



Efficiency of Cotton Cultivation Using the Physiologically Active Substance Boms without Application of Mineral Fertilizers

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Abstract. Cotton production is the main branch of agriculture in Uzbekistan, where extensive scientific and practical experience has been accumulated in cotton-growing agro-technologies. The unique soil and climatic conditions of the country create natural challenges for cotton cultivation. Early spring precipitation and the early onset of cold weather in autumn—such as snowfall or rainfall in early October—complicate both the ripening and harvesting of cotton. Therefore, in Uzbekistan’s cotton production, the breeding of early-maturing cotton varieties and the development of intensive agrotechnical measures hold great importance. Although almost all of the cotton varieties currently cultivated in the republic are early-maturing, due to the strong influence of weather conditions, harvesting often extends until November, making the production of high-yield and high-quality cotton problematic. Considerable scientific research has been conducted in this regard. In particular, in recent years, the widespread application of physiologically active substances in Uzbekistan’s cotton production has yielded positive results in producing early, abundant, and high-quality yields. These physiologically active substances may be applied to the soil, treated on cotton seeds prior to sowing, or used during the vegetation period. They are of natural origin and non-toxic, and therefore are considered to occupy a specific niche in the production of organic cotton. This article examines the use of the physiologically active substance *Tevevit BOMS* during soil preparation, applied at rates of 300–1000 kg/ha without the use of chemical mineral fertilizers, and its effects on seed germination, growth and development of cotton plants, as well as the prospects of producing early, abundant, high-quality, and environmentally friendly cotton.

Keywords: Cotton, typical gray soil, Tevevit BOMS, physiologically active substance

1 Introduction

Cotton cultivation remains one of the most critical sectors in Uzbekistan's agricultural economy. Despite the country's extensive experience and technological advancements in cotton-growing, the unique agro-climatic conditions—characterized by early spring rains and the onset of cold weather in early autumn—continue to pose significant challenges to cotton ripening and harvesting. Although most cotton varieties cultivated in the country are early-maturing, unfavorable weather conditions frequently delay harvesting into November, negatively affecting both yield and quality.

To address these issues, scientific attention has increasingly focused on the use of physiologically active substances that can enhance cotton growth, development, and yield under stress-prone environments. One such promising substance is Tevevit BOMS, a biologically derived, non-toxic compound that can be integrated into organic cotton cultivation systems. Unlike traditional mineral fertilizers, Tevevit BOMS is environmentally friendly and complies with the requirements of organic agriculture. In the context of a national push toward organic production—aligned with global standards such as “Organic” and “Global G.A.P.”—Uzbekistan is actively developing sustainable cotton cultivation technologies. Organic agriculture, which avoids the use of synthetic chemicals and genetically modified organisms, not only meets growing international demand but also supports long-term soil fertility and environmental health. This research specifically investigates the efficacy of applying Tevevit BOMS to the soil without mineral fertilizers in enhancing seed germination, plant growth, and cotton yield under field conditions typical of the Tashkent region's gray soils.

2 Materials and methods

The field experiments were conducted in 2019 in the Tashkent region of Uzbekistan, which is characterized by typical gray soils, commonly found in the region's irrigated zones. These soils are moderately fertile and present both opportunities and challenges for sustainable cotton production. The study involved five treatment variants including both control and BOMS-treated plots. The treatments were:

1. Control (with full NPK mineral fertilizers)
2. Boms + NPK – 600 kg/ha of BOMS with standard mineral fertilization
3. Boms only (300 kg/ha) – without mineral fertilizers
4. Boms only (600 kg/ha) – without mineral fertilizers
5. Boms only (1000 kg/ha) – without mineral fertilizers

Each treatment was applied during soil preparation prior to sowing, and the cotton variety used in the trials was Andijan-37.

Tevevit BOMS was applied to the soil at varying rates (300, 600, and 1000 kg/ha) before cotton seeds were sown. In one variant, BOMS was combined with standard mineral fertilizers (NPK), while in other treatments, no chemical fertilizers were used, enabling a comparative evaluation of BOMS performance in organic conditions.

The Presidential Decree of the Republic of Uzbekistan “On Additional Measures to Ensure Compliance of Agricultural Products with International Quality and Safety Standards” serves as a strategic program for the production of agricultural products that meet global requirements. In developed countries, special attention is given to issues

directly related to human health, and in this context, the importance of producing organic products is particularly emphasized. Organic products are defined as agricultural goods cultivated and produced without the use of chemical agents or genetically modified organisms. Within the global community, the development of agricultural products in accordance with “Organic” and “Global G.A.P” standards, the improvement of their quality and safety indicators, and the expansion of exports are considered essential. In Uzbekistan, a national concept for the development of organic agriculture and the production of organic food has been introduced.

Organic agriculture is an ecologically clean production system that avoids the use of environmentally harmful chemical agents in crop cultivation. At present, developed countries require organic certification for imported agricultural and food products, which necessitates the development of organic farming in Uzbekistan. This includes advanced agro-technologies for crop production as well as the biological control of pests and diseases as an integral part of the system.

It should be noted that organic agriculture is not a novelty for Uzbek farmers. Historical evidence shows that long before the advent of chemical agents, agriculture in this region relied on organic practices. To achieve desired crop yields, farmers widely used manure, ash, clay fragments from old walls, and other natural residues. Even today, in countries such as India, Pakistan, China, and Afghanistan, green manures are still applied as organic fertilizers, while in Kazakhstan’s rainfed lands, wheat is cultivated without the use of mineral fertilizers.

Uzbekistan ranks 5th–6th among the world’s largest cotton-producing countries, with more than 1.0 million hectares allocated to cotton cultivation. Cotton grown in the country is exported to over 30 countries in the form of raw fiber, yarn, and other products. This makes the development of organic cotton production of significant economic importance.

Currently, population growth in Uzbekistan has led to increasing demand for agricultural products. However, the limited availability of irrigated land, coupled with climate change, water scarcity, soil salinization, and unfavorable weather conditions, poses serious challenges for obtaining high and stable yields. Under such conditions, the priority is to cultivate early-maturing, high-yielding, and high-quality cotton varieties that are resistant to environmental stresses, diseases, and pests. To enhance soil fertility, increase the efficiency of macro- and microelement utilization, and stimulate plant growth and development, the physiologically active substance Tevevit BOMS is used. Its mechanism of action is associated with improving metabolic processes in plants through the activation of natural growth regulators, particularly auxins and cytokinins. In the context of global warming, environmental changes, heatwaves, drought, and irregular precipitation—such as excessive rainfall and cool weather in early spring or autumn—the role of biostimulants in crop management has become increasingly important. Seed treatment with physiologically active substances improves germination, growth, and development, while simultaneously increasing resistance to drought, salinity, and diseases. Furthermore, such treatments contribute to enhanced soil fertility and more efficient utilization of mineral fertilizers, thereby creating favorable conditions for achieving high and high-quality yields.

3 Results

In the experiment conducted by Sh. Abdualimov et al. (2017), when cotton seeds were treated with the stimulator Bioduks (active ingredient: arachidonic acid) at a rate of 3.0 ml/t before sowing, and during the budding and flowering stages at 2.0 ml/ha, seedling emergence accelerated by 10.1–13.3%. Plant growth and development intensified, and a yield of 44.0 centners/ha of raw cotton was obtained, which was 4.7 centners/ha higher compared to the control.

According to Sh. Abdualimov and Sh. Karimov (2017), when the stimulator Obereg was applied to cotton seeds at 1.0 ml/t and during the budding and flowering stages at 10.0 ml/ha, Fitovak at 200 ml/t for seeds and 400 ml/ha during budding, and sodium humate at 2.2 kg/t for seeds, seedling emergence was accelerated, intensive growth and development of cotton plants were observed, the number of bolls increased by 1.0–2.0 per plant, cotton yield rose by 3–5 centners/ha, and profitability improved. Various biostimulators of organic origin positively affected seed germination, plant growth and development, and yield improvement. Therefore, we studied the effect of applying the organic preparation Boms to the soil before sowing cotton seeds on seedling emergence, plant growth and development, and yield under both fertilized and unfertilized conditions. The analysis of the obtained research results is presented below.

Seed Germination. Scientific literature reports that seed germination increases when treated with different physiologically active substances. For instance, under the conditions of Tashkent region, when seeds were treated with the preparations Nitrolin and Uchqun before sowing, accelerated germination was observed [5] (Niyazmetov, 2007). Similar findings were reported in other experiments where various stimulators were applied.

In our experiment, the effect of the Tevevit Boms preparation, applied to the soil during field preparation, on seedling emergence was studied. Seedling germination was monitored across six observation dates, from May 10 to May 22.

In the first observation on May 10, in the control plot, 75.7 seedlings were recorded per 10 m², whereas in the Boms-treated plots the number ranged from 73.3 to 105.3. Subsequent observations on May 12, 14, 17, 20, and 22 showed similar trends, with seedling emergence in the Boms treatments at rates of 300–600 kg/ha being higher than in the control.

In the final observation on May 22, the number of seedlings emerged in the Boms treatments at 300–600 kg/ha ranged from 231.7 to 234.0 per 10 m², which was 4.4–6.7 seedlings more compared to the control (227.3). However, in the variant where Boms was applied at 1000 kg/ha, the number of seedlings was 250.3, exceeding the control by 23.0. Thus, the application of Boms at rates of 300–1000 kg/ha positively influenced seed germination (Table 1).

Table 1. Effect of Boms on cotton seed germination of the Andijan-37 variety under Tashkent conditions, 2019

№	Experi- mental variants	Applica- tion rate to soil before sowing, kg/ha	Number of emerged seedlings, pcs/10 m ²						Dif- ference from con- trol, pcs
			10.05	12.05	14.05	17.05	20.05	22.05	
1	Control (NPK)	-	75,7	161,0	174,0	196,0	216,0	227,3	-
2	Boms+ NPK	600	73,3	139,0	164,7	177,0	214,0	234,3	7,0
3	Boms	300	105,3	144,3	185,0	203,3	225,0	231,7	4,4
4	Boms	600	74,7	174,7	200,0	213,7	231,0	234,0	6,7
5	Boms	1000	82,0	153,0	200,7	210,3	233,0	250,3	23,0

Thus, when Tevevit Boms was applied to the soil at rates of 300, 600, and 1000 kg/ha during field preparation prior to sowing, the number of emerged seedlings ranged from 231.7 to 250.3 plants per 10 m², which was 4.4–23.0 plants higher than the control. This indicates a positive effect of Boms on seedling emergence.

Effect of Boms on Cotton Growth and Development. During the vegetation period, the influence of Boms on the growth and development of cotton plants was systematically studied in the experimental field (Table 2). Observations conducted on June 1, 2019, revealed that plant height across treatments ranged from 9.2 to 10.8 cm, with 2.4–2.6 true leaves per plant, showing no significant differences between variants.

In subsequent observations at the mass budding stage (July 1), the control variant recorded a plant height of 39.6 cm, with 5.7 fruiting branches and 5.7 buds. In contrast, treatments with Boms at 600 kg/ha + NPK and Boms at 300–1000 kg/ha produced plants with heights of 39.2–40.7 cm, 5.5–6.0 fruiting branches, and 5.6–6.0 buds. Compared with the control, these treatments exhibited slightly shorter plants (by 0.9–1.1 cm), fewer fruiting branches (by 0.2–0.3), and fewer buds (by 0.1–0.3).

During the flowering and fruit-setting phases (July 1 and August 1, 2019), phenological observations likewise showed that while Boms-treated plants tended to be shorter with fewer fruiting branches, they produced a greater number of reproductive structures (buds, flowers, and bolls) compared with the control. For instance, by the end of the growing season (September 1, 2019), plant height in the control was 94.4 cm, while in the Boms + NPK treatment it was 97.0 cm, and in the Boms 300 kg/ha treatment it was 91.6 cm (2.8 cm shorter than the control). However, when Boms was applied at 600–1000 kg/ha, plant height reached 95.9–100.0 cm, or 1.5–5.6 cm higher than the control. The number of fruiting branches per plant was 15.5 in the control, compared with 15.0–16.0 in the Boms treatments. The number of bolls per plant was 8.8 in the control, whereas in the Boms 600 kg/ha + NPK treatment, boll number reached 9.7, and in the

Boms 300–1000 kg/ha treatments without mineral fertilizers it was 9.9–10.8, representing an increase of 1.1–2.0 bolls over the control.

It should be emphasized that, because no mineral fertilizers were applied in the Boms-only treatments, vegetative biomass accumulation was somewhat reduced. This explains the shorter plant height and lower number of fruiting branches. Nevertheless, by the fruit-setting and maturation stages, the number of reproductive organs increased in the Boms treatments. For example, by September 20, prior to harvest, the number of bolls per plant was 9.3 in the control, compared with 10.8 in the Boms + NPK treatment (1.5 more bolls), 10.5 in the Boms 300 kg/ha treatment, 11.2 in the Boms 600 kg/ha treatment, and 10.2 in the Boms 1000 kg/ha treatment. Overall, the Boms 300–600 kg/ha treatments produced 0.9–1.9 more bolls per plant than the control.

The highest boll numbers were observed in the Boms 300–600 kg/ha treatments. Notably, boll opening in the control averaged 5.7 bolls (61.3%), while in the Boms-treated variants it ranged from 7.1 to 7.9 bolls (68.6–70.5%), representing an acceleration of 7.3–9.2% compared with the control.

In summary, application of Boms to the soil had a distinct influence on cotton growth and development. Under the conditions of typical gray soils in Tashkent region, when Boms was applied at 300–600 kg/ha without additional NPK fertilization, no major differences were observed in plant height or fruiting branch number. However, boll number per plant increased by 0.9–1.9, and boll opening accelerated by 7.3–9.2% relative to the control.

Table 2. Effect of the Boms Preparation on the Growth and Development of Cotton (Andijan-37 Variety), Tashkent Region, 2019

№	Experimental variants	Application rate to soil before sowing, kg/ha	Plant height, cm		Number of bolls, pcs			Number of opened bolls	
			1.08	1.09	1.08	1.09	20.09	Piece	%
1	Control (NPK)	-	83,7	94,4	5,6	8,8	9,3	5,7	61,3
2	Boms+ NPK	600	84,5	97,0	5,4	9,7	10,8	7,2	66,7
3	Boms	300	82,7	91,6	5,2	9,9	10,5	7,2	68,6
4	Boms	600	85,9	100,0	5,4	10,8	11,2	7,9	70,5
5	Boms	1000	84,5	95,9	5,4	10,0	10,2	7,1	69,6

Effect of Boms Preparation on Cotton Yield. The experiment evaluated the impact of the Boms preparation on cotton productivity. First, the weight of a single boll was measured across the variants: in the control, it averaged 5.5 g, whereas in the Boms-treated variants it ranged from 5.7 to 5.8 g, which is 0.2–0.3 g heavier than the control. Plant density in the experimental variants was relatively uniform, ranging from 71.0 to 73.0 thousand plants per hectare (Table 3).

In the first harvest, cotton yield in the control variant was 28.1 c/ha, while in the Boms + NPK treatment it reached 32.9 c/ha. Application of Boms at 300 kg/ha resulted in 33.3 c/ha, at 600 kg/ha in 34.8 c/ha, and at 1000 kg/ha in 32.1 c/ha. Thus, within the range of 300–1000 kg/ha, the Boms-treated variants produced 5.2–6.7 c/ha more cotton compared to the control.

During the second harvest, yields varied from 6.8 to 8.3 c/ha across the experimental treatments (Table 3). Specifically, yields were 6.8 c/ha in the control, 8.3 c/ha in the Boms + NPK treatment, 7.4 c/ha with 300 kg/ha Boms, 7.0 c/ha with 600 kg/ha Boms, and 8.0 c/ha with 1000 kg/ha Boms. When cotton was grown without mineral fertilizers and only with Boms, the additional yield compared to the control (full mineral fertilizer application) amounted to 5.8 c/ha at 300 kg/ha, 6.9 c/ha at 600 kg/ha, and 5.2 c/ha at 1000 kg/ha of Boms. Under combined application (Boms + mineral fertilizers), the 600 kg/ha Boms treatment produced 6.3 c/ha more yield than the control. Overall, yield indicators in the Boms-treated variants were found to be 14.9–19.8 percent higher than in the control.

Table 3. Application on Cotton Yield, Variety Andijan-37, 2019

№	Variants	Applica- tion rate be- fore sowing, kg/ha	Weigh t of cotton per boll, g.	Planting density, thou- sand plants/h a	Yield by harvests		Total yield, q/ha	Additional yield	
					1	2		q/ha	%
1	Control (NPK)	-	5,5	72,2	28,1	6,8	34,9	-	-
2	Boms+NPK	600	5,8	71,0	32,9	8,3	41,2	6,3	18,1
3	Boms	300	5,7	73,0	33,3	7,4	40,7	5,8	16,6
4	Boms	600	5,7	72,4	34,8	7,0	41,8	6,9	19,8
5	Boms	1000	5,7	71,0	32,1	8,0	40,1	5,2	14,9

NSR₀₅=2,2 s/ga, NSR₀₅=5,1%

Thus, under the conditions of typical gray soils in Tashkent region, when the Boms biopreparation was applied to the soil at rates of 300–600 kg/ha during pre-sowing land preparation, cotton yield reached 40.7–41.8 q/ha, with an increase of 5.8–6.9 q/ha compared to the control, or 16.6–19.8% higher.

4 Conclusion

Under the conditions of typical gray soils in Tashkent region, the application of the Tevevit Boms preparation to the soil at rates of 300–600 kg/ha during pre-sowing land preparation proved to be an effective method for producing early, high, and quality cotton yields without the use of mineral fertilizers (NPK). Furthermore, the use of phys-

ologically active substances derived from ecologically natural products has been scientifically and practically demonstrated to provide high efficiency in organic cotton cultivation.

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