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Issue Article

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INFLUENCE OF FOLIAR FERTILIZERS ON THE FORMATION OF FRUITING BRANCHES IN COTTON

Abstract: *The article presents the results of studying the effect of foliar fertilizers Uzbiogumin, PK-Maks, and Kaliy-450, used individually and in combination, on the formation of fruiting branches in cotton varieties "Bukhara-8" and "Marvarid". It was established that the most stable increase in the number of fruiting branches was provided by the combined application of PK-Maks 3.0 l/ha + Kaliy-450 2.5 l/ha + Uzbiogumin 0.5 l/ha.*

Key words: *cotton, fruiting branches, foliar feeding, Uzbiogumin, PK-Maks, Kaliy-450, variety, growth and development.*

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Introduction

Currently, under the soil and climatic conditions of the Republic of Uzbekistan, research is being conducted on the cultivation of cotton using foliar fertilization, various biostimulants and physiologically active substances alongside conventional mineral fertilization practices. These preparations are of considerable importance because they can stimulate physiological and biochemical processes in plants, promote root system development, improve the formation of vegetative and reproductive organs, and enhance plant tolerance to adverse environmental conditions (Sh.Abdualimov, F.Abdullaev, 2010, Sh.Abdualimov et al., 2010).

The use of physiologically active substances and plant growth regulators is an important approach to improving seed germination and germination vigor, promoting plant growth and development throughout the growing season, and enhancing tolerance to drought, salinity, diseases, and insect pests (Davronov Q., Tuxtashev F., 2022).

Furthermore, physiologically active plant growth regulators can influence various physiological processes within plants, potentially improving photosynthetic efficiency, nutrient metabolism, and the formation of reproductive organs. The foliar application of these preparations in the form of working solutions may contribute to the development of higher yields and improved crop quality. (Sh.Abdualimov et al., 2010).

Upland cotton (*G.hirsutum* L.) is one of the most important fiber crops, playing a vital role in supplying raw materials to the global textile industry. This cotton species is characterized by its high yield potential, adaptability to diverse soil and climatic conditions, and the wide range of applications of its fiber. However, in recent years, global climate change, increasing weather variability, and adverse environmental factors have negatively affected cotton production, leading to impaired formation of yield components and a decline in fiber quality (Ahmed et al., 2024; Chorshanbiev et al., 2025).

At the same time, the development and improvement of Pima cotton (*G.barbadense* L.) varieties that are resistant to adverse environmental conditions are of considerable importance for expanding opportunities for the production of high-quality cotton fiber. This cotton species is distinguished by its superior fiber properties, including fiber length, fineness, strength, and uniformity. These characteristics make Pima cotton fiber a valuable raw material for manufacturing high-

quality yarns and premium textile products. Furthermore, investigating the valuable agronomic traits and biological characteristics of *G.barbadense* L. varieties, evaluating their responses under diverse soil and climatic conditions, and identifying genotypes with enhanced tolerance to stress factors are of considerable practical importance. Such studies can contribute to increasing the production of high-quality cotton fiber, improving the efficiency of cotton cultivation, and ensuring the sustainability of cotton production under changing climatic conditions (Amanov et al., 2020; Chorshanbiev et al., 2021; Avliyoqulov and Durdiev, 2021).

The formation of fruiting branches is one of the most important morphobiological indicators characterizing the transition of cotton to generative development. The formation of buds, flowers, and bolls, and consequently the realization of the potential productivity of plants, largely depends on the quantity and rate of formation of fruiting branches. In intensive agriculture, regulating cotton nutrition during critical growth phases is of particular importance, when the root system is not always able to fully meet the demand of above-ground organs for available nutrients.

Foliar feeding allows for the prompt correction of the mineral and physiological state of plants. Their effectiveness is determined by the composition of the preparation, application rate, crop development phase, weather conditions, and varietal characteristics. Therefore, when evaluating biostimulants and complex fertilizer preparations, it is important to consider not only the final yield, but also changes in individual elements of plant architectonics, including fruiting branches.

The purpose of the study was to determine the effect of Uzbiogumin, PK-Maks, and Kaliy-450, applied separately and in combination, on the dynamics of fruiting branch formation in cotton varieties "Bukhara-8" and "Marvarid" under field experiment conditions in 2023.

Materials and Research Methods

Field observations were carried out in 2023 on crops of two cotton varieties: "Bukhara-8" and "Marvarid". The experimental design included control variants without foliar feeding, variants with Uzbiogumin at rates of 0.3 and 0.5 l/ha, combinations of PK-Maks and Kaliy-450 at two application rate levels, and three-component combinations of these preparations. The evaluation was carried out at the same calendar dates for both varieties.

The number of fruiting branches was determined per single plant on July 1, August 1, and September 1. The analysis took into account the absolute value of the indicator, the increase relative to the corresponding varietal control, the relative change in percentage, and the dynamics between recording dates. Comparing the variants made it possible to evaluate both the effect of individual preparations and the possible effect of their combined application.



Plant height - 90-120 cm, not inclined to lie down.
Growing period – 120-125 days
The first fruit branches appear in 5-7 nodes.
Boll weight – 9.0-11.0 g
1000-seed weight – 125-130 g
Fiber belongs to type - IV
Fiber output – 35.0-36.0 %
Fiber length – 33-34 mm
Micronaire-4.3-4.5
Developed by A.M. Battalov and others. The variety is mid-ripening, and was included in the State Register in 2007.

Figure 1. Medium fiber cotton cultivar Bukhara-8



Plant height – 90-100 cm,
a branching type 0, growing period – 117-120 days, the number of branches in the main stem – 22, between of branches – 4.0 sm, cotton weight in one boll – 3.5-4.0 g, weight of 1000 seeds – 115-120 g, fiber output – 35-36 %, fiber index – 6.6 g, fiber length – 38 mm, productivity per plant -56,0 g and higher, micronеr-3,8-4,0, strength -48.8.
Developed by N.E. Chorshanbev and others. The cultivar is fast-ripening, and was included in the State Register in 2018.

Figure 2. Fine fiber cotton cultivar Marvarid.

Research Results and Discussion

By the first recording date, foliar feeding had already caused a noticeable differentiation of variants. In the "Bukhara-8" variety, 7.2 fruiting branches per plant were formed in the control. The application of Uzbiogumin at 0.3 l/ha increased this indicator to 7.5, and at 0.5 l/ha to 7.7 pcs/plant, which exceeded the control by 4.2% and 6.9%, respectively. With the combination of PK-Maks 3.0 l/ha and Kaliy-450 2.5 l/ha, the indicator was 7.6 pcs/plant, and an increase in the rates of these preparations to 6.0 and 5.0 l/ha was accompanied by an increase to 7.9 pcs/plant.

The most pronounced effect at the beginning of July was obtained with three-component application. In the variant with PK-Maks 3.0 l/ha + Kaliy-450 2.5 l/ha + Uzbiogumin 0.3 l/ha, 8.1 fruiting branches were formed, while with an increase in the Uzbiogumin rate to 0.5 l/ha, it was 8.4 pcs/plant. The latter value exceeded the control by 1.2 pcs/plant, or 16.7%. At higher rates of PK-Maks and Kaliy-450, the indicators were 8.2–8.3 pcs/plant. Consequently, the maximum rate of the complex did not automatically ensure a further increase in the number of fruiting branches.

Table 1. Influence of foliar fertilizers on the formation of cotton fruiting branches, 2023

No	Variety	Preparation and single rate	July 1, pcs/plant	August 1, pcs/plant	September 1, pcs/plant
1	Bukhara-8	Control	7.2	12.6	14.3
2	Bukhara-8	Uzbiogumin 0.3 l/ha	7.5	13.1	14.9
3	Bukhara-8	Uzbiogumin 0.5 l/ha	7.7	13.5	15.4
4	Bukhara-8	PK-Maks 3.0 + Kaliy-450 2.5 l/ha	7.6	13.4	15.2
5	Bukhara-8	PK-Maks 6.0 + Kaliy-450 5.0 l/ha	7.9	13.8	15.7
6	Bukhara-8	PK-Maks 3.0 + Kaliy-450 2.5 + Uzbiogumin 0.3 l/ha	8.1	14.3	16.3
7	Bukhara-8	PK-Maks 3.0 + Kaliy-450 2.5 + Uzbiogumin 0.5 l/ha	8.4	14.9	17.0
8	Bukhara-8	PK-Maks 6.0 + Kaliy-450 5.0 + Uzbiogumin 0.3 l/ha	8.2	14.6	16.6
9	Bukhara-8	PK-Maks 6.0 + Kaliy-450 5.0 + Uzbiogumin 0.5 l/ha	8.3	14.7	16.8
10	Marvarid	Control	6.9	12.4	14.2
11	Marvarid	Uzbiogumin 0.3 l/ha	7.2	12.9	14.8
12	Marvarid	Uzbiogumin 0.5 l/ha	7.4	13.3	15.3
13	Marvarid	PK-Maks 3.0 + Kaliy-450 2.5 l/ha	7.3	13.2	15.1
14	Marvarid	PK-Maks 6.0 + Kaliy-450 5.0 l/ha	7.6	13.6	15.6
15	Marvarid	PK-Maks 3.0 + Kaliy-450 2.5 + Uzbiogumin 0.3 l/ha	7.8	14.1	16.2
16	Marvarid	PK-Maks 3.0 + Kaliy-450 2.5 + Uzbiogumin 0.5 l/ha	8.1	14.7	16.9
17	Marvarid	PK-Maks 6.0 + Kaliy-450 5.0 + Uzbiogumin 0.3 l/ha	7.9	14.4	16.5

18	Marvarid	PK-Maks 6.0 + Kaliy-450 5.0 + Uzbiogumin 0.5 l/ha	8.0	14.5	16.7

For the "Marvarid" variety, the pattern was similar. In the control, there were 6.9 fruiting branches per plant. Against the background of Uzbiogumin 0.3 and 0.5 l/ha, the indicator reached 7.2 and 7.4 pcs/plant, respectively. Among the two-component combinations, the higher rate of PK-Maks + Kaliy-450 provided 7.6 pcs/plant. The highest result—8.1 pcs/plant—was noted in the variant with PK-Maks 3.0 l/ha + Kaliy-450 2.5 l/ha + Uzbiogumin 0.5 l/ha, which exceeded the control by 17.4%.

By August 1, the number of fruiting branches increased significantly in all variants. In the "Bukhara-8" variety, the control indicator was 12.6 pcs/plant, and with the application of Uzbiogumin it was 13.1–13.5 pcs/plant. In the variant with PK-Maks 3.0 + Kaliy-450 2.5 + Uzbiogumin 0.5 l/ha, 14.9 pcs/plant were formed, which was 2.3 pcs/plant, or 18.3%, higher than the control. In variants with increased rates of PK-Maks and Kaliy-450 and the addition of Uzbiogumin, 14.6–14.7 pcs/plant were obtained, which is slightly less than in the optimal combination.

For the "Marvarid" variety on August 1, the control was 12.4 pcs/plant. In the three-component variants, 14.1–14.7 pcs/plant were formed, with the highest value again obtained with the combination of PK-Maks 3.0 l/ha + Kaliy-450 2.5 l/ha + Uzbiogumin 0.5 l/ha. The excess over the control was 2.3 pcs/plant, or 18.5%. Thus, the advantage of the optimal combination of preparations persisted during the period of active formation of the generative part of the plant.

The recording results of September 1 confirmed the stability of the identified trend. In "Bukhara-8", 14.3 fruiting branches per plant were formed in the control. Uzbiogumin at a rate of 0.3 l/ha provided 14.9, and at 0.5 l/ha—15.4 pcs/plant. In the variant with PK-Maks 3.0 + Kaliy-450 2.5 + Uzbiogumin 0.5 l/ha, the indicator reached 17.0 pcs/plant, i.e., it was higher than the control by 2.7 pcs/plant, or 18.9%. In variants with increased rates of the three components, the values were 16.6 and 16.8 pcs/plant.

For "Marvarid" in the control variant by September 1, 14.2 fruiting branches were noted. Against the background of Uzbiogumin, the indicator increased to 14.8–15.3 pcs/plant, and in two-component variants—to 15.1–15.6 pcs/plant. The maximum of 16.9 pcs/plant was registered with PK-Maks 3.0 + Kaliy-450 2.5 + Uzbiogumin 0.5 l/ha. The excess of the control was 2.7 pcs/plant, or 19.0%. Increasing the rates of PK-Maks and Kaliy-450 in the presence of Uzbiogumin did not give an additional advantage: 16.5–16.7 pcs/plant were formed in the corresponding variants.

An analysis of the dynamics shows that the main increase in the number of fruiting branches occurred in the period from July 1 to August 1. In the control of "Bukhara-8", the growth was 5.4 pcs/plant, and in the best variant—6.5 pcs/plant. For "Marvarid", the corresponding values were 5.5 and 6.6 pcs/plant. From August 1 to September 1, the growth was smaller, but the optimal three-component variants retained their advantage: 2.1 pcs/plant for "Bukhara-8" and 2.2 pcs/plant for "Marvarid". This indicates a more intensive and prolonged formation of generative organs with a balanced combination of preparations.

When comparing varieties, the absolute values for "Bukhara-8" in most similar variants were 0.1–0.3 pcs/plant higher than for "Marvarid". At the same time, the relative reaction to complex feeding was comparable. By September 1, the advantage of the best variant over the control was 18.9% for "Bukhara-8" and 19.0% for "Marvarid". Consequently, differences in the initial morphological vigor of the varieties did not change the general nature of the response to foliar nutrition.

In general, all variants with the use of preparations exceeded the corresponding varietal controls. At the same time, an increase in the dose of each component separately was usually accompanied by an increase in the indicator, however, in the three-component system, the maximum rates were not the most effective. The most stable effect at all recording dates was provided by the combination of PK-Maks 3.0 l/ha + Kaliy-450 2.5 l/ha + Uzbiogumin 0.5 l/ha. Probably, such a combination created a more favorable ratio of nutrients and biologically active substances during the period of initiation and growth of fruiting branches.

Conclusion

Observations carried out in 2023 showed that the use of foliar fertilizers Uzbiogumin, PK-Maks, and Kaliy-450 positively affected the formation of fruiting branches in both studied cotton varieties. At all recording dates, the number of fruiting branches in the treated variants exceeded the control. The most pronounced advantage was noted with the combined application of PK-Maks 3.0 l/ha + Kaliy-450 2.5 l/ha + Uzbiogumin 0.5 l/ha: in the "Bukhara-8" variety on September 1, 17.0 pcs/plant were formed versus 14.3 in the control, and in the "Marvarid" variety—16.9 versus 14.2 pcs/plant. The relative increase was 18.9% and 19.0%, respectively.

Comparison of rates showed that a further increase in the doses of PK-Maks and Kaliy-450 in three-component variants did not provide an additional increase in the number of fruiting branches. This allows us to consider the combination of PK-Maks 3.0 l/ha + Kaliy-450 2.5 l/ha + Uzbiogumin 0.5 l/ha as the most promising among the studied variants from the standpoint of forming the generative structure of plants. The obtained results should be

taken into account in further comprehensive analysis of bud and boll formation, yield, and economic efficiency of cotton foliar feeding.

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