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THE EFFECT OF USING BENTONITE CLAYS IN LENTIL CULTIVATION UNDER THE CONDITIONS OF NAVOI REGION ON CHANGES IN PLANT HEIGHT AND LEAF AREA

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Annotation: This article presents the results of field experiments conducted to study the effect of seed encapsulation with bentonite clay powder at rates of 0, 60, 80 and 100 g/kg on germination dynamics and the effect of leaf dressing during the growing season with a suspension of various compositions on plant growth and development when growing lentils in typical gray soils of the Navoi region.

Keywords: lentils, bentonite clay powder, encapsulation, germination dynamics, leaf feeding, suspension, plant height, leaf area of one plant.

Introduction. Agricultural production today requires the development of more advanced technologies for crop cultivation aimed not only at obtaining stable yields, but also at producing high-quality, competitive grain products.

In recent years, considerable attention has been paid worldwide to lentils, an important leguminous crop that serves as a complete source of plant protein. Lentils are one of the most ancient food crops and occupy a worthy place among grain legumes due to their high nutritional value and medicinal significance.

Grain legumes, including lentils, do not terminate the upper part of the above-ground vegetative organs with an inflorescence; therefore, lentil plants can continue vegetative growth for an extended period under favorable environmental conditions. However, under the influence of environmental factors—such as a decrease in soil moisture, an increase in air temperature, and the onset of the generative phase of plant development—the growth rate significantly decreases [1].

In crop production, leaf feeding of plants is considered one of the most effective methods. Moreover, when a certain portion of mineral fertilizers is applied through leaf feeding in addition to root fertilization, the amount of harmful substances remaining in the soil is significantly reduced.

Nutrients applied to plant leaves in the form of a suspension are rapidly absorbed by epidermal cells. As a result, plant growth is accelerated, the chemical composition changes, and this process has a positive effect on metabolism.

According to the results of studies conducted by Egyptian scientists, in variants where bentonite was applied at a rate of 2 kg during leaf feeding of cotton, growth parameters—such as plant height and the number of fruiting branches—were higher compared to variants where 4 kg was applied. In addition, the lower application rate increased the number of yield components and accelerated crop maturation [3].

In soybean, foliar application of nitrogen at rates ranging from 5 to 20 kg during the phase of four true leaves increased stem height by 3.1 to 7.4 cm compared to the control treatment.

In the control variant at the pod formation stage, stem height was 55.1 cm. When foliar nitrogen fertilization was applied at rates from 5 to 20 kg, stem height increased by 10 cm.

During the branching and flowering stages, the application of N_{10} and N_{15} resulted in a stem height of 74.8 cm, which is 19.7 cm higher than that of the control variant [2].

Research methods. Scientific investigations were conducted based on the manuals *"Methods of Conducting Field Experiments"* and *"Scientific Research in Plant Science."* Photosynthetic activity was assessed using the method of A.A. Nichiporovich. Leaf area was determined by the "cut-out" method as well as by using a YMJ-A leaf area meter manufactured in China.

Results and discussion. Experimental studies aimed at determining the effect of using natural bentonite clays on changes in plant height and leaf area in lentil cultivation were carried out in 2024 at the "Dostlik" agrofirm affiliated with NMMC.

The agrofirm is located in the Karmana district, and the soils of the experimental field are classified as typical gray soils with slight salinity. The humus content in the plow layer was 0.14%; total and available phosphorus contents were 0.18% and 13.6 mg/kg; total and nitrate nitrogen contents were 0.14% and 11.3 mg/kg; and exchangeable potassium content was 186 mg/kg. These indicators demonstrate that the levels of essential nutrients required for plant development in the field soils were very low.

Lentil seeds were encapsulated with bentonite clay powder at rates of 0 (control), 60, 80, and 100 g/kg relative to seed weight and sown in the third ten-day period of April at a seeding rate of 3.0 million seeds per hectare.

Experimental studies were conducted in 12 treatments according to a predetermined scheme based on seed encapsulation rates and types of suspensions. The treatments were arranged in four replications in two tiers.

Normal plant growth and development primarily depend on obtaining uniform and healthy seedlings, which in turn is ensured by high seed quality. Therefore, great importance is attached to developing effective pre-sowing seed treatment methods to enhance the viability of emerging seedlings.

In this study, one of the main objectives was to investigate the effect of encapsulating lentil seeds with bentonite clay powder at different rates on the speed and quality of germination and to determine the optimal application rate.

Ten days after sowing, seedling counts showed that in the variants where seeds were encapsulated with bentonite powder at a rate of 80 g/kg, 98% germination was observed, which was 15% higher than the control (83%).

In the plots where seeds were encapsulated with bentonite clay powder at rates of 60 and 100 g/kg prior to sowing, germination percentages were slightly lower, being 7% and 12% higher than the control, respectively.

In addition, seedlings emerging from seeds encapsulated with bentonite clay powder were observed to be more vigorous compared to those in the control plots.

During the growing period, agronomic practices in the experimental field were carried out on time and with high quality. Phosphorus and potassium fertilizers were applied under the plow, while nitrogen fertilizers were applied to the plants during sprouting and flowering stages. The field was weeded once manually and cultivated. The plants were irrigated three times throughout the season, taking into account the water requirements of the lentil.

During the growing period, in each plot of seeds encapsulated with bentonite clay powder at the above-mentioned rates, four-leaf and budding stage plants were foliarly fertilized twice with different suspensions (water; urea at 3 and 4 kg/ha; urea at 3 and 4 kg/ha + bentonite at 1 and 1 kg/ha).

Encapsulating lentil seeds with bentonite clay powder at different rates, along with leaf feeding with various suspensions during the growing period, had a significant effect on plant height and yield components.

At the ripening stage, the plant height in the control plots reached 51.7 cm, whereas in the encapsulated seed variants where the plants were foliarly fed only with water (60, 80, and 100 g/kg), the plant height increased by 0.4, 2.1, and 1.2 cm compared to the control.

The highest increase in this indicator was observed in the variant where seeds were encapsulated with 80 g/kg bentonite clay powder and leaf feeding was carried out using a urea + bentonite suspension. In this variant, the plant height was 9.4 cm, or 18.1%, higher than the control (Figure 1).

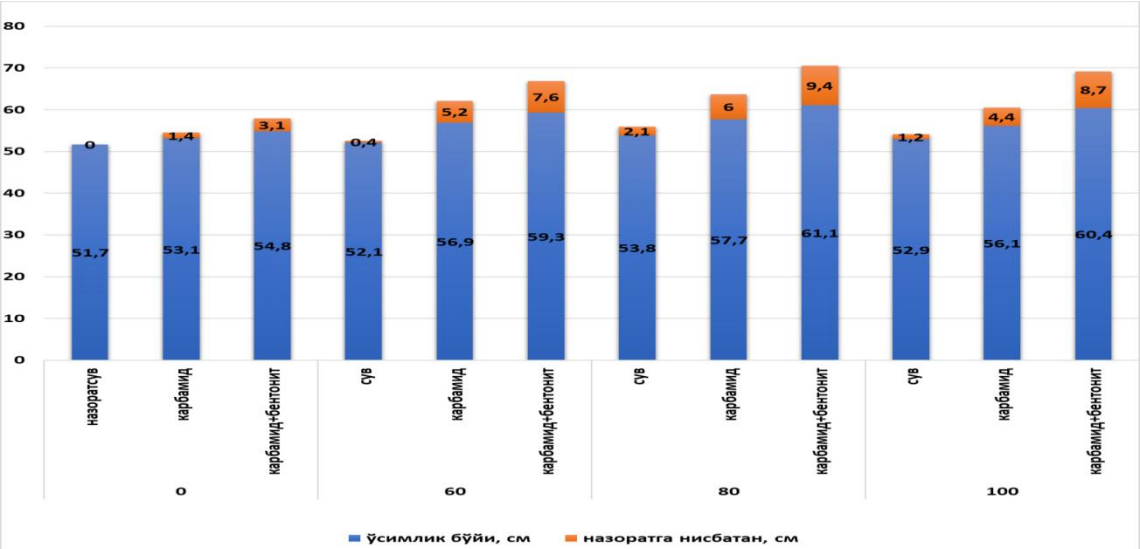

***Figure 1*. Effect of bentonite clay powder on lentil height**

The presence of bentonite clay powder in the seed encapsulating and leaf feeding suspensions positively influenced indicators reflecting rapid plant development, such as leaf area, branching, and the number of flowers and pods.

When studying the leaf area, the lentil leaf area was measured during the budding, flowering, and podding stages.

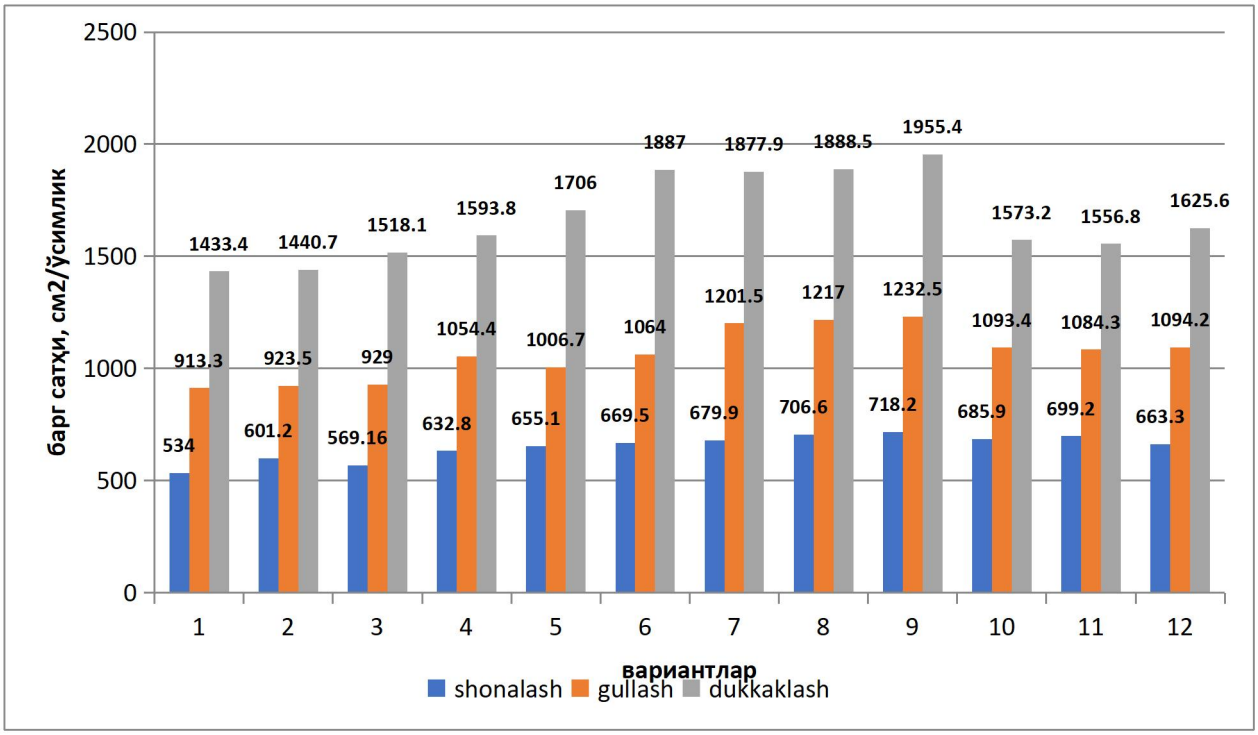

***Figure 2*. Effect of bentonite suspension on lentil leaf area**

During the budding stage, the leaf area per lentil plant ranged from 534.0 to 718.2 cm², with the highest value observed in the variant treated with 80 g/kg bentonite mineral. As the lentil began flowering, the leaf area continued to expand, and differences between the variants became noticeable. During the flowering stage, the leaf area ranged from 913.3 to 1232.5 cm², and by the podding stage, it reached 1433.4–1955.4 cm².

At all stages, the highest leaf area was recorded in variant 3, where 80 g/kg of bentonite mineral was applied. In this variant, the leaf area per plant exceeded the control by 145.9 cm² during the budding stage, 319.2 cm² during the flowering stage, and 522.0 cm² during the podding stage.

When rows of lentils encapsulated with bentonite clay powder were foliarly fertilized with different suspensions (water; urea at 3 and 4 kg/ha; urea at 3 and 4 kg/ha + bentonite at 1 and 1 kg/ha), the leaf area during the budding, flowering, and podding stages was highest in the variant treated with the urea + bentonite suspension. In this variant, the leaf area per plant exceeded the control by 149.04 cm² during the budding stage, 303.5 cm² during the flowering stage, and 437.3 cm² during the podding stage.

Conclusion. Based on the results of the experiment, under the typical gray soils of the Navoi region, for achieving full and high-quality lentil yield, it is advisable to encapsulate the seeds

with bentonite clay powder at a rate of 80 g/kg and to apply leaf feeding during the growing period with a suspension containing urea and bentonite to support active growth and development.

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