The American Journal of Agriculture and Biomedical Engineering
ISSN 2689-1018 Volume 08 - 2026

Influence of Seed Watering and Use of Suspension Fertilizers on Biometric Indicators of Plants

Atamuratov R.T.
Karakalpak Institute of Agriculture and Agrotechnologies, Uzbekistan

Dauletmuratov M.M.
Karakalpak Institute of Agriculture and Agrotechnologies, Uzbekistan

Received: 24 May 2026 | Received Revised Version: 02 June 2026 | Accepted: 22 June 2026 | Published: 17 July 2026

Volume 08 Issue 07 2026 | Crossref DOI: 10.37547/tajabe/Volume08Issue07-02

Abstract

This study investigated the effects of seed coating and the application of macro- and micronutrient fertilizers on the key biometric characteristics of spring wheat (Triticum aestivum L.) grown on irrigated meadow alluvial soils in the Nukus district of the Republic of Karakalpakstan. The effects of the treatments on plant height, length of the uppermost internode, spike length, and the number of spikelets per spike were evaluated. The results showed that seed coating combined with the application of macro- and micronutrient fertilizers before sowing significantly improved the biometric characteristics of the plants. In particular, the treated variants exhibited greater plant height, longer uppermost internodes, increased spike length, and a higher number of spikelets per spike compared with the untreated control. The findings demonstrate that pre-sowing seed treatment together with the rational application of macro- and micronutrient fertilizers is an effective agronomic practice for promoting plant growth, improving yield components, and enhancing the productivity of spring wheat under the soil and climatic conditions of the Republic of Karakalpakstan.

Keywords: Spring soft wheat (Triticum aestivum L.), seed coating, macro- and micronutrient fertilizers, seed treatment, plant height, uppermost internode length, spike length, number of spikelets per spike, yield components.

Cite This Article: Atamuratov R.T., & Dauletmuratov M.M. (2026). Influence of Seed Watering and Use of Suspension Fertilizers on Biometric Indicators of Plants. The American Journal of Agriculture and Biomedical Engineering, 8(07), 13–18. https://doi.org/10.37547/tajabe/Volume08Issue07-02

1. Introduction

Ensuring food security, strengthening grain self-sufficiency, and promoting the sustainable development of agricultural production are among the key priorities of the Republic of Uzbekistan. In this context, cereal production, particularly wheat cultivation, plays a strategic role in the country's agricultural sector. Comprehensive reforms are being implemented to ensure a stable supply of high-quality and safe food products for the population, meet domestic demand for grain, and increase crop productivity. Alongside winter wheat, increasing attention is being paid to the cultivation of spring wheat and the improvement of scientifically based cultivation technologies to enhance its productivity and grain quality under different soil and climatic conditions.

Spring wheat is characterized by a relatively short growing season, a high capacity to adapt to diverse soil and climatic conditions, and its effective use as a reserve

crop in regions where winter wheat cultivation is limited. These biological characteristics enable spring wheat to be cultivated under adverse agroecological conditions and contribute to maintaining stable grain production. In addition, the short growing period of spring wheat makes it particularly valuable in situations where grain shortages occur, as it allows grain to be produced within a relatively short period. Its wide adaptability to different environmental conditions also makes it suitable for cultivation in areas exposed to climatic risks, thereby contributing to the stability of grain reserves and enhancing food security.[1]

The irrigated areas of the Republic of Karakalpakstan are characterized by a sharply continental climate, high summer temperatures, low precipitation, limited irrigation water resources, and varying degrees of soil salinity. In addition, the irrigated meadow alluvial soils of the region are characterized by low humus content and insufficient availability of plant-accessible nitrogen, phosphorus, and certain micronutrients. These unfavorable soil conditions restrict the nutrient supply to plants, adversely affecting their growth, development, physiological and biochemical processes, as well as grain yield and quality.

In the mineral nutrition system of plants, micronutrients such as zinc, manganese, copper, and boron, in addition to macronutrients, play essential physiological roles in enhancing enzymatic activity, stimulating photosynthesis, regulating protein and carbohydrate metabolism, promoting the development of reproductive organs, and improving the technological quality of grain. In particular, integrating seed coating (encapsulation) technology with micronutrient-based formulations ensures a more efficient supply of nutrients during the early stages of plant development, enhances plant tolerance to environmental stress, and contributes to the formation of high-quality grain yield.[2]

From this perspective, a comprehensive evaluation of the effects of seed coating technology and the scientifically based application of macro- and micronutrient fertilizers on the growth, development, yield, and grain quality of spring soft wheat grown on irrigated meadow alluvial soils of the Republic of Karakalpakstan is of considerable scientific and practical importance. The findings of this study provide a theoretical and practical basis for developing resource-efficient and highly effective cultivation technologies adapted to the soil and climatic conditions of the region, thereby contributing to the sustainable improvement of spring wheat production.

2. Methods

Field experiments and laboratory analyses were conducted to evaluate the effectiveness of mineral fertilizers (NPK) and foliar-applied micronutrient fertilizers on irrigated meadow alluvial soils in the Nukus district of the Republic of Karakalpakstan. The experimental site was established in the "Aq Terek OFI" experimental field located in the Nukus district. Field experiments, phenological observations, and the collection of soil and plant samples were carried out in accordance with the methodologies described in Methods of Field Experiments with Cotton under Irrigated Conditions (Metody polevykh opytov s khlopchatnikom v usloviyakh orosheniya), Methodology of Field Experiments (Metodika polevogo opyta), Methodology of the State Variety Testing of Agricultural Crops (Metodika gosudarstvennogo sortoispytaniya sel'skokhozyaystvennykh kul'tur), and the national guideline Methods for Conducting Field Experiments.

3. Results

The study evaluated the effects of seed coating and the optimal application rates of mineral and micronutrient fertilizers on the biometric characteristics of the spring wheat cultivar Janub Gavhari under irrigated meadow alluvial soil conditions in the Nukus district of the Republic of Karakalpakstan. Particular attention was given to changes in plant height, uppermost internode length, spike length, and the number of spikelets per spike. The results demonstrated that the rational use of seed coating technology in combination with mineral and micronutrient fertilizers positively influenced the growth and development of spring wheat, leading to improvements in the evaluated biometric parameters.

According to the results of the study, the biometric characteristics of spring soft wheat were significantly influenced by the applied fertilization methods and micronutrient treatments. Under the background application of mineral fertilizers at a rate of N160P112K50, the control treatment (foliar application of water only) produced a plant height of 69 cm. In contrast, the treatment involving bentonite-based seed coating combined with foliar micronutrient application during the growing season increased plant height to 70 cm, indicating a positive response compared with the control.

Seed coating with Bentonite + Labirent Combi, followed by foliar application during the growing season,

increased plant height to 72 cm. The highest value was recorded in the treatment where seeds were coated with Bentonite + Ento Micro and supplemented with foliar micronutrient application, resulting in a plant height of 74 cm. This value was considerably higher than that of the control treatment, indicating the beneficial effect of micronutrient application on plant growth and vegetative development. In the treatment where seeds were coated with Bentonite + IFO Aminocal and foliar fertilization was applied during the growing season, plant height reached 71 cm (Figure 1).

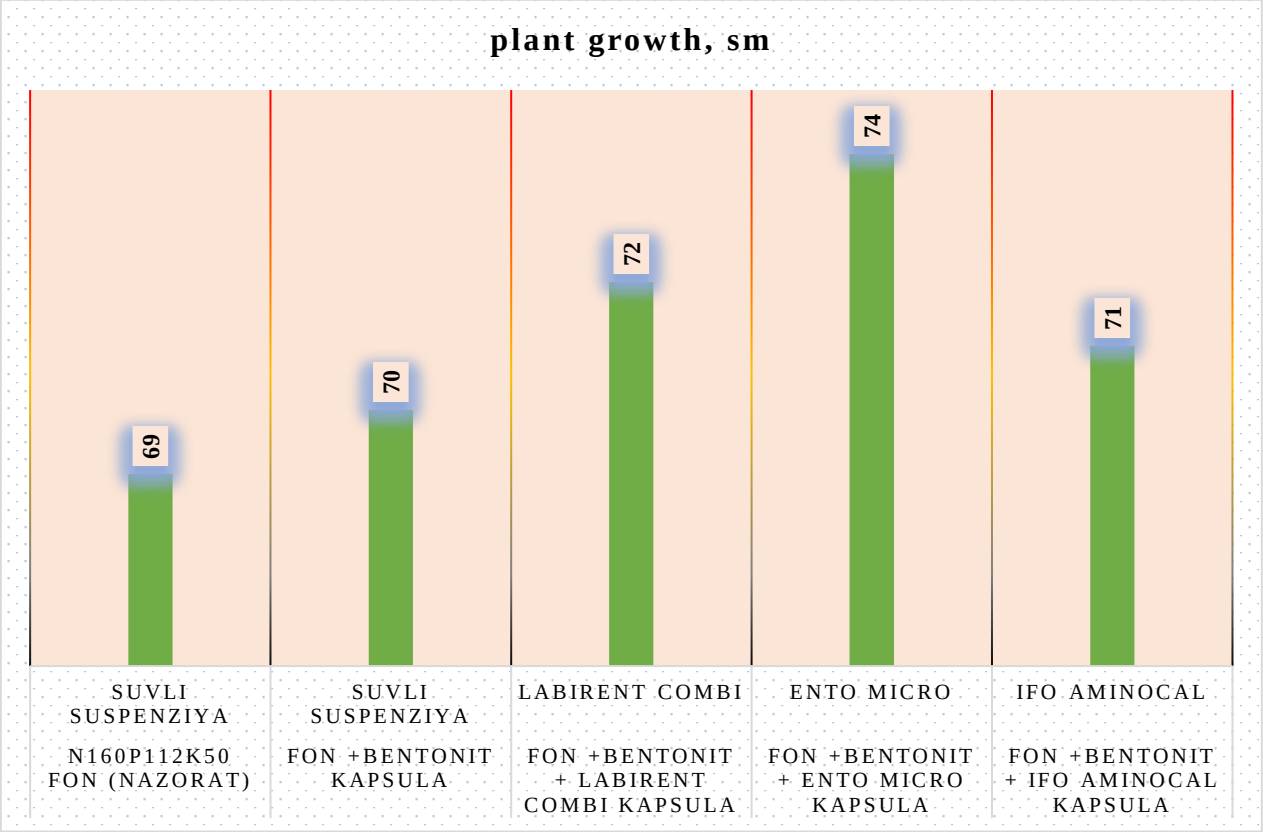

Figure 1. Effect of Seed Coating and Suspension Fertilizer Application on Plant Height of Spring Wheat.

Plant height in wheat is determined by the genetic characteristics of the cultivar, soil fertility, moisture availability, temperature conditions, and nutrient management. In addition to the macronutrients nitrogen, phosphorus, and potassium, micronutrients such as zinc, boron, copper, and manganese play essential roles in plant mineral nutrition. An adequate supply of these nutrients enhances physiological and biochemical processes, promotes stem elongation and internode development, and consequently increases plant height.

The length of the uppermost internode is an important morphological trait in wheat, as it is associated with improved drought tolerance and reflects the proper development of reproductive organs. Under the background application of mineral fertilizers at a rate of N160P112K50, the uppermost internode length in the control treatment (foliar application of water only) was 30 cm. In the treatment involving bentonite-based seed coating combined with foliar nutrient application during the growing season, the uppermost internode length increased to 32 cm, demonstrating a positive response compared with the control.

Similarly, seed coating with Bentonite + Labirent Combi, followed by foliar nutrient application during the growing season, also resulted in an uppermost internode length of 32 cm (Figure 2).

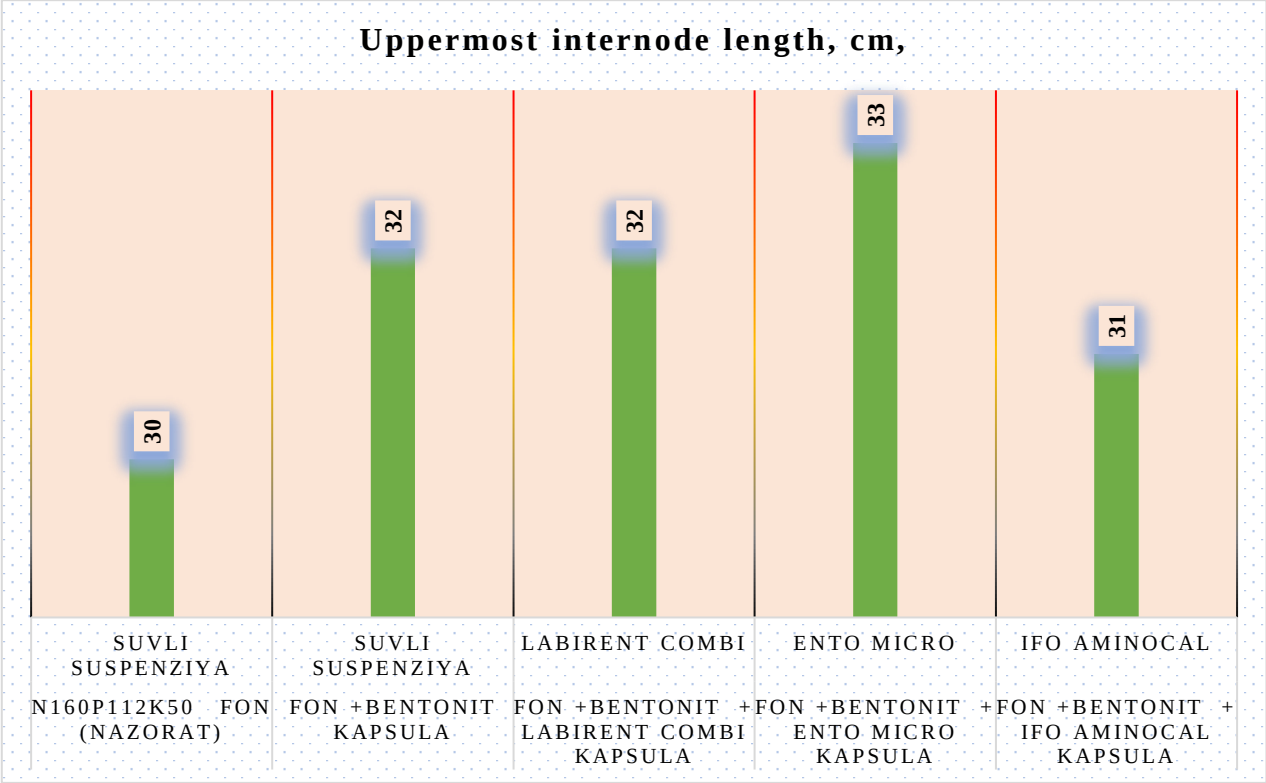

Figure 2. Effect of Seed Coating and Suspension Fertilizer Application on the Length of the Uppermost Internode of Spring Wheat.

The highest value was recorded in the treatment where seeds were coated with Bentonite + Ento Micro and supplemented with foliar micronutrient application during the growing season, resulting in an uppermost internode length of 33 cm. This value was higher than that of the control treatment, indicating the beneficial effect of integrated nutrient management on stem elongation and vegetative growth. In the treatment involving Bentonite + IFO Aminocal seed coating combined with foliar fertilization, the uppermost internode length reached 31 cm.

The results demonstrated that the application of mineral fertilizers and micronutrient formulations significantly affected the length of the uppermost internode in spring wheat. Compared with the control, all fertilized treatments showed an increase in internode length. This improvement can be attributed to enhanced nutrient availability, which promoted vegetative growth and stem development. The combined application of mineral fertilizers and micronutrients positively influenced the biometric characteristics of wheat by increasing the length of the uppermost internode.

Spike length and the number of spikelets per spike are important yield-related traits that reflect plant development and the effectiveness of agronomic practices. These characteristics directly contribute to grain formation by influencing the number of grains per spike and, consequently, the final grain yield. Both traits are strongly affected by the genetic characteristics of the cultivar, soil and climatic conditions, and plant nutrient availability. In particular, the balanced application of mineral fertilizers promotes spike development, increases spike length, and enhances spikelet formation. Nitrogen, phosphorus, and potassium stimulate metabolic processes and ensure the proper development of reproductive organs.

Furthermore, micronutrients such as zinc, manganese, and copper activate enzymatic processes, improve photosynthetic efficiency, and contribute to the development of spike morphology. As a result, both spike length and the number of spikelets per spike increase, thereby enhancing grain formation and overall yield potential.

Overall, the findings indicate that the combined application of mineral fertilizers and micronutrients, together with bentonite-based seed coating, is an effective agronomic practice for improving the biometric characteristics of spring soft wheat under irrigated

meadow alluvial soil conditions (Figure 3).

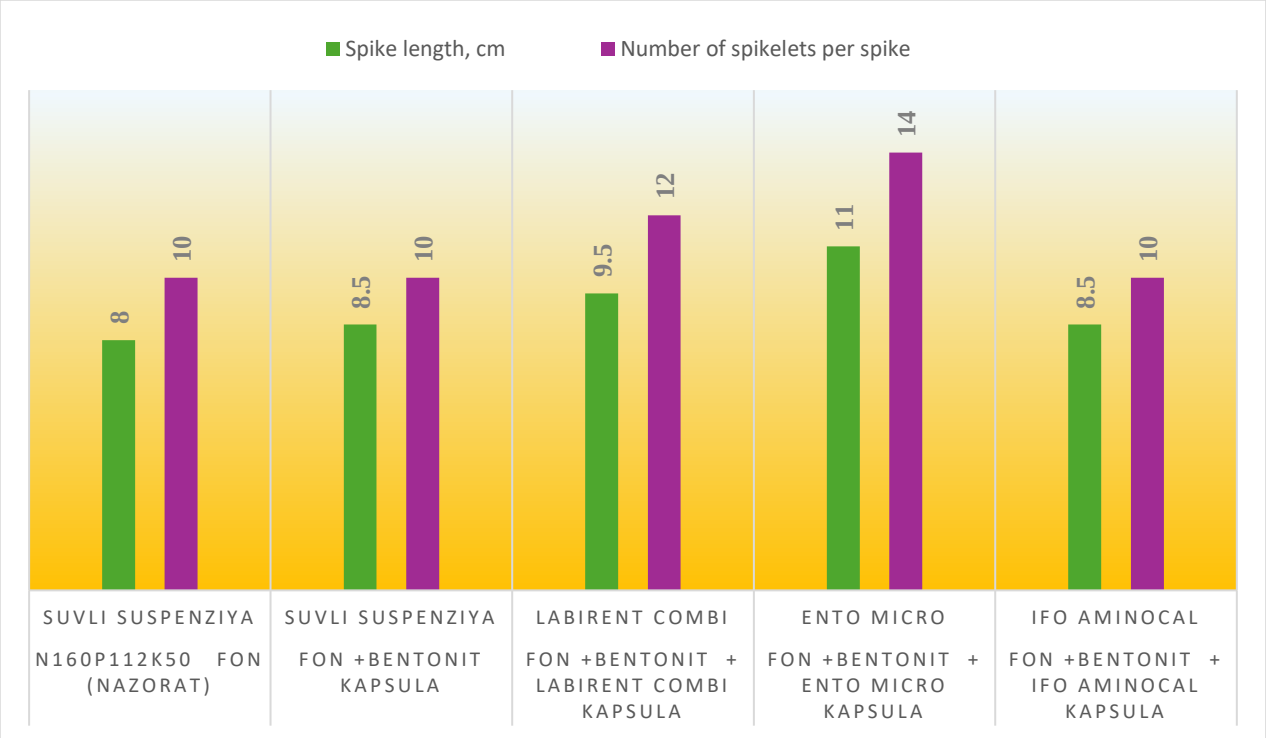

Figure 3. Effect of Seed Coating and Suspension Fertilizer Application on Spike Length and the Number of Spikelets per Spike in Spring Wheat.

The applied treatments had a significant effect on spike length and the number of spikelets per spike in spring soft wheat. Under the background application of mineral fertilizers at a rate of N160P112K50, the control treatment (foliar application of water only) produced a spike length of 8.0 cm and 10 spikelets per spike. In the treatment involving bentonite-based seed coating combined with foliar nutrient application during the growing season, spike length increased to 8.5 cm, while the number of spikelets per spike remained 10.

Seed coating with Bentonite + Labirent Combi, followed by foliar nutrient application, increased spike length to 9.5 cm and the number of spikelets per spike to 12. The highest values were recorded in the treatment with Bentonite + Ento Micro seed coating combined with foliar micronutrient application during the growing season, where spike length reached 11.0 cm and the number of spikelets per spike increased to 14. In contrast, the treatment involving Bentonite + IFO Aminocal seed coating together with foliar fertilization resulted in a spike length of 8.5 cm and 10 spikelets per spike.

The obtained results indicate that integrated fertilization with mineral and micronutrient fertilizers, particularly the application of Bentonite + Ento Micro, had a positive effect on spike length and spikelet formation. The improvement in these yield-related traits can be attributed to enhanced nutrient availability, which promoted the development of reproductive organs. Consequently, the increase in spike length and the number of spikelets per spike is expected to contribute to a greater number of grains per spike and, ultimately, higher grain yield.

Furthermore, bentonite-based seed coating not only improved field emergence but also promoted early plant growth and development, enhanced root system establishment, and increased nutrient uptake efficiency. As a result, both vegetative and reproductive growth were stimulated, leading to improved biometric characteristics of spring wheat.

4. Conclusion

The results of the present study demonstrated that bentonite-based seed coating combined with the integrated application of mineral and micronutrient fertilizers had a positive effect on the biometric characteristics of spring soft wheat grown on irrigated meadow alluvial soils in the Republic of Karakalpakstan.

Compared with the control treatment, the fertilized treatments showed superior performance in plant height, uppermost internode length, spike length, and the number of spikelets per spike.

Among the evaluated treatments, the Bentonite + Ento Micro treatment exhibited the highest effectiveness. Pre-sowing seed coating with this formulation, combined with foliar nutrient application during the growing season, promoted the development of both vegetative and reproductive organs, resulting in significant improvements in plant height, uppermost internode length, and the number of spikelets per spike.

Overall, the findings indicate that bentonite-based seed coating together with the integrated application of mineral fertilizers and micronutrient formulations represents an effective agronomic practice for improving the biometric characteristics and yield potential of spring soft wheat under irrigated meadow alluvial soil conditions in the Republic of Karakalpakstan.

References

1. http://www.fao.org/worldfoodsituation/csdb/ru.https://www.fao.org/statistics/ru/
2. Marschner, P. (2012). Marschner's Mineral Nutrition of Higher Plants (3rd ed.). London: Academic Press. 651 p.
3. Zhang, F., Nyu, J., Zhang, W., Chen, X., Li, C., Yuan, L., & Xie, J.. Potassium nutrition of crops under varying nitrogen supply regimes. Plant and Soil, (2010) 335 (1–2), 21-34. https://doi.org/10.1007/s11104-010-0323-4
4. Guo J. Jia Y. Chen H. Zhang L. Yang J. Zhang J. et al. (2019). Growth, photosynthesis, and nutrient uptake in wheat are affected by differences in nitrogen levels, forms, and potassium supply. Scientific Reports 9 1248.1-12-b https://doi.org/10.1038/s41598-018-37838-3
5. Pandey M. Shrestha J. Subedi S. Shah K.K. "Role of Nutrients in Wheat: A Review" 2020 18-23 pp.
6. Bekbanov B. Nag‘ymetov O. NuratdinovaP, Allamjarova B, Joldasova G. “Bahorgi bug‘doy navlarining biometrik ko‘rsatkichlari” 2022 jil AGRO Ilm – O‘zbekiston qishloq va suv xo‘jaligi №6. 2022 [11-12 b]