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Issue Article

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STUDY OF ECONOMIC VALUABLE TRAITS IN MEDIUM FIBER COTTON LINES UNDER DIFFERENT WATER SUPPLY CONDITIONS

***Abstract**: The article presents the economic valuable characteristics of some of medium-fiber cotton samples under conditions of optimal water supply and with water deficiency. Under water stress, plant productivity in medium-fiber cotton lines decreased from 15.55 to 38.5% compared to the control (optimal water regime). Under these stress conditions, relatively high productivity and resistance were recorded in lines T-22, T-11, T-15 and T-7, which amounted to 76.2g., 69.8g., 66.3g., respectively. These lines can be used as starting material for drought tolerance selection of medium-fiber cotton. Under water stress, weight of boll and fiber output in medium-fiber cotton lines decreased to different degrees. In this case, fiber output in lines T-11, T-16 and T-3 was 37.1 - 38.2%.*

***Key words**: optimal water supply, water deficiency, water regime, trait, hybrid, line, variety, plant productivity.*

***Language**: English*

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Introduction

Currently, global warming and climate change pose a serious threat to the essential human and biological diversity (S.Abbas, 2020). Agriculture stands out among the sectors most vulnerable to climate change, as global climate change leads to reduced crop productivity and altered crop patterns (M.Rahman et al. 2018). Cotton fiber is mainly composed of cellulose and grows and thrives in conditions of abundant sunlight, frost-free conditions, and sufficient rainfall. According to FAO, global cotton production in 2019 was valued at approximately $46 billion and sales at $15 billion (FAO 2021). However, the cotton industry is highly vulnerable to climate change (Jans et al. 2021). Abiotic stresses, including drought, salinity, and temperature changes, affect cotton quality and yield (Bawa et al. 2022).

Cotton grown in warm and subtropical regions sows drought tolerance during the vegetative growth stage. However, drought during the reproductive stage has a significant impact on yield (Singh et.al., 2022). Therefore, it is necessary to study in more depth the plant responses to drought in order to create drought-resistant varieties. R.Y.Alikulov (1992) found that the different sensitivity of cotton varieties to water deficit depends on their biological characteristics, and that a lack of moisture in the soil slows down the growth of the main stem. N.A.Saakova (2000) studied medium-fiber cotton varieties and hybrids under different water regimes. According to their results, all valuable economic traits changed to different degrees under water deficit conditions, that is, genotypes showed different sensitivity to drought in terms of these traits. In particular, it was found that under drought conditions, the traits of productivity, number of bolls, plant height and changed strongly, boll weight, 1000-seed weight, fiber index, number of seeds per boll changed moderately, and fiber yield, length of the growing season, and changed weakly.

In accordance with the Decree of the President of the Republic of Uzbekistan dated October 5, 2020 No. UP-6079 "On Approving the Strategy 'Digital Uzbekistan - 2030' and Measures for its Effective Implementation" and the Resolution No. PQ-4699 dated April 28, 2020 "On Measures for the Wide

Introduction of the Digital Economy and E-Government," as well as to increase the effectiveness of digital and geoinformation technologies in agriculture and water management, the Cabinet of Ministers' strategy includes important tasks for developing "Smart Agriculture" technologies, implementing digital and geoinformation technologies in agricultural land use, developing and monitoring digital technologies for water resource management and use through the application of modern computer technologies, and advancing scientific and technical activities [1;2].

Conditions and methods for experiments.

Our trial were conducted in the experimental field of the Zangiota Experimental Base of Institute of Genetics and Plant Experimental Biology of the Academy of Sciences of the Republic of Uzbekistan. New lines of medium-fiber cotton obtained on the basis of interspecific and intraspecific hybridization, F_3 families and seed materials of their parental forms were sown manually in the third decade of April in conditions of optimal water supply (irrigation scheme 1-2-1) and water deficit (irrigation scheme 1-1-0). Modeled drought was created by reducing the number of irrigations in the flowering and post-flowering stages of the plant growth period. The soil of the experimental field is a typical gray soil with a low humus content, previously irrigated. The groundwater is located deep (8.0 m and more). The limited field moisture capacity (LFMC) of the soil is 22%, and its volumetric weight is 1.32-1.33 g/cm^3. Except for the water regime, all other agrotechnical measures were the same for both trials.

We used as the object of research the new T-1, T-2, T-3, T-7, T-11, T-16, T-20, T-21 and T-22 lines of medium-fiber cotton of the species *G. hirsitum* L. and F_3 families obtained on the basis of inter varieties and lines hybridization within the species and their parental forms.

Results and discussion

Our analysis of the results obtained on plant productivity, the most important of the valuable economic characteristics of the cotton plant, i.e. the weight of cotton per plant, showed that, under optimal water supply conditions, the highest productivity of medium-fiber cotton among the lines studied in our research was in the T-7 line (101.06 g.), and the lowest productivity was in the T-3 line, which amounted to 82.23 g (Table 1).

Table 1. Plant productivity in medium-fiber cotton lines under different water supply conditions, g/plant

№	Lines	Origin of combinations	OF	SD	Cad %
1	L-1	(L-SA x Diyor) x (G.hir. x G.tomen)	86.19	56.08	-34.9
2	L-2	(Navbakhor x L-SA) x (G.hir. x G.tomen)	85.44	57.50	-32.7
3	L-3	(C-9082 x 3Б) x (*G.hir.* x *G.arb.)*	82.23	52.77	-35.8
4	L-7	C-9082 x 4B	101.06	65.50	-35.2
5	L-11	Barkhat	90.03	69.75	-22.5
6	L-15	Navbakhor	83.87	66.34	-20.9
7	L-16	C-9082 x C-9080	91.28	56.13	-38.5
8	L-20	(Nav. x AN-16) x (Ishonch x S-9082)	85.04	58.58	-31.1
9	L-21	L-1849	87.93	57.68	-34.4
10	L-22	Navbakhor-2 x S-9082	90.23	76.23	-15.5
$LSD_{0.05}$			4,18	5,07	

Note: OF - Optimum water regime, SD - simulated drought

Relatively high plant productivity indicators under water deficit conditions were recorded in the T-22, T-11, T-15 and T-7 lines (76.23g.; 69.75g.; 66.34g. and 65.50g., respectively), while the lowest indicator was recorded in the T-3 line, which was 52.77g. Our studies show that the T-22 (Navbakhor-2 x S-9082), T-11 (Barkhat), T-15 (Navbakhor) and T-7 (S-9082 x 4V) lines with relatively high plant productivity under water deficit conditions can be used as starting materials for drought tolerance selection of medium-fiber cotton.

In general, the range of variability in plant productivity in the medium-fiber cotton lines studied in our experiment was 82.23 - 101.06 g. under optimal water supply conditions, and 52.77 - 76.23 g. under water deficit conditions. This indicates that water stress led to a slight increase in the range of variability in plant productivity. It should be noted that under optimal agrotechnical conditions, including optimal water supply, it is difficult to determine the differences between plants, while water deficit allows us to distinguish genotypes of a variety or ridge population. According to the coefficient of adaptation (Cad %), the strongest sensitivity to water deficit in terms of plant productivity was found in the T-16 line (Cad. = -38.5%), while the weakest sensitivity was found in the T-22, T-15, and T-11 lines (Cad. = -15.5%; Cad. = -20.9%, and Cad. = -22.5%).

The weight of boll is one of the important components of plant productivity.

According to the results of this table, under optimal water supply conditions, the highest weight of boll was found in the T-7 line (5.1 g.), and the lowest indicators were in the T-22, T-3 and T-16 lines (4.5 g..4.6 g. and 4.7 g., respectively). Under conditions of soil water shortage, relatively high indicators of boll size were recorded in the T-1, T-15, T-2 and T-20 lines (respectively, 4.6 g.; 4.6 g.; 4.5 g. and 4.5 g.), and the lowest indicator was recorded in the T-3 line (4.2 g.).

Table 2. The weight of boll in medium-fiber cotton lines under different water supply conditions, g

№	Lines	Origin of combinations	OF	SD	Cad %
1	L-1	(L-SA x Diyor) x (G.hir. x G.tomen)	4.9	4.6	-6.1
2	L-2	(Navbakhor x L-SA) x (G.hir. x G.tomen)	4.8	4.5	-6.3
3	L-3	(C-9082 x 3Б) x (*G.hir.* x *G.arb.)*	4.6	4.2	-8.7
4	L-7	C-9082 x 4B	5.1	4.3	-15.7
5	L-11	Barkhat	5.0	4.4	-12.0
6	L-15	Navbakhor	4.8	4.6	-4.2
7	L-16	C-9082 x C-9080	4.7	4.4	-6.4
8	L-20	(Nav. x AN-16) x (Ishonch x S-9082)	5.0	4.5	-10.0
9	L-21	L-1849	5.0	4.3	-14.0
10	L-22	Navbakhor -2 x S-9082	4.5	4.4	-2.2
$LSD_{0.05}$			0,3	0,4	

Note: OF - Optimum water regime, SD - simulated drought

Analysis of the coefficient of adaptation (Cad.) indicators revealed that the strongest sensitivity to water deficit the weight of boll was found in the T-7 and T-21 lines (Cad.=15.75 and Cad.=-14.0%), while the weakest sensitivity was found in the T-22 line (Cad.= -2.2%).

Under optimal water supply conditions, the highest indicator of the trait was on the T-11 line, 40.7±0.8%, the lowest indicator was recorded on the T-1 line, 35.9±0.9%, on the T-7 line, 36.5±1.9%, and in the remaining lines, it was in the range of 37.2 - 39.1%.

Under water deficit conditions, fiber yield decreased to varying degrees in all cotton lines studied in our study compared to the control. The highest relative yield was observed in line T-11 (38.2%), while the lowest yield was recorded in line T-1 (33.1%), as was the case under optimal water conditions.

According to the analysis of the coefficient of adaptation (Cad.), the strongest sensitivity to water shortage of fiber yield was in the T- and T-2 lines, Cad.= 7.8% and Cad.= -6.9%, and the weakest sensitivity was in the T-22 line, Cad.= -1.6%.

The highest fiber index, i.e. the fiber weight per 100 seeds, was recorded in the T-11 line (9.0 g.) under optimal water conditions, and the lowest values were recorded in the T-16 and T-20 lines (respectively, 6.1 g. and 6.3 g.) (Table 3).

Water deficit condition to a decrease in the fiber index to varying degrees in all the lines of medium-fiber cotton studied in our experiment. Against the background of this stress, relatively high indicators of the indicator were in lines T-21, T-11 and T-2, which were 7.7g., 7.3g. and 7.1g. respectively, and the lowest indicators were in lines T-20 and T-16, which were respectively 5.5g. and 5.8g.

According to the analysis of the coefficient of adaptation (Cad.), the strongest sensitivity to water deficit in terms of the fiber index sign was in the T-11 and T-7 lines (respectively, Cad. = 18.9% and Cad. = -18.7%), and the weakest sensitivity was in the T-21 and T-16 lines, respectively Cad. = +4.1% and Cad. = -4.9%.

In our research in the medium-fiber cotton lines studied, the highest indicator of 1000-seed weight under optimal water regime was recorded in line T-11, which was 124.0 g, and the lowest indicator was in line T-16, which was 99.1 g (Table 4).

The lack of water in the soil in our experiment varying degree of decrease in the weight of 1000 seeds trait in many medium-fiber cotton lines. At the same time, the relatively highest indicator of this trait was recorded in the T-11 line, as in the optimal water regime, and was 116.8 g., and the lowest indicator was found in the T-16 line (95.2 g.), as in the control variant.

According to the analysis of the coefficient of adaptation (Cad.), the strongest sensitivity to water deficit trait of weight 1000 seeds was noted in the T-7 and T-20 lines (respectively, Cad. = -8.6% and Cad. = -8.4%), while the weakest sensitivity was noted in the T-1, T-3 and T-2 lines (respectively, Cad. = -0.7%; Cad. = -0.5% and Cad. = -2.0%).

Under optimal water supply conditions, plant productivity in medium-fiber cotton lines had a moderate positive correlation with total water content in leaves and potential transpiration (r=0.40), and a weak negative correlation with leaf specific surface density (BSSZ), 3rd leaf dry weight and level (r=-

0.19; r=-0.32 and r=-0.22, respectively). Under these optimal conditions, increasing plant productivity was positively correlated with decreasing leaf water retention (r=0.35).

Under water stress conditions, plant productivity in medium-fiber cotton lines showed weak positive correlations with total water content in leaves and potential transpiration (r=0.25; r=0.30, respectively). Under these abiotic stress conditions, plant productivity was not statistically significantly correlated with leaf specific surface density (BSSZ), 3rd leaf dry weight and level (r=-0.04; r=0.06 and r=-0.05, respectively). A weak but positive correlation (r=0.20) was observed between increasing plant productivity and increasing leaf water retention capacity under water stress.

CONCLUSION

Under water stress, plant productivity in medium-fiber cotton lines decreased from 15.55 to 38.5% compared to the control (optimal water regime). Under these stress conditions, relatively high productivity and resistance were recorded in lines T-22, T-11, T-15 and T-7, which amounted to 76.2g., 69.8g., 66.3g., respectively. These lines can be used as starting material for drought tolerance selection of medium-fiber cotton. Under water stress, weight of boll and fiber output in medium-fiber cotton lines decreased to different degrees. In this case, fiber output in lines T-11, T-16 and T-3 was 37.1 - 38.2%.

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