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Effect of Microelements (B, Zn) on Cotton Plant's Productivity, Its Leaf Area and Plant Height

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Abstract

In this article, for the first time applied in our republic, the results of the effect of nano-micro fertilizers on cotton plant are given. The results of the study of the effect of microelements on the leaf area, plant height formation and yield of cotton in the conditions of the gray soil of the Zarafshan Valley are presented. Currently, the demand for ecological and safe food is increasing not only in Uzbekistan, but also in the whole world. The solution to this problem is effective use of land and increasing the amount of macrofertilizers, and after increasing the yield per unit of area, the micronutrients in the soil will decrease more, and less attention was paid to fertilizing with trace elements. This will affect the quality of the product, as well as the decrease in productivity and salinity of the land. Therefore, it is necessary to develop environmentally friendly and more economical approaches that do not harm the environment. The best solution for this is to reduce micronutrient deficiency in combination with agrotechnical methods. One of the urgent issues is the development of the technology of applying macro- and micro-fertilizers in the appropriate proportions, convenient terms, norms and methods for the cultivation of high-quality cotton crops under the soil conditions of our republic. The optimal rate of using microelements had a positive effect on the leaf area and dry mass of cotton plants. The highest result was observed when $N_{200}P_{140}K_{100}$ + KUPRUMHITE + NANOSEREBRO kg/ha was applied with mineral fertilizer.

Keywords

Fertility, Cotton, Organic Fertilizers, Physiological Process, Biometrical Measures, Micronutrient, Productivity

1. Introduction

Today famine is becoming one of the most serious global problems. The reason for that is the increase in the number of the world population, moreover, the weather and soil conditions are changing dramatically. Also, the lack of micronutrients in plants causes a decrease in the yield of plants [1].

As a result of the positive effect of microelements, the amount of chlorophyll in the leaves increases, photosynthesis increases, and the assimilative activity of the whole plant increases [2].

Deficiency of microelements causes defects in the growth and development of agricultural crops, their development is delayed, resistance to adverse conditions decreases, and they are often damaged by diseases and pests [3]. To meet the food demand of the growing world population, food production needs to be greatly increased. At the same time, the increase in the world's population due to urbanization and intensive farming puts serious pressure on the available agricultural land [4].

The rapid growth of the population and the reduction of arable land to a certain extent create the need for the development and scientific justification of measures to increase soil fertility, and improve the weight and quality of crops obtained from agricultural crops [5]. Taking into account the ecological problems, the use of micronutrients in combination with proper agrotechnical methods appears to be the most sustainable and cost-effective solution for alleviating food shortages. Reducing the use of macro fertilizers can provide a number of advantages, such as tolerance to abiotic and biotic stresses. The use of micro fertilizers which are rich in biologically available microelements is the most optimal way to improve the nutritional status of the land [6]. After increasing the amount of fertilizer, higher yields per unit area led to a greater depletion of micronutrients in the soil, and less attention was paid to micronutrient fertilization.

Currently, micronutrient deficiency has become a limiting factor in the productivity of many agricultural lands around the world [7]. Currently, intensive crop cultivation, high yield production, improvement of agricultural mechanization, and micronutrients with low mixtures of macronutrients, the production of fertilizers and the use of modern irrigation systems have increased crop production per unit area and the amount of trace elements in the soil increased [8].

Micronutrient deficiency has become a limiting factor in crop productivity in many agricultural soils. To increase the productivity of crops, it is necessary to solve the deficiency of microelements [9]. In developing countries, there are several solutions, including soil and foliar fertilization, cropping systems, correcting micronutrient deficiencies, and applying organic amendments to increase their density in the digestible parts of plants [10].

To correct micronutrient deficiencies and increase their concentration in plant parts that can absorb them, a variety of methods such as soil and foliar fertilization, improved cropping systems, application of soil amendments, and organic nutrient sources are used [11]. Taking into consideration the environmental concerns, sustainable agriculture is looking for environmentally friendly and more cost-effective approaches that use less energy and chemicals. Among the various strategies used to correct micronutrient deficiencies in plants, the most sustainable solution, especially for developing countries, is to reduce micronutrient deficiencies in combination with proper agronomic practices [12].

Today, the main directions of the world's cotton production are aimed at obtaining a high and high-quality cotton crop due to the introduction of resource and energy-saving technologies. Because 30 - 40 percent of the world's land areas are depleted of humus, nutrients, and the process of erosion is observed, which leads to a decrease in soil fertility and crop yield. Eliminating these situations is achieved by using microfertilizers in feeding agricultural crops in the USA, Germany, Austria and other countries [13].

In the practice of cotton growing in the world (USA, Egypt, Israel, Türkiye, India, etc.), it is possible to increase productivity by 14 - 17 percent by using microfertilizers, taking into account the fact that the soil is supplied with micronutrients. In addition, it is observed that the application of various forms of microfertilizers to the soil optimizes the nutritional regime and increases the tolerance of plants to external extreme conditions [14]. From this point of view, the development of the technology of applying macro- and micro-fertilizers in appropriate proportions, in convenient terms, standards and methods for the cultivation of high-quality cotton crops in the conditions of the soils of our Republic with a shortage of microelements is considered one of the urgent issues of agrochemistry and cotton growing. [15]. Boron not only affects the formation and development of reproductive organs of plants [10] [16], but also plays an important role in the vegetative development of plants [17] [18].

This element affects the transport and metabolism of photosynthetic products in plants [19] [20] and also participates in the structural composition of cell walls and [16] [21] indirectly affects the metabolism of proteins and nucleic acids [21] [22].

B deficiency inhibits root elongation [13] [20] and affects leaf growth and development [23] [24]. The important reason is that the root and leaf are the important organs of plants for obtaining nutrients.

Several studies have examined leaf vascular bundles under B deficiency and found that B deficiency affects growth and causes increased vascular tissue in plants [25]. Kumar V. (2011) reported the emergence of nano-fertilizers. Although fertilizers are very important for plant growth and development, most of the applied fertilizers are not readily absorbed by plants due to many factors.

Therefore, it is necessary to minimize the loss of nutrients in fertilizing and increase the yield by using new nano fertilizers (Siddiqui *et al.*, 2015) [26]. Zinc also plays a significant role in controlling the production and toxicity of free radicals that can be caused damage to membrane lipids [27]. Zinc deficiency leads to a decrease in vegetative and fruitful growth [28]. Yas, A. A. showed a significant increase in cotton yield due to spraying zinc and boron [29].

The use of nano-nutrient particles as a basis for fertilizers in agricultural production is a modern technology that has been introduced for the purpose of increasing production and reducing costs [30].

The application of fertilizer in the crop fields is the common practice for increasing the crop production to fulfill the global demand of food [31].

Further, Fatima *et al.* [32] stated that the fertilizer application 13 times increased from 15 to 194 million tons between 1950 and 2020. Meanwhile, excess use of mineral fertilizers is unsafe due to increase the pollution issues. However, conventional fertilizers do not provide the required results because most nutrients do not reach at the target areas due to the loss by evaporation, leaching, volatilization, erosion, and runoff or nutrients photolytic deprivation [33].

Nevertheless, nutrient use efficiency (NUE) has been considered the serious issue of lower soil fertility and reduction of crops yield. So, the improvement of NUE is needed for better cropping systems, sup-porting the sustainable agricultural production systems and increasing soil quality components [34]. Nano-fertilizers increase the nutrient use efficiency, provide better yield and may help in reducing the soil pollution due to overapplication of fertilizers [35]. However, to increasing the food production with minimum adverse environmental effects, it's essential to developed the new type fertilizers that release the nutrients according to the plant demand. For this, nano-fertilizers could be effective choice that improve the nutrients use efficiency of plants [34].

Moreover, several studies showed that the nano-materials based fertilizer can be more effective than the conventional forms of the fertilizers nutrients uptake but also potentially decrease the adverse environmental affects related with the loss of nutrients [36]. Nano-fertilizers are valuable over the conventional fertilizers as they can improve the soil fertility, yield and the quality parameters of the crop [37].

Under the effect of continuous use of chemical fertilizers, reduced soil fertility and crops productivity is reported which may be due to lower nutrients use efficiency [38]. Furthermore, nano-fertilizers are considered as slow-release fertilizer to overcome the fluctuations *i.e.*, soil acidity, moisture and temperature to enhance plant growth [39].

Chhipa and Joshi [14] stated that the nano-fertilizer has great potential to improve nutrients use efficiency, minimize the cost and reduce environmental deterioration.

As compared with Chemical fertilizers, nano-fertilizer have been found to significantly improve the plants growth *i.e.*, plant height, leaf area, number of leaves and biomass by increasing the photosynthetic pigments and translocation photosynthetic products to different parts of the plant [40]. Eco-friendly approaches like green or biological synthesis of NPs are good alternatives to the chemical fertilizers [41].

The nano-fertilizers considered as the vital tool in the new age agriculture sector for better crop growth and enhance the nutrients use efficiency [42].

The nano-fertilizer is the vital tools in agriculture to increase the crop growth and production with increasing nutrients use efficiency (NUE) and decrease the nutrients losses and cost of cultivation [43].

However, Cui *et al.* [44] specified that the nano-fertilizers enhance the efficiency and uptake capacity of the nutrients from soil and reduce the nutrients loss to boost the crop productivity. Furthermore, nano-fertilizers are effective overcome damage and effects of salinity, stress, drought, flooding, temperature fluctuations, heat stress, oxidative stress, and excessive light on crops [45]. The usage of nano materials could effectively replace the traditional fertilizer and increase the oil content in the plant.

The combined dose of chemical fertilizer and nano chelated fertilizer when supplemented to peppermint plant, resulted in enhanced essential oil quality and quantity [46].

2. Object and Methods of Research

Our research was conducted in the gray soils of Pastdargham district of Samarkand region in 2020-2022. In our research, we used the "Omad" sort of cotton. This variety is planted in large areas in Samarkand region.

All of the analyses, phenological observations, calculations were made based on methodologies [47]—phenological observations, biometric measurements of the state inspection for variety testing of agricultural crops ([48]: p. 239) style and Beideman ([49]: p. 153], and the level of leaves was determined by N.N. Tretyakov's style, [50] and weighing method.

We applied micronutrients by spraying to the leaves with the help of technologies after 6 p.m. in the evening. The reason is that the mouths of the leaves are well opened at this time.

3. Results Obtained and Their Analysis

We determined the effect of trace elements in the development stages of cotton, the object of our research. The obtained results are presented in **Table 1**.

In the period of 3 - 4 leaves, the assimilation surface formed by leaves in the control variant was 47.6 cm^2, in the 1st variant, the assimilation surface formed by leaves was 55.4 cm^2, in the 2nd variant, the assimilation surface formed by leaves was 49.2 cm^2, and in the 3rd variant, leaves the assimilation surface created by the leaves was 62.1 cm^2, and in the 4th option the assimilation surface created by the leaves was 54.2 cm^2, and in the 5th option the assimilation surface created by the leaves was 66.7 cm^2, and in the 6th option the assimilation surface created by the leaves was 61.3 cm^2 , and in the 7th option, the absorptive surface created by the leaves was 53.6 cm^2, and in the 8th option, the assimilative surface created by the leaves was 60.7 cm^2, and in the 9th option, the assimilative surface created by the leaves was 57.6 cm^2, and in the 10th option, the assimilative surface created by the leaves absorption surface was 61.2 cm^2, and in option 11, the absorption surface created by leaves was 53.8 cm^2, and in option 12, the absorption surface created by leaves was 70.9 cm^2, and in option 13, the absorption surface created by leaves was 62.3 cm^2, and in option 14, the assimilation surface created by the leaves was 64.8 cm^2.

Table 1. The effect of microelements on the formation of the leaf surface of cotton (cm^2).

Options	leaf surface cm^2	leaf surface cm^2	leaf surface cm^2	leaf surface cm^2
	Cinnabar	Polishing	Flowering	Ripening
Control Option	47.6	430.6	1004.3	4534.9
$N_{200}P_{140}K_{100} + B_{0.02\%}$	55.4	454.7	1105.4	4689.6
$N_{200}P_{140}K_{100} + B_{0.05\%}$	49.2	441.4	1086.2	4595.1
$N_{200}P_{140}K_{100} + Zn_{0.02\%}$	62.1	454.2	1024.4	4671.3
$N_{200}P_{140}K_{100} + Zn_{0.05\%}$	54.2	453.3	1103.2	4569.4
$N_{200}P_{140}K_{100}$ + KUPRUMXIT + NANOSEREBRO	66.7	494.6	1209.2	4779.2
$N_{200}P_{140}K_{100}$ + PMK XZ-Co^{2+}	61.3	453.7	1071.7	4687.8
$N_{200}P_{140}K_{100}$ + KUPRUMXIT	53.6	438.9	1203.6	4612.6
$N_{250}P_{175}K_{125} + B_{0.02\%}$	60.7	451.9	1265.7	4659.9
$N_{250}P_{175}K_{125} + B_{0.05\%}$	57.6	447.7	1221.4	4607.7
$N_{250}P_{175}K_{125} + Zn_{0.02\%}$	61.2	452.3	1230.6	4652.4
$N_{250}P_{175}K_{125} + Zn_{0.05\%}$	53.8	450.2	1221.2	4645.1
$N_{250}P_{175}K_{125}$ + KUPRUMXIT + NANOSEREBRO	70.9	532.3	1469.6	5098.7
$N_{200}P_{175}K_{125}$ + PMK XZ-Co^{2+}	62.3	461.3	1261.3	4780.8
$N_{250}P_{175}K_{125}$ + KUPRUMXIT	64.8	524.2	1311.9	4906.2

The assimilation surface created by the leaves during the pruning period was 430.6 cm^2 in our control option, and in the 1st option the assimilation surface created by the leaves was 454.7 cm^2, in the 2nd option the assimilation surface created created by the leaves was 441.4 cm^2 surface was 454.2 cm^2, and in the 4th option the assimilation surface formed by the leaves was 453.3 cm^2, in the 5th option the assimilation surface formed by the leaves was 494.6 cm^2, and in the 6th option the assimilation surface formed by the leaves was 453.7 cm^2, in option 7, the absorptive surface created by leaves was 438.9 cm^2, and in option 8, the assimilative surface created by leaves was 451.9 cm^2, and in option 9, the assimilative surface created by leaves was 447.7 cm^2, and in option 10, the assimilative surface created by leaves was 452.3 cm^2, and in the 11th option, the absorptive surface created by the leaves was 450.2 cm^2, and in the 12th option, the assimilative surface created by the leaves was 532.3 cm^2, and in the 13th option, the assimilative surface created by the leaves was 461.3 cm^2, and in the 14th option it was determined that the assimilation surface formed by the leaves was 524.2 cm^2.

In the flowering phase, the absorptive surface created by the leaves in our control option was 1004.3 cm^2, and in the 1st option, the assimilative surface created by the leaves was 1105.4 cm^2, and in the 2nd option, the assimilative surface created by the leaves was 1086.2 cm^2, and in the 3rd option, the assimilative surface created by the leaves was 1086.2 cm^2. surface was 1024.4 cm^2, and in the 4th option the assimilation surface formed by the leaves was 1103.2 cm^2, in the 5th option the assimilation surface formed by the leaves was 1209.2 cm^2, and in the 6th option the assimilation surface formed by the leaves was 1071.7 cm^2, in the 7th option the assimilation surface formed by the leaves was 1203.6 cm^2, in option 8 the assimilation surface created by leaves was 1265.7 cm^2, in option 9 the assimilation surface created by leaves was 1221.4 cm^2, and in option 10 the assimilation surface created by leaves was 1230.6 cm^2, and in the 11th option, the absorptive surface created by the leaves was 1221.2 cm^2, and in the 12th option, the assimilative surface created by the leaves was 1469.6 cm^2, and in the 13th option, the assimilative surface created by the leaves was 1261.3 cm^2, and in the 14th option it was determined that the assimilation surface formed by the leaves was 1311.9 cm^2.

In the ripening phase, the absorptive surface created by the leaves in our control variant was 4534.9 cm^2, and in the 1st variant, the assimilation surface created by the leaves was 4689.6 cm^2, and in the 2nd variant, the assimilative surface created by the leaves was 4591.5 cm^2, and in the 3rd variant, the assimilation surface created by the leaves was 4591.5 cm^2 absorption surface was 4761.3 cm^2, and in option 4, the absorption surface formed by leaves was 4569.4 cm^2, and in option 5, the absorption surface formed by leaves was 4779.2 cm^2, and in option 6, the absorption surface formed by leaves was 4687.8 cm^2, in option 7, the absorption surface formed by leaves was 4612.6 cm^2, in option 8 the assimilation surface formed by leaves was 4659.9 cm^2, in option 9 the assimilation surface formed by leaves was 4607.7 cm^2, and in option 10 the assimilation surface formed by leaves was 4652.4 cm^2, and in the 11th option, the assimilation surface formed by the leaves was 4645.1 cm^2, in the 12th option, the assimilation surface formed by the leaves was 5098.7 cm^2, and in the 13th option, the assimilation surface formed by the leaves was 4780.8 cm^2, in the 14th option and it was determined that the assimilation surface formed by the leaves was 4906.2 cm^2.

The results of plant height are given in **Table 2**.

According to the information given in the table, on May 15, the height of the plant in our control variant was 7.3 cm. The remaining options were as follows. 7.8 cm in option 1, 7.4 cm in option 2, 7.5 cm in option 3, 7.6 cm in option 4, 7.9 cm in option 5, 7.7 cm in option 6, in option 7 7.3 cm, in option 8 8.1 cm, in option 9 7.5 cm, in option 10 7.8 cm, in option 11 7.6 cm, in option 12 8.2 cm, in option 13 7.9 cm, in the 14th option it was 7.7 cm.

On May 30, our plants grew 19.9 cm in the control option, 20.6 cm in option 1, 20.2 cm in option 2, 20.4 cm in option 3, 20.3 cm in option 4, 21.5 cm in option 5, 21.6 cm in option 6, 19.9 cm in option 7, 20.9 cm in option 8, 20.2 cm in option 9, 20.9 cm in option 10, 20.4 cm in option 11, It was 21.5 cm in the 12th variant, 20.8 cm in the 13th variant, 20.6 cm in the 14th variant.

On June 15, our plants grew 26.9 cm in the control option, 28.4 cm in option 1, 27.1 cm in option 2, 28.2 cm in option 3, 27.2 cm in option 4, 28.6 cm in option 5, 28.4 cm in option 6, 27.7 cm in option 7, 28.5 cm in option 8, 27.4 cm in option 9, 28.8 cm in option 10, 27.1 cm in option 11, 28.9 cm in the 12th variant, 27.6 cm in the 13th variant, 27.5 cm in the 14th variant.

Table 2. The effect of microelements on the formation of the plant height of cotton.

Options	plant height	plant height	plant height	plant height	plant height	plant height
	15.05	30.05	15.06	30.06	15.07	30.07
Contraol option	7.3	19.9	26.9	48.7	63.8	80.7
$N_{200}P_{140}K_{100} + B_{0.02\%}$	7.8	20.6	28.4	51.4	68.7	86.1
$N_{200}P_{140}K_{100} + B_{0.05\%}$	7.4	20.2	27.1	49.3	65.6	81.2
$N_{200}P_{140}K_{100} + Zn_{0.02\%}$	7.5	20.4	28.2	50.5	68.6	84.7
$N_{200}P_{140}K_{100} + Zn_{0.05\%}$	7.6	20.3	27.2	49.1	66.4	82.2
$N_{200}P_{140}K_{100}$ + KUPRUMXIT + NANOSEREBRO	7.9	21.5	28.6	54.3	72.3	87.4
$N_{200}P_{140}K_{100}$ + PMK XZ-Co^{2+}	7.7	21.6	28.4	49.6	69.9	85.1
$N_{200}P_{140}K_{100}$ + KUPRUMXIT	7.3	19.9	27.7	48.7	64.7	80.6
$N_{250}P_{175}K_{125} + B_{0.02\%}$	8.1	20.9	28.5	51.6	69.7	87.7
$N_{250}P_{175}K_{125} + B_{0.05\%}$	7.5	20.2	27.4	49.4	66.8	82.4
$N_{250}P_{175}K_{125} + Zn_{0.02\%}$	7.8	20.9	28.8	50.4	69.6	88.4
$N_{250}P_{175}K_{125} + Zn_{0.05\%}$	7.6	20.4	27.1	49.2	68.5	84.6
$N_{250}P_{175}K_{125}$ + KUPRUMXIT + NANOSEREBRO	8.2	21.5	28.9	50.8	73.4	94.1
$N_{200}P_{175}K_{125}$ + PMK XZ-Co^{2+}	7.9	20.8	27.6	49.9	70.8	89.2
$N_{250}P_{175}K_{125}$ + KUPRUMXIT	7.7	20.6	27.5	49.4	71.1	91.9

On June 30, our plants were 48.7 cm in the control option, 51.4 cm in option 1, 49.3 cm in option 2, 50.5 cm in option 3, 49.1 cm in option 4, 54.3 cm in option 5, 49.6 cm in option 6, 48.7 cm in option 7, 51.6 cm in option 8, 49.4 cm in option 9, 50.4 cm in option 10, 49.2 cm in option 11, 50.8 cm in the 12th variant, 49.9 cm in the 13th variant, 49.4 cm in the 14th variant.

On July 15, our plants grew 63.8 cm in the control option, 68.7 cm in option 1, 65.6 cm in option 2, 68.6 cm in option 3, 66.4 cm in option 4, 72.3 cm in option 5., 69.9 cm in option 6, 64.7 cm in option 7, 69.7 cm in option 8, 66.8 cm in option 9, 69.6 cm in option 10, 68.5 in option 11 cm, 73.4 cm in the 12th variant, 70.8 cm in the 13th variant, 71.1 cm in the 14th variant.

On July 30, 80.7 cm in the control option, 86.1 cm in option 1, 81.2 cm in option 2, 84.7 cm in option 3, 82.2 cm in option 4, 87.4 cm in option 5, 85.1 cm in option 6, 80.6 cm in option 7, 87.7 cm in option 8, 82.4 cm in option 9, 88.4 cm in option 10, 84.6 cm in option 11, 94.1 cm in the 12th version, 89.2 cm in the 13th version, 91.9 cm in the 14th version.

From the data presented in Table 3, it was found that the productivity of our control option was equal to 41.6 s. On the other hand, the best result was recorded in our version $N_{250}P_{175}K_{125}$ + KUPRUMHITE + NANOSEREBRO, the yield was 47.2 centner and 123.91 centner more than the control version. Also, in our $N_{200}P_{140}K_{100}$ + CUPRUMHITE + NANOCEREBRO option, the yield was 45.4 quintals and the yield was found to be 117.11% higher than our control option.

Table 3. Effect of micronutrients on the productivity of cotton.

Options	Productivity kg\ha	Additional crop	
	Total	s/ga	%
Control option	38.9	-	100.00
$N_{200}P_{140}K_{100} + B_{0.05\%}$	39.5	0.6	101.54
$N_{200}P_{140}K_{100} + B_{0.02\%}$	39.7	0.8	102.05
$N_{200}P_{140}K_{100} + Zn_{0.05\%}$	41.0	2.1	105.39
$N_{200}P_{140}K_{100} + Zn_{0.02\%}$	39.8	0.9	102.31
$N_{200}P_{140}K_{100}$ + KUPRUMXIT + NANOSEREBRO	43.1	4.2	110.79
$N_{200}P_{140}K_{100}$ + PMK XZ-Co^{2+}	42.7	3.8	109.76
$N_{200}P_{140}K_{100}$ + KUPRUMXIT	40.2	1.3	113.16
$N_{250}P_{175}K_{125} + B_{0.05\%}$	40.4	1.5	103.85
$N_{250}P_{175}K_{125} + B_{0.02\%}$	44.2	5.3	113.62
$N_{250}P_{175}K_{125} + Zn_{0.05\%}$	43.7	4.8	112.33
$N_{250}P_{175}K_{125} + Zn_{0.02\%}$	41.8	2.9	107.45
$N_{250}P_{175}K_{125}$ + KUPRUMXIT + NANOSEREBRO	45.6	6.5	117.22
$N_{200}P_{175}K_{125}$ + PMK XZ-Co^{2+}	42.3	3.4	108.74
$N_{250}P_{175}K_{125}$ + KUPRUMXIT	42.6	3.7	109.51

4. Conclusions

1) The agriculture field is facing the challenges of nutrient deficiency, crop yield reduction, weakening the soil organic matter, and low water availability as the result of poor nutrients use efficiencies.

2) However, the application of different nano-fertilizers has a greater role in improving nutrients use efficiency (NUE), enhancing the crop yield, reducing the environmental pollution hazard and the fertilization cost for crop production.

3) Thus, the optimization of nano-fertilizer dose is prime important to improve nutrients use efficiency in different crops.

4) In our version $N_{200}P_{140}K_{100}$ + KUPRUMHITE + NANOCEREBRO, it was determined that the leaf surface was 4779.2 cm^2.

5) It was observed that plant height increased rapidly with $N_{200}P_{140}K_{100}$kg/day nitrogen fertilizers, and fertilization had little effect on plant height increase.

6) It was determined that the most favorable nitrogen rate for cotton grown in the conditions of Samarkand region was 200 kg per hectare, and plant height was from 80.7 to 94.1 cm.

7) The best result was observed in our variant $N_{200}P_{140}K_{100}$ + kuprumhite + nanoserebro and the yield was equal to 45.4 centner.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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