

Date: 27th August-2026

THE EFFECT OF BENTONITE CLAY APPLICATION METHODS ON COTTON YIELD

Davronova Zokhida Zokhidovna

Basic Doctoral Student, Navoi Branch of the Academy of Sciences of the Republic
of Uzbekistan

ORCID ID: 0009-0005-4871-0938

Abstract. The study investigates the effect of applying bentonite clay to cotton seeds (seed coating) and through foliar feeding on cotton yield. The results demonstrated an increase in yield by 5,67–8,8%. The most effective application rate was determined to be 1,5 kg/t.

Keywords: cotton, bentonite clay, yield, seed coating, agrotechnology.

Achieving high and stable yields in agriculture requires the implementation of modern agrotechnologies. In particular, methods aimed at improving soil fertility, accelerating seed germination, and supporting the early stages of plant development are of considerable importance. In this context, the use of bentonite clay, a natural mineral, represents one of the promising directions in agricultural practice.

Bentonite clay is characterized by high sorption capacity, enabling it to retain moisture, preserve nutrients, and facilitate their efficient uptake by plants. In addition, it plays a crucial role in improving soil structure and stabilizing the microclimate.

Taking the above-mentioned factors into account, the present study was conducted under the specific soil and climatic conditions of the Navoi region. In particular, the experiments were carried out on typical sierozem (gray desert) soils at the Navoi experimental station of PSUEAITI. The study area—Karmana district—is considered favorable for cotton cultivation in terms of climatic conditions. The average air temperature in spring ranges from 9,2 to 23,3 °C, while in summer it varies between 28,1 and 37,3 °C. During autumn, temperatures gradually decrease, averaging 23,6 °C in September and 15,5 °C in October.

The soil of the experimental field is composed of typical sierozem (gray desert) soils, with the groundwater table located at a depth of 2,5–3,0 m and subject to seasonal fluctuations. According to the results of soil analyses, the 0–30 cm soil layer contained 0,917% humus, 0,847% total nitrogen, 0,146% total phosphorus, 18,1 mg/kg nitrate nitrogen, 24,3 mg/kg available phosphorus, and 190 mg/kg exchangeable potassium. In the 30–50 cm layer, these indicators were 0,683%, 0,0619%, 0,119%, 12,7 mg/kg, 19,3 mg/kg, and 165 mg/kg, respectively. These data indicate that the nutrient content of the soil is sufficient for cotton cultivation and that no adverse effects are expected when appropriate agrotechnical practices are properly implemented.

The objective of this study was to evaluate the effect of applying bentonite clay to cotton seeds (seed coating) and through foliar feeding on cotton yield, as well as to identify the most effective agrotechnical combination.



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In our experiment, cotton seeds were coated with bentonite clay at rates of 50 and 100 kg t⁻¹, while foliar application of bentonite clay suspension was carried out three times during the growing season at rates of 1.0, 1.5, and 2.0 kg ha⁻¹.

According to the results of the conducted experiments, the effectiveness of applying bentonite clay powder through seed coating and foliar feeding methods on cotton yield was established. In the control treatment, where bentonite was not applied, the average yield over the period 2023–2025 amounted to 38,6 centners per hectare. Compared to other experimental treatments, this clearly demonstrates the positive effect of bentonite on cotton growth and productivity.

In the treatment where seeds were not coated with bentonite, but foliar feeding was applied at a rate of 1 kg/ha, the yield reached 41,1 c/ha in 2023, 40,3 c/ha in 2024, and 39,8 c/ha in 2025. These results are higher than the control by 2,0, 2.1, and 1,2 c/ha, respectively (or 5,1%, 5,5%, and 3,1%). In this variant, the average additional yield was 1,77 c/ha, corresponding to an increase of 4,57 %.

When the bentonite application rate for foliar feeding was increased to 1,5 kg/ha, the average yield reached approximately 41,6 c/ha, which is 2,97 c/ha or 7,67 % higher than the control. Increasing the bentonite rate further to 2 kg/ha resulted in an average yield of about 41,0 c/ha, with an additional yield of 2,37 c/ha or 6,1 %.

When cotton seeds were coated with bentonite clay at a rate of 50 kg/t and grown without foliar application of bentonite, the average yield reached 39,9 c/ha, which is 1,23 c/ha or 3,17 % higher than the control. In the variant where foliar feeding was carried out using a bentonite suspension at a rate of 1 kg/ha, the average yield increased to 43,1 c/ha, providing an additional yield of 4,47 c/ha or 11,57 % compared to the control. When the foliar application rate was increased to 2 kg/ha, the average yield reached 44,1 c/ha, with an additional yield of 5,5 c/ha or 14,23%.

In the treatment where seeds were coated with bentonite at a rate of 100 kg/t and no foliar feeding was applied, the average yield amounted to 42,9 c/ha, exceeding the control by 4,3 c/ha or 11,2%. The variant with foliar feeding using a bentonite suspension at 1 kg/ha also demonstrated high performance, with an average yield of 44,7 c/ha, which is 6,1 c/ha or 15,8% higher than the control. Increasing the foliar application rate to 2 kg/ha resulted in an average yield of 45,7 c/ha, corresponding to an additional yield of 7,03 c/ha or 18,2% compared to the control.

Analysis of the experimental results indicates that the combined application of bentonite clay powder through seed coating and foliar feeding significantly increases cotton yield. The optimal treatment is recommended as coating seeds with bentonite at a rate of 100 kg/t combined with foliar application at 1,5 kg/ha. Under these conditions, the average yield reached 46,3 c/ha, with an additional yield of 7,63 c/ha or 19,76% compared to the control.

Based on the results of experiments conducted during 2023–2025, it was established that the application of bentonite clay in cotton cultivation technology is an effective agrotechnical measure for increasing yield. The findings showed that bentonite clay



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produces positive effects not only in seed coating but also when applied as a foliar treatment during the growing season.

The high sorption capacity of bentonite clay contributed to improved retention of soil moisture and nutrients, enhancing their efficient uptake by plants and thereby promoting both vegetative and generative development of cotton. In addition, foliar application improved the plant's resistance to stress factors.

Overall, the integrated use of bentonite clay as part of a комплекс agrotechnological approach represents a promising strategy for increasing cotton yield, improving soil fertility, and ensuring sustainable agricultural production.

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