

Article

# The Effect of Foliar Feeding on the Biometric Indicators of Winter Wheat Varieties

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**Abstract:** *The research results showed that compared to the variant fertilized at the generally accepted norm, the application of a suspension of urea and micronutrients leads to the formation of plants with spike lengths 0.5–0.9 cm longer, depending on the variety and the type of micronutrients used.*

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**Keywords:** *Farboma, Yaksart, mineral fertilizers, urea, feeding, micronutrients, plant height, spike length.*

## Introduction

Cryptosporidium Literature data indicates that since winter wheat does not absorb nutrients uniformly throughout its growth period, it is necessary to provide adequate nutrients, particularly through multiple applications of nitrogen fertilizers [1]. It has been established that spraying a suspension of mineral fertilizers on grain fields in early spring accelerates the developmental processes of the crop [2].

According to research findings, the spike length in control variants was 10 cm, while in variants where the suspension was applied, it reached 12 cm, showing a 2 cm increase compared to the control. Additionally, it was found that the number of spikelets per spike, as well as the number and weight of grains per spike, were 8–17% lower in the control variant than in the experimental variants. Grain yield amounted to 4.18 t/ha in the control variant, whereas it reached 5.44 t/ha in the variant treated with the suspension [3].

Foliar feeding of plants not only accelerates physiological processes but also leads to certain biochemical changes within the plant. An excess of nitrogen in the leaves, combined with a deficiency of phosphorus and potassium, can lead to an increase in sucking pests. Foliar application is considered a crucial measure that increases crop yields while simultaneously enhancing plant resistance to insect pests [4].

A. Kurbonov and others conducted scientific research on the positive impact of foliar feeding on the technological quality indicators of grain [5]. According to researchers, feeding winter wheat with a 7–10% urea solution during the heading stage increases grain yield by 0.2–0.25 t/ha, protein content by 1.5–2.0%, and gluten content by 3–4% [6].

## Research methods

Research on the studied topic was conducted in 2025–2026 at the experimental fields of the Samarkand Institute of Agro-innovations and Research. The soil of the experimental site consists of irrigated meadow-gray soils. According to the experimental design, the field plots were arranged in four replications. The calculated area of each plot was 50 m<sup>2</sup> (length 10 m, width 5 m), and they were organized in a single-tier layout. For supplemental foliar feeding, urea suspensions at a rate of 15 kg/ha were utilized, prepared as a solution in 300 liters of water per hectare [7]. Micronutrients were applied according to recommended norms, specifically SEAWEED Ca+Mg at a dosage of 300 ml per 300 liters of water per hectare. The humus content in the experimental field soil was determined using the I.V. Tyurin method (GOST 26213-91). Total NPK (Nitrogen, Phosphorus, Potassium) content was analyzed using the improved methods of I.M. Maltseva and L.P. Gritsenko. Specifically, nitrate nitrogen (NO<sub>3</sub>-N) was determined by the Grandvald-Lyaju method, mobile phosphorus (P<sub>2</sub>O<sub>5</sub>) by the B.R. Machigin method, and exchangeable potassium (K<sub>2</sub>O) by the P.V. Protasov method using a flame photometer. Soil bulk density and porosity in the 0–30 cm layer were determined using cylinders via the N.A. Kachinsky method [8]. Agrochemical and agrophysical analyses of soil samples were performed following established guidelines, including "Methods of Agrochemical Analysis of Soils and Plants of Central Asia" [9], "Methods of Agrochemical, Agrophysical, and Microbiological Research in Irrigated Cotton Regions" [10], and the manual "Methods of Conducting Field Experiments." To study the growth, development, and productivity of wheat, the following phenological observations and biometric measurements were carried out: Phenological observations: Field germination of seeds, germination dynamics, and the onset of developmental phases (10% and 75%), including tillering, booting, heading, flowering, and ripening. Biometric indicators: Plant height, number of stems per plant, spike length, number of spikelets per spike, number of grains per spikelet, grain weight per spike, and 1,000-grain weight. These measurements were conducted according to the "Methodology of State Variety Testing of Agricultural Crops" [11].

## Research results.

Research results indicate that applying mineral fertilizers at the standard rate of N<sub>180</sub>P<sub>90</sub>K<sub>60</sub> kg/ha leads to the formation of taller plants compared to the control variant. For instance, in the variant fertilized with N<sub>180</sub>P<sub>90</sub>K<sub>60</sub> kg/ha, the average plant height of the "Jasmina" variety was 80.3 cm, whereas the average height in the control variant was 47.4 cm. Similar trends were observed in the "Farboma" variety. Foliar application of urea during the growing season of winter wheat resulted in enhanced

growth; specifically, in the variant where 15 kg/ha of urea was applied, the plants of the "Farboma" variety were 4.0 cm taller than those in the standard treatment. Furthermore, it was determined that feeding with micronutrients during the growing season led to the formation of plants that were 2.9–3.2 cm taller, depending on the variety[12]. In experiments where plants received a basal application of  $N_{180}P_{90}K_{60}$  kg/ha supplemented by foliar treatments with a suspension of urea and micronutrients, the increase in plant height was 5.1 cm for the "Jasmina" variety and 6.6 cm for the "Farboma" variety. Across all varieties, the highest growth indicators were recorded in the variants treated with a combined suspension of urea and the "SEAWEED Ca+Mg" preparation. These results can be attributed to the stimulatory effect of supplemental urea on plant growth and the optimization of physiological processes through the involvement of calcium (Ca) and magnesium (Mg) from the "SEAWEED Ca+Mg" preparation in plant metabolism. One of the most important yield components of winter wheat is spike length. Within the framework of cultivation technology, the formation of plants with long spikes ensures high crop productivity. The field experiments demonstrated that the mineral fertilizers used for crop nutrition play a significant role in achieving these results during the cultivation of winter wheat[13].

**Table 1. Effect of foliar feeding on the biometric indicators of winter wheat varieties**

Variantlar	Biometric indicators analysis of varieties				
	Jasmina		Farboma		
	Plant height, cm	Spike length, cm	Plant height, cm	Spike length, cm	
Control (without fertilizer)	47,4±3,0	5,3±0,3	54,2±3,8	5,7±0,4	
Background $N_{180}P_{90}K_{60}$ -standard norm)	80,3±5,1	9,4±0,6	95,4±5,8	10,0±0,5	
Fon+ Urea (15 kg/ga)	84,3±5,6	9,8±0,6	99,5±6,9	10,6±0,6	
Background + SEAWEED Ca+Mg	83,5±5,6	9,5±0,5	98,3±5,5	10,2±0,7	
Background + Urea + SEAWEED Ca+Mg	85,4±5,0	9,9±0,5	102,0±5,5	10,9±0,7	

In the "Jasmina" variety, the average spike length in the variant treated with mineral fertilizers at a rate of  $N_{180}P_{90}K_{60}$  kg/ha reached 9.4 cm, whereas this figure was only 5.3 cm in the control variant. Similar results were obtained across all other studied varieties. Supplemental foliar feeding with urea during the growing season also contributed to the formation of longer spikes; specifically, an average increase of 0.4 cm in the "Jasmina" variety and 0.6 cm in the "Farboma" variety was observed, depending on the specific characteristics of the variety. While it has been reported in some literature that micronutrients alone do not significantly affect spike length, our research involved a combined application of micronutrients with urea[14]. The results demonstrated that compared to the variant fertilized at the standard norm, the addition of a urea and micronutrient suspension led to the formation of spikes that were 0.5–0.9 cm longer, depending on the variety. Among the studied varieties, the highest indicator was recorded in the "Farboma" variety, where the most significant difference (0.9 cm) between variants was observed. In general, the basal application of  $N_{180}P_{90}K_{60}$  kg/ha, combined with foliar urea and micronutrient suspensions, results in the formation of taller plants with a higher number of productive stems and longer spikes[15].

## Conclusion

The data presented above served as the fundamental basis for our ongoing research aimed at studying the effects of supplemental foliar feeding, in addition to basal fertilization, on the growth, development, yield, and grain quality of winter wheat varieties.

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