

# The influence of different application rates of various phosphorus fertilizers on the growth and development of winter wheat

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**Abstract:** The article presents data on the influence of different application rates of various phosphorus fertilizers on the growth and development of winter wheat. According to research, phosphorus fertilizers had a significant impact on the growth and development of soft winter wheat on light-gray soils in the Kashkadarya region.

**Key words:** phosphorus, fertilizer, norm, ammophos, superphosphate, ammophos, growth, development.

Ensuring food security for the population and achieving high-quality agricultural yields are currently among the most pressing issues. In particular, winter wheat is one of the main grain crops in the Republic of Uzbekistan and plays a vital role in meeting the country's domestic needs. Our country is undertaking large-scale efforts to modernize agriculture, utilize resources rationally, and improve soil fertility.

Phosphorus fertilizers play a vital role in plant cell division and root system development, and are especially important during the formation period of cotton and grain crops. Phosphorus fertilizers are crucial in wheat cultivation: they accelerate root development, increase yield and grain quality, and enhance plant resistance to stress factors. The amount and method of application of phosphorus fertilizers directly affect their effectiveness. Therefore, scientific study of the effects of various phosphorus fertilizers at different rates on the growth and development of winter wheat is particularly relevant. This research is aimed not only at increasing yields but also at the economical and environmentally friendly use of fertilizers.

For the proper growth and development of winter crops and successful overwintering, it is necessary to apply higher amounts of phosphorus and potassium fertilizers and lower amounts of nitrogen fertilizers in autumn. Supplying winter crops with phosphorus and potassium in the fall promotes better tillering, stronger root system development, greater accumulation of carbohydrates (sugars), and increased winter hardiness (Dorofeev N.V., 1998).

Phosphorus has a comprehensive effect on plants. It enhances root system development and stimulates rapid growth during the early stages. Under the influence of phosphorus, the winter hardiness of crops increases, heading is accelerated, yield rises, and product quality improves (Pannikov V.D., Mineev V.G., 2009).

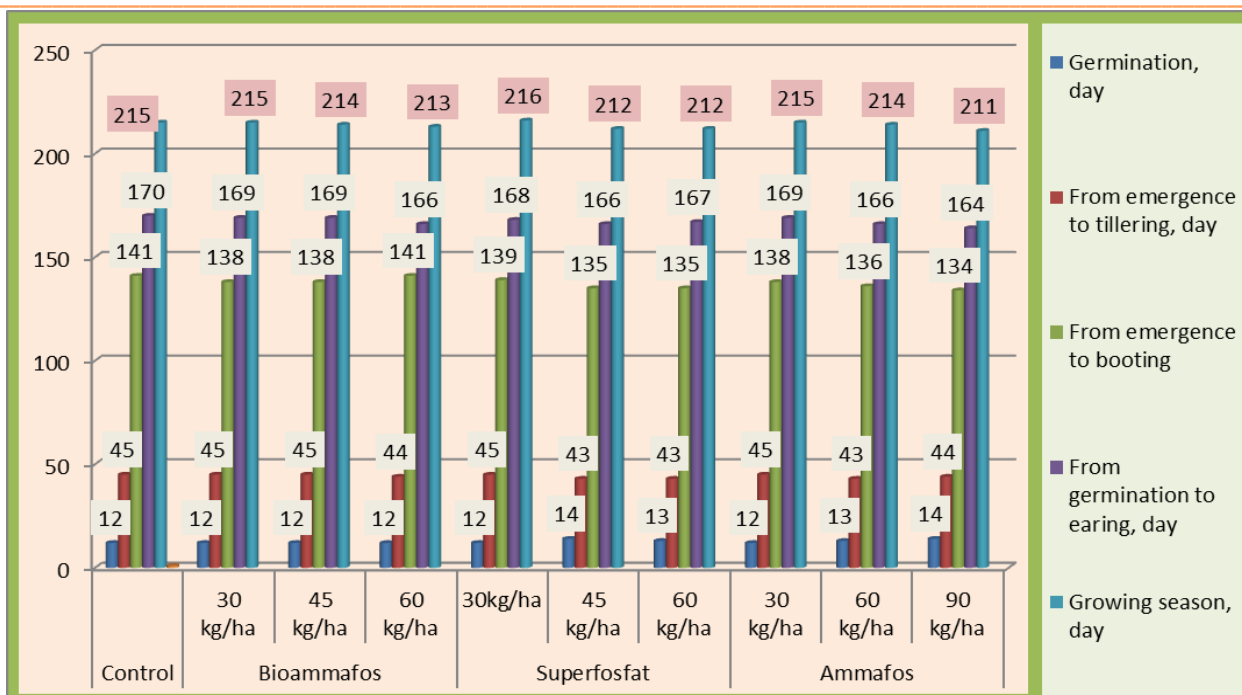
Phosphorus fertilizers increase yield only when there is sufficient soil moisture. The highest uptake of nitrogen and phosphorus fertilizers by winter wheat occurs during the stem elongation and heading stages (Siddiqov R.I., 2018).

Based on the above, the effects of different rates of phosphorus fertilizers bioammophos, superphosphate, and ammophos—on the new winter soft wheat variety Shukrona were studied in light sierozem soils of the Kashkadarya region.

The study was conducted in 10 variants: a control without phosphorus fertilizer application, as well as with the application of bioammophos and superphosphate at rates of 30, 45, and 60 kg/ha, and ammophos at rates of 30, 60, and 90 kg/ha.

Phenological observations revealed that, depending on the treatment, winter soft wheat germination occurred between November 27 and 29; germination took 12–14 days, and the tillering phase lasted 43–45 days until December 10–12. There were virtually no significant differences between the treatments in the duration of the germination and tillering phases under the influence of phosphorus fertilizers.

The booting phase was observed from March 12 to 17 and lasted 134–138 days, depending on the treatment. Increasing the phosphorus fertilizer rate was noted to contribute to an earlier transition to booting. In treatments with 60 kg/ha of bioammophos and 90 kg/ha of ammophos, the period from germination to booting lasted 134–135 days.



**Figure 1. The effect of various phosphorus fertilizers applied at different rates on the growth and development of winter wheat.**

The heading phase was observed from April 11 to 15. In the variants with superphosphate application, it was observed on April 13, in the variants with 30–45 kg/ha of bioammophos and 30 kg/ha of ammophos – on April 14, with 60 kg/ha of ammophos application – on April 12, and with 90 kg/ha – on April 11. It was noted that with an increase in the ammophos rate, the heading phase began earlier.

The ripening phase of winter soft wheat is one of the key indicators, and differences in ripening times were observed depending on the phosphorus fertilizer applied. With different phosphorus fertilizers, ripening occurred between April 28 and 31, with accelerated ripening observed in the treatments with bio-ammonium phosphate and ammonium phosphate at 60 kg/ha, as well as ammonium phosphate at 90 kg/ha, compared to the control.

In conclusion, in the light sierozem soils of Qashqadaryo viloyati, phosphorus fertilizers had a significant impact on the phenological development of winter soft wheat. Particularly high rates (Bioammophos 60 kg/ha and Ammophos 90 kg/ha) promoted earlier transition to the booting, heading, and ripening phases, accelerating ripening by 2–4 days. Thus, the use of phosphorus fertilizers at high rates stimulates the growth and development of winter soft wheat, positively influencing the shortening of the growing season.

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