

Article

# The Dependence of Cotton Yield on Plant Density When Grown Under Film

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**Abstract:** In the second period from March 15 to 25, the seeds of cotton variety UzPITI-201 when sown under transparent film with a plant density of an average of 95.5 and 155.4 thousand plants / ha and at mineral fertilizer rates of N 180 P 125 K 90 kg / ha with optimal irrigation of 70-75-60% compared to HB compared to the control options (8-9-10 options) sowing seeds in the usual open way with two-row and single-row planting were provided with nutrients at a higher level and had the property of longer retention of soil moisture and due to favorable soil conditions under transparent film, an additional yield of 7.2 and 9.3 c / ha was obtained.

**Keywords:** Cotton, Double-Row Sowing, Single-Row Sowing, Black Film, Mulching, Transparent Film, Irrigation Timing, Norm, Yield.

## Introduction

Globally, the profitability of cotton cultivation has remained unchanged in recent years. This is negatively impacted by global climate change, the lack of agricultural technologies to combat resource shortages, environmental stress on cotton production, excessive rainfall during planting, rising temperatures during flowering, declining soil fertility, and an increase in pest and disease populations. Therefore, it is necessary to conduct research to improve resource efficiency in cotton production and introduce innovative resource-saving technologies into the cotton industry [1].

In the conditions of the Republic of Karakalpakstan, when growing cotton of the Chimboy-5018 variety using the single-row method with a plant density of 90-100 thousand plants/ha, the weight of cotton in one boll was 6.3-5.4 g, and for the S-4724 variety - 5.7-5.1 g. With an increase in the plant density to 110-120 thousand plants/ha, for the Chimboy-5018 variety this figure was 6.1 g, and for the S-4724 variety - 5.5-4.9 g. It was established that with an increase in plant density, a decrease in the weight of cotton in one boll is observed [2].

In the conditions of weak saline meadow-marsh soils of the Fergana region, it is recommended to plant the cotton varieties "Andizhan-36" and "Sultan" after winter wheat and soybeans, leaving 90-95 thousand seedlings per hectare, apply fertilizers in the amount of N-150, P<sub>2</sub>O<sub>5</sub>-105, K<sub>2</sub>O-75 kg / ha for the cotton variety "Andizhan-36" and carry out irrigation in the order of 65-70-60% of the total amount of nitrogen according to the system 0-3-1 (4 times), and for the cotton variety "Sultan" apply fertilizers in the amount of N-150, P<sub>2</sub>O<sub>5</sub>-105, K<sub>2</sub>O-75 kg / ha and carry out irrigation in the order of 70-75-60% of the total amount of nitrogen according to the system 1-3-1 (5 times) [3].

Cotton crop formation and other processes varied depending on the rate and timing of nitrogen fertilizer application. Experiments revealed that the optimal method is to apply 200 kg/ha of nitrogen fertilizer in divided doses throughout the growing season, or to apply 50% of the fertilizer before sowing and 50% during the growing season. Increasing the fertilizer rate also slows down the maturation of the cotton crop [4].

According to the results of research conducted at the Andijan branch of UzPITI on light sierozem soils, it was established that the length of the internodes in the cotton varieties "Andijon-36" and "Okdaryo-6" changed depending on the irrigation regime and fertilizer application rates. When maintaining soil moisture at a level of 65–65–60% of the maximum permissible soil moisture content and applying mineral fertilizers at a rate of N–150, P–105, K–75 kg/ha, the length of fruit internodes in the Andijon-36 variety was 1.5–2.2 cm shorter compared to the Okdaryo-6 variety and was 15.9–16.2 cm. With an increase in fertilizer rates to N–250, P–175, K–125 kg/ha, the length of fruit internodes increased by 0.8 cm compared to the Okdaryo-6 variety, while some slowdown in plant development was observed [5].

The cotton yield is 3.9 centners for the Okkorgon-2 variety, 2.4 centners for the Akdaryo-6 variety, 110-120 thousand bushels for the Akkorgon-2 variety, with a yield of 80-90 thousand bushels per hectare, compared to the variants with 65-65-60% irrigation and soil moisture of 70-70-60% ChDNS. 1.7 t/ha for the Akkorgon-2 variety in the variant with leaving seedlings per bush/ ha. The yield of the Okdaryo-6 variety increased by 2.3 c/ha. In the experiment, the highest cotton yield was achieved for both varieties, where the soil moisture was 70-70-60%, and 80-90 thousand seedlings were left per hectare. The Okkurgan-2 variety yielded 45.7 centners of cotton per hectare, while the Okdaryo-6 variety yielded 42.1 centners per hectare. The lowest yields were observed in varieties where irrigation was 65-65-60%, and 110-120 thousand seedlings were left per hectare [6].

## Materials and Methods

Field experiments were conducted in the fields of the Andijan Experimental Station of the Research Institute of Selection, Breeding and Agrotechnologies of Cotton Cultivation, located in the Asaka district of the Andijan region.

The experiment included two different sowing dates: March 5-15 and March 15-25, in addition, sowing seeds in double-row rows, in one row, in open ground, under black film, under transparent film, two different plant densities (90-100; 150-160 thousand/ha), the experiments were conducted on the cotton variety UzPITI-201, fertilizers were applied at the rate of N<sub>200</sub> P<sub>140</sub> K<sub>100</sub> and N<sub>180</sub> P<sub>125</sub> K<sub>90</sub> kg/ha, respectively, according to different options. Field experiments included 14 options, located in 3 replicates, and the options were located in 1 tier.

Scientific research was carried out on the basis of the "Methodology for conducting field agrotechnical experiments with oil crops", "Methodology for conducting field experiments" and phenological observations were carried out according to the "Methodology of state varietal nutrition of agricultural crops", soil permeability was determined at the beginning and at the end of the growing season of cotton for 6 hours in each variant according to the methods of S.I. Dolgov and S.N. Ryzhov, humus in the soil according to the Tyurin method, total nitrogen, total phosphorus according to the method of Maltseva, Gritsenko, nutrients in mobile form in the soil, nitrate nitrogen according to the colorimetric method of Granwald-Lyaju, mobile phosphorus according to the Machigin method, exchangeable potassium according to the Protasov method, statistical processing of the results was carried out by the method of B.A. Dospekhov [7].

## Results and discussion

In scientific research experiments, UzPITI-201 cotton seeds were planted on March 8, according to the first sowing date. Observations 7 days after sowing revealed that in control variants 1-3, where seeds were sown in open double- and single-row beds, 7.3-10.2% of seeds germinated, which was due

to the extremely low air and soil temperatures on the aforementioned days. Even under difficult soil and weather conditions on these days, in double- and single-row beds, under transparent film (variants 11-14), even at low air temperatures, due to the effective exposure of sunlight passing through the film, seedling germination occurred twice as much as in the control variant: up to 15.1 and 16.3; 13.8 and 13.0%, respectively.

The same pattern of seed germination was maintained in subsequent observations. On March 25, seed germination rates in double- and single-row beds under transparent film were 88.6% and 89.3%, 82.2% and 83.7%, respectively. On March 27, it was found that 100% of the seeds had germinated within 17 days. In variants 1-3, where seeds were sown using the conventional open method in double- and single-row beds, due to the aforementioned extremely low air and soil temperatures on these days, seed germination rates were 51.3-57.5%, with germination continuing until April 1-3 [8], [9].

Each agricultural measure used in the experiment had a specific effect on the seedling density of the UzPITI-201 cotton variety. Based on the results of a 3-year study, it was revealed that UzPITI-201 cotton seeds planted between March 5th and 15th in variants 1-7 were severely damaged during germination, under unstable weather conditions, low soil temperatures, and high humidity. As a result, the number of seedlings decreased by 15-25% compared to the theoretical number. Especially in variants 1-3 with planting in open beds, the average seedling density over 3 years was 74.0, 124.2, and 75.3 thousand plants/ha, and compared to the theoretical number of seedlings, the decrease was 20-23%. In 4-7 variants with planting seeds under transparent film in two-row and single-row beds, the positive effect of the film is on average 84.3/ha; 133.6; 82.7; Although it amounted to 130.7 thousand plants, it was found that it decreased by 12-15% compared to the theoretical number of seedlings [10].

During the study, at the initial stage of growth and development of the UzPITI-201 cotton variety, plant growth and development accelerated only due to the positive influence of resource-saving technology, year-on-year improvement in soil density and porosity in the above-mentioned beds, enrichment of the soil composition with nutrients, and other factors.



**Figure 1.** The impact of resource-saving technologies on the growth and development of the cotton variety UzPITI-20, average over 3 years.

In particular, the patterns of seed germination in the experimental years were noted during the first observation of growth and development on June 1. In the 2nd planting period, from March 15 to 25, the seeds were sown under a transparent film in a two-row method, they germinated early and abundantly, on average 95.5 and 155.4 thousand seedlings per hectare were preserved, in the 11-12

variants with a reduction in mineral fertilizers by 10-15%  $N_{180} P_{125} K_{90}$  kg / ha compared to the annual rate of fertilizer application of plants planted in a two-row method in open ground 91.3-145.5 thousand plants / ha were preserved; In variants 8-9-10 with the use of mineral fertilizers  $N_{200} P_{140} K_{100}$  kg/ha, compared to the plants of the control variant, growth was on average 2.4 and 2.1 cm higher and amounted to 22.5 and 21.8 cm. In accordance with this, 4.4 and 3.2 pieces of fruit branches, 4.5 and 4.3 pieces of buds were formed [11], [12].

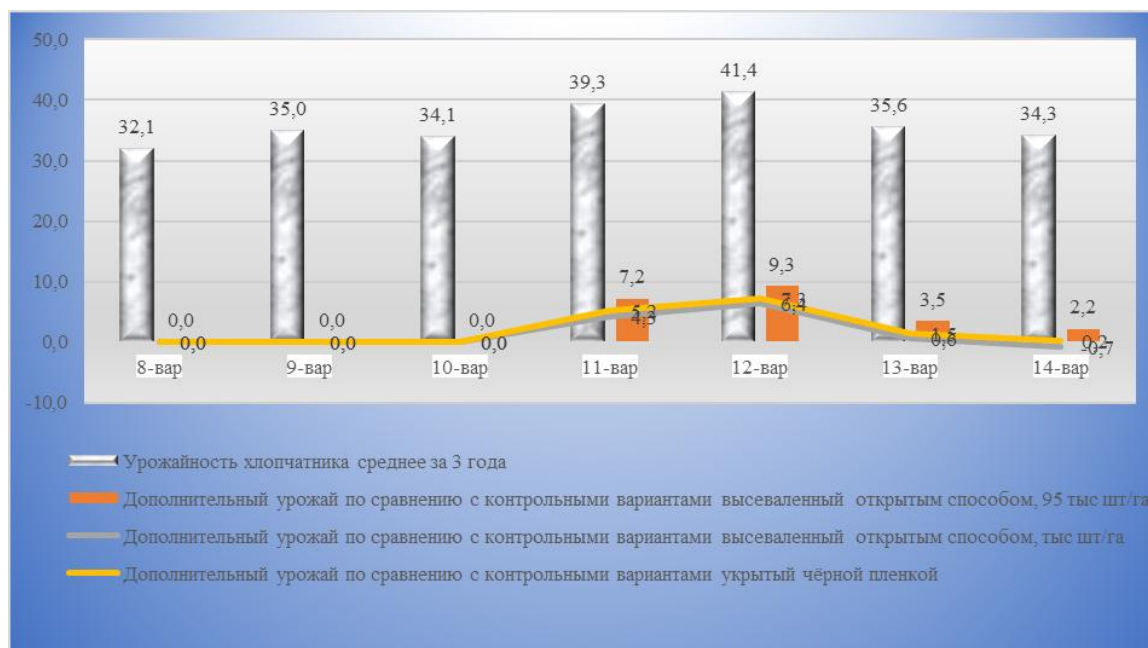
Also, when sowing seeds under a transparent film in a single-row method, with early and strong germination, an average of 92.2 and 153.7 thousand seedlings per hectare were preserved, and in variants 13-14 with an annual rate of  $N_{180} P_{125} K_{90}$  kg / ha, enriched with nutrients due to the positive effect of the film compared to plants of the control variants (variants 8-9-10), where seeds were sown in open ground in a two-row method and mineral fertilizers were applied at a rate of  $N_{200} P_{140} K_{100}$  kg / ha, the plants grew on average by 2.8 and 1.1 cm higher and amounted to 22.9 and 21.0 cm.

In accordance with this, 3.7 and 3.1 pieces of fruit branches, 3.9 and 3.2 pieces of buds were formed (Figure 1 ).

Due to unstable low weather and soil temperatures, high soil moisture, and other adverse factors, seedling emergence in variants 1-7 of the UzPITI-201 cotton variety planted during the first early sowing period (March 5-15) yielded 20-25% of seedlings compared to the second sowing period. Thinning was recommended. Therefore, these variants, compared to the second sowing period (March 15-25), yielded lower results in terms of boll growth and cotton harvest maturation.

During the second planting period, March 15-25, especially in variants 11-14, sown under film in two-row and single-row beds, the number of bolls increased depending on the plant density [13]. For example, in variants 11-12, when sowing UzPITI-201 cotton seeds in two rows under film with the application of mineral fertilizers at the rate of  $N_{180} P_{125} K_{90}$  kg/ha, and cotton was watered in the optimal order of 70-75-60% compared to the maximum field moisture capacity, the average number of plants over 3 years was 95.5 and 155.4 thousand plants/ha, respectively, the average number of bolls per plant was 9.0 pcs. in the thinned 11-variant, 7.2 pieces, in the thickened 12-variant, 0.5 and 0.6 pieces more were formed per hectare than the control variants used at the rates of  $N_{200} P_{140} K_{100}$  kg/ha.

In the 12-variant, which had a relatively small number of capsules, an acceleration of the rate of capsule opening by 25-30% was observed compared to the 11-variant, where the number of plants was thinned out, and compared to its control variants, in which mineral fertilizers were used at  $N_{200} P_{140} K_{100}$  kg/ha per hectare. Also, depending on the number of plants in these variants, the weight of cotton formed in 1 boll varies, if the number of plants in the thinned 11-variant was 5.1 g, and in the densified 12-variant the number of plants decreased to 1.2 g and amounted to 3.9 g. In the second planting period from March 15 to 25, the seeds of the cotton variety UzPITI-201 were sown under a transparent film with a plant density of an average of 95.5 and 155.4 thousand plants / ha over 3 years, although the annual rate of mineral fertilizers was reduced by 10-15% to  $N_{180} P_{125} K_{90}$  kg / ha [14], [15]. The yield of cotton in 11-12 variants irrigated in the optimal mode of 70-75-60%, in relation to the maximum field moisture capacity, amounted to 39.3 and 41.4 c/ha, due to the improvement of soil temperature, humidity, bulk density, enrichment of the soil composition with nutrients and others. soil characteristics compared to the variant with plant density (91.3 thousand plants/ha variant 8) on average over 3 years 7.2 and 9.3 c/ha ; when sowing seeds in the usual open way 4.3 and 6.4 c/ha compared to the variant with plant density of 150 thousand plants/ha, where the seeds were sown in the usual open way at 5.2 and 7.3 c/ha more than in the control variant covered with black film, with plant density



**Figure 2.** The impact of resource-saving technologies on the yield of cotton variety UzPITI-201, on average over 3 years.

## Conclusion

With a two-row method of sowing cotton seeds under a transparent film, which is considered the main element of resource-saving technologies, the plant density of the UzPITI-201 cotton variety is 95.5 and 155.4 thousand plants / ha over 3 years, with a reduction in the annual rate of mineral fertilizers by 10-15% to N 180 P 125 K 90 kg per hectare and irrigation in the optimal order of 70-75-60 % compared to HB, the cotton yield in variants 11-12 was 39.3 and 41.4 c /ha. Compared with variant 8, where the seeds were sown in the usual open way at an average plant density of 91.3 thousand plants /ha, an increase in yield of 7.2 and 9.3 c/ha was grown over 3 years; compared with the variant with a plant density of 150 thousand plants /ha, where the seeds were sown in the usual open way at 4.3 and 6.4 c/ha; the increase in cotton yield compared to the control variant, covered with black film and with a plant density of 90.2 thousand units /ha was 5.2 and 7.3 c/ha.

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