenges in modern agriculture.

At present, the agricultural system of our republic is undergoing profound transformation. Particular attention is being given to the modernization and accelerated development of agriculture, the deepening of structural reforms, the continuous expansion of agricultural production, the strengthening of national food security, and the increased production of environmentally friendly products.

The development of optimal seeding rates for newly bred wheat varieties serves as a crucial factor in enabling producers to obtain high and high-quality yields, preventing excessive increases in production costs, and ensuring economic sustainability.

Degree of research on the topic. Ensuring high grain productivity of winter soft wheat (Triticum aestivum L.) may be achieved through the use of higher seeding rates, which can produce favorable results [4]. As a consequence, determining the optimal seeding rate contributes to the efficient use of available resources, thereby enhancing crop yield [2]. One of the key factors influencing the determination of seeding rates is the tillering capacity of a particular variety [5]. Lower seeding rates may be applied to varieties with a high tillering potential [1]. Conversely, increasing the seeding rate is more effective for varieties characterized by limited tillering capacity [5].

However, caution is required when determining seeding rates for winter wheat, as exceeding the optimal level intensifies competition among plants for resources,

which may result in yield losses and additional seed costs. Seeding rates and varietal characteristics of winter wheat also affect yield components such as the number of spikes, spike length, grain weight per spike, and thousand-grain weight [2].

In conclusion, to enable producers to make informed decisions regarding seeding rates based on varietal characteristics, newly developed winter wheat varieties should be comprehensively studied under the specific soil and climatic conditions of each region.

Materials and methods. The research was conducted in the southern region of the Republic, under the conditions of light gray soils of Kashkadarya Province, at the experimental field of the Southern Farming Research Institute located in the S. Rakhimov area of Qarshi District. The study examined the effects of different seeding rates on grain yield and quality using the Shukrona variety of winter soft wheat as a model.

Field experiments were carried out in accordance with the methodological guidelines of the All-Russian Research Institute of Plant Industry (1985). Phenological observations and biometric analyses were performed following the methodology of the State Commission for Testing Agricultural Crop Varieties (1989).

The technological quality indicators of grain harvested from the experimental plots were determined in compliance with the requirements of O‘z DST 880:2015. Sampling was conducted according to GOST 13586.3–83; thousand-grain weight was measured in accordance with GOST 10842–89; grain bulk density (test weight) was assessed following GOST 10840–64; vitreousness was determined according to GOST 10987–76; protein content was analyzed based on GOST 10846–91; and gluten content and quality (IDK index) were evaluated in accordance with GOST 13586.1–68.

Mathematical and statistical analyses of the experimental results were performed using the methodology proposed by B.A. Dospekhov (1985).

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Results and discussion. The present study aimed to determine the optimal seeding rate for winter wheat in order to achieve stable yields, improve grain quality, and develop practical recommendations for farmers.

For this purpose, different seeding rates were investigated using the newly developed local Shukrona variety of winter soft wheat under the conditions of light gray soils in Kashkadarya Province. In the experiments, the Shukrona variety was selected as the research object and evaluated at seeding rates of 4.0 million seeds per hectare (160 kg/ha), 5.0 million seeds per hectare (200 kg/ha), and 6.0 million seeds per hectare (240 kg/ha).

Sowing was carried out on October 15, which is considered the optimal sowing time for the region, using a Vence Tudo 14600 SA seed drill. After sowing, the plots were irrigated to ensure uniform germination. Seed emergence was observed on October 28, corresponding to 13 days after sowing (Table 1).

Analysis of plant emergence in the experimental field showed that, in the treatment with a seeding rate of 4.0 million seeds per hectare, the number of seedlings per 1 m² ranged from 348 to 357 plants, representing an average field emergence of 88% relative to the number of seeds sown. In the treatment with 5.0 million seeds per hectare, seedling density ranged from 416 to 446 plants per 1 m², corresponding to an average emergence of 86%. In contrast, the treatment with 6.0 million seeds per hectare resulted in 483 to 497 seedlings per 1 m², with an average field emergence of 82% relative to the sown seeds.

TABLE 1

Seedling Density and Field Germination of Winter Soft Wheat under Different Seeding Rates (2024)

Treatments (Seeding rates)	Sowing date	Emergence date	Days to emergence	Seedling density, plants m^{-2} (Rep. 1)	Seedling density, plants m^{-2} (Rep. 2)	Seedling density, plants m^{-2} (Rep. 3)	Mean seedling density, plants m^{-2}	Field germination, %
4.0 million seeds ha^{-1}	October 15	October 28	13	348	352	357	352.3	88
5.0 million seeds ha^{-1}	October 15	October 28	13	446	416	428	430.0	86
6.0 million seeds ha^{-1}	October 15	October 28	13	497	483	491	490.3	82

Results and discussion (continued). Tillering of the plants was observed between December 9 and 11, and it was determined that the tillering phase varied depending on the nutritional area available to the plants. An increase in the feeding area had a positive effect on the degree of tillering (Table 2).

The transition of the Shukrona variety of winter soft wheat to the stem elongation stage was recorded between March 12 and 15. The earliest onset of the stem elongation phase was observed in the treatment with the highest seeding rate (6.0 million seeds per hectare).

According to the results of phenological observations, the heading stage of the Shukrona variety occurred between April 14 and 18. Specifically, heading was recorded on April 18 in the treatment with a seeding rate of 4.0 million seeds per hectare, on April 16 in the treatment with 5.0 million seeds per hectare, and on April 14 in the treatment with 6.0 million seeds per hectare. These findings indicate that an increase in seeding rate led to an earlier onset of the heading stage.

Grain maturity is one of the key indicators in winter soft wheat, and variations in seeding rates were found to influence the timing of maturity. In the experiments, the treatment with a seeding rate of 6.0 million viable seeds per hectare reached full maturity earlier than the other treatments, with full ripening observed on May 27.

TABLE 2

Effect of Seeding Rates on the Growth and Development of Winter Soft Wheat (2024–2025)

Treatments (Seeding rates)	Replication	Sowing date	Emergence date	Days to emergence	Tillering date	Emergence–tillering interval, days	Stem elongation date	Tillering–stem elongation interval, days	Heading date	Flowering date	Maturity date	Vegetation period, days
4.0 million seeds ha^{-1}	1	Oct. 15	Oct. 28	13	Dec. 09	42	Mar. 14	95	Apr. 18	Apr. 22	May 31	228
5.0 million seeds ha^{-1}	1	Oct. 15	Oct. 28	13	Dec. 10	43	Mar. 13	93	Apr. 16	Apr. 20	May 29	226
6.0 million seeds ha^{-1}	1	Oct. 15	Oct. 28	13	Dec. 11	44	Mar. 12	91	Apr. 14	Apr. 18	May 27	224
4.0 million seeds ha^{-1}	2	Oct. 15	Oct. 28	13	Dec. 09	42	Mar. 15	96	Apr. 18	Apr. 22	May 31	228
5.0 million seeds ha^{-1}	2	Oct. 15	Oct. 28	13	Dec. 10	43	Mar. 14	94	Apr. 16	Apr. 20	May 29	226
6.0 million seeds ha^{-1}	2	Oct. 15	Oct. 28	13	Dec. 12	45	Mar. 13	91	Apr. 14	Apr. 18	May 27	224
4.0 million seeds ha^{-1}	3	Oct. 15	Oct. 28	13	Dec. 09	42	Mar. 15	96	Apr. 18	Apr. 22	May 31	228
5.0 million seeds ha^{-1}	3	Oct. 15	Oct. 28	13	Dec. 11	44	Mar. 14	93	Apr. 16	Apr. 20	May 29	226
6.0 million seeds ha^{-1}	3	Oct. 15	Oct. 28	13	Dec. 12	45	Mar. 13	91	Apr. 14	Apr. 18	May 27	224

Full maturity in the treatment with a seeding rate of 5.0 million seeds per hectare was recorded two days later, on May 29, while in the treatment with 4.0 million seeds per hectare, full maturity was observed on May 31.

Conclusion

Under the conditions of light gray soils in Kashkadarya Province, the field germination of seeds of the newly developed *Shukrona* variety of winter soft wheat varies directly depending on the seeding rate.

An increase in the seeding rate of *Shukrona* winter soft wheat leads to a gradual decline in field germination.

Although no significant differences were observed in the duration of seed emergence among the different seeding rates applied at the optimal sowing time on light gray soils of Kashkadarya Province, field germination varied within the range of 82–88% depending on the seeding rate.

When cultivating the newly developed *Shukrona* variety, increasing the seeding rate partially accelerates plant growth and development due to a reduced nutritional area per plant. In contrast, a larger nutritional area contributes to an extension of the vegetative period.

The duration of the vegetative period of the *Shukrona* variety was found to range from 224 to 228 days depending on the seeding rate, with the longest vegetative period observed at a seeding rate of 4.0 million viable seeds per hectare.

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