



IMPACT OF IRRIGATION REGIMES AND MINERAL FERTILIZER RATES ON PRODUCTIVITY INDICATORS OF WINTER RYE VARIETIES

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Article history:		Abstract:
Received:	24 th April 2026	This article analyzes the influence of irrigation regimes and mineral fertilizer application rates on productivity indicators — namely the total and productive stem counts — of winter rye varieties grown on light gray soils of the Kashkadarya region.
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Rye is the second most important bread crop after wheat in a number of countries, used mainly in food production, animal feed, and certain industrial products. Although rye grain contains somewhat less protein than wheat, it is considered biologically more complete in terms of amino acid composition. Under the conditions of Uzbekistan, rye cultivation today plays an important role in ensuring agricultural sustainability [1; 2].

Rye is particularly productive in rainfed and foothill areas. Its root system is strongly developed, allowing it to draw nutrients and moisture from deep soil layers. As a result, it produces relatively good yields even on low-fertility, saline, and drought-prone lands, which increases the efficiency of land resource use [5–9].

Winter rye is a crop demanding in terms of the soil-climatic conditions of the growing region, mineral fertilizers, and moisture, and its productivity varies depending on these factors.

According to the conclusions of numerous researchers, achieving high yields of cereal crops, including rye, requires 550–600 productive spikes per square meter [3].

G.M. Dobrynin noted that when the number of productive stems per square meter exceeds 600, plants' tendency toward overcrowding increases, which in turn leads to a decrease in grain weight per spike [4].

Our own research also established that irrigation regimes and mineral fertilizers had a significant effect on the productivity indicators of winter rye varieties. Among the winter rye varieties studied, "Vakhshskaya 116" showed a total stem count of 374–660 stems/m² and a productive stem count of 312–550 stems/m²; for "Shalola," these figures were 369–657 stems/m² and 308–548 stems/m², respectively; and for "Falenskaya 4," 365–648 stems/m² and 304–540 stems/m² (Figure 1).

Field experiments also showed a significant effect of irrigation regime on the total and productive stem counts of winter rye varieties: under the 70-75-60% and 75-80-70% irrigation regimes, the corresponding total and productive stem count indicators increased proportionally. For example, in the "Vakhshskaya 116" variety, under the 70-75-60% irrigation regime the total stem count across variants was 374–654 stems/m² and productive stem count 312–545 stems/m², while under the 75-80-70% regime the total stem count was 383–660 stems/m² and productive stem count 319–550 stems/m² — exceeding the 70-75-60% regime by 6–15 and 4–13 stems, respectively.

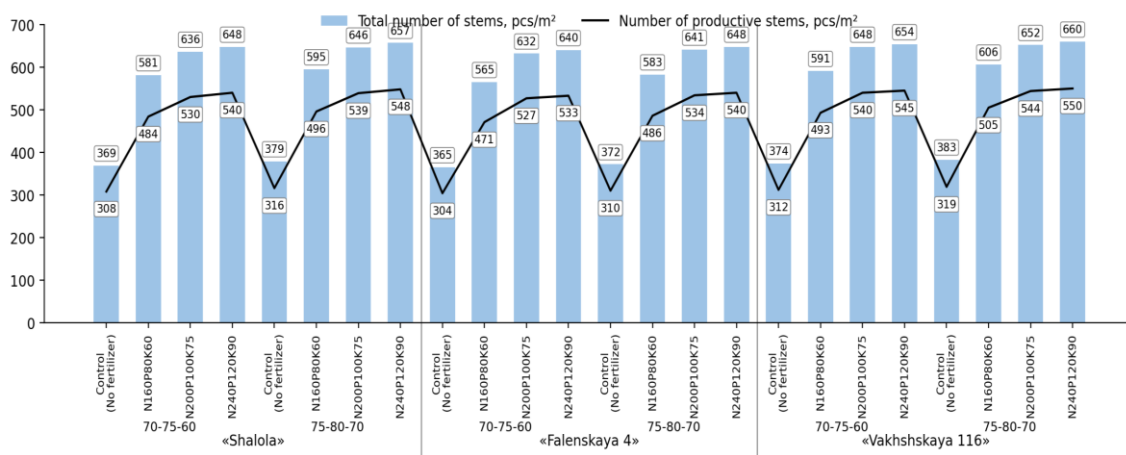


Figure 1. Effect of irrigation regime and mineral fertilizers on productivity indicators of winter rye varieties

Analysis of the effect of irrigation regime on total and productive stem counts for the "Shalola" and "Falenskaya 4" varieties yielded the following results. Under the 70-75-60% irrigation regime, "Shalola" showed a total stem count of 369–648 stems/m² and productive stem count of 308–540 stems/m², while "Falenskaya 4" showed 365–640 stems/m² and 304–533 stems/m², respectively. Under the 75-80-70% regime, total stem counts were 379–657 and 372–648 stems/m² for the respective varieties, and productive stem counts were 316–548 and 310–540 stems/m² — exceeding the 70-75-60% regime by 10–14 and 8–18 stems/m² for total stems, and by 8–11 and 6–15 stems/m² for productive stems, respectively.

Our experiments also established a significant effect of applied mineral fertilizer rates on the productivity indicators of winter rye varieties. The total and productive stem counts increased proportionally from the control (no fertilizer) to the fertilizer rates of N160P80K60, N200P100K75, and N240P120K90 kg/ha. For the "Vakhshskaya 116" variety under the 70-75-60% irrigation regime, the unfertilized control (variant 17) showed a total stem count of 374 stems/m² and productive stem count of 312 stems/m², while variants 18, 19, and 20 (with fertilizer rates N160P80K60, N200P100K75, and N240P120K90 kg/ha, respectively) showed total stem counts of 591, 648, and 654 stems/m², and productive stem counts of 493, 540, and 545 stems/m² — exceeding the unfertilized control by 217, 57, and 6 stems/m² for total stems, and by 181, 48, and 5 stems/m² for productive stems. Under the 75-80-70% irrigation regime, the unfertilized control (variant 21) showed total and productive stem counts of 383 and 319 stems/m², respectively, while variants 22, 23, and 24 (with increasing fertilizer rates) showed 606, 652, and 660 stems/m² (total) and 505, 544, and

550 stems/m² (productive) — exceeding the control by 223, 46, and 8 stems/m² and 186, 39, and 6 stems/m², respectively. A similar pattern was observed for the "Shalola" and "Falenskaya 4" varieties.

According to our research findings, the highest total and productive stem counts among the winter rye varieties were recorded for "Vakhshskaya 116" under the 75-80-70% irrigation regime with the N240P120K90 kg/ha fertilizer rate (variant 24): 660 stems/m² total and 550 stems/m² productive. The lowest indicators were recorded for "Falenskaya 4" under the 70-75-60% irrigation regime without fertilizer application (control, variant 9): 365 and 304 stems/m², respectively.

Based on the results of research conducted under the takyr-like soil conditions of the Kashkadarya region, it can be concluded that in order to achieve sufficient productivity indicators for high yields of the winter rye varieties "Shalola," "Falenskaya 4," and "Vakhshskaya 116," it is advisable to apply the 75-80-70% irrigation regime combined with a mineral fertilizer rate of N240P120K90 kg/ha.

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