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## Soil Salinity And Sustainability Of Cotton Plant

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### ABSTRACT

The following article deals with the data obtained as a result of the effect of soil salinity on the physiological properties and tolerance levels of medium-fibre cotton varieties. Also, changes in physiological processes under the influence of different levels of salinity and differences in the adaptive properties of varieties have been noted. Salinity had a negative impact on all studied cotton varieties, while the radical decline in yield and its quality was observed in varieties with high levels of adaptability and hardiness.

### KEYWORDS

Cotton, salinity, drought, water scarcity, physiological indicators, durability, productivity, yield, and yield quality.

### INTRODUCTION

Nowadays, about 20 per cent of the world's arable land and more than half of irrigated land is affected by salinization, and currently, about 800 million hectares of irrigated lands have soil

salinity. One of the main reasons for the declining productivity in botany is the effect of various abiotic stressors, among which the main role is played by soil salinity. Salinization

is one of the strongest environmental stresses in the world, which reduces plant productivity, and research in this area has great scientific and practical importance [1,2].

The study and discovery of salt resistance mechanisms in plants is one of the most actual, theoretical, and scientific problems in the world. The need for such work is explained by the fact that it requires the activation of various physiological and biochemical mechanisms to overcome the stress that occurs in plants under saline conditions [3,4].

Improving the agro-ameliorative condition of irrigated lands of the country, improving agro-technical measures to prevent soil salinization, creating and implementing varieties of agricultural crops adapted to saline soil conditions, physiological and biochemical properties of cotton varieties in saline soils and climatic conditions certain results have been obtained in the scientific substantiation of adaptive response reactions. For carrying out these tasks, it is important to study the adaptation and resistance of cotton to soil salinity and to develop effective methods of increasing salt resistance by scientifically substantiating rapid methods for determining their resistance [5-7].

Development of high-yielding cotton varieties resistant to adverse environmental factors, development of optimal agrotechnologies for growing crops, including cotton, in areas with varying levels of soil salinity and water scarcity, creation of salinization and drought-resistant genotypes is based on selection and cell and genetic engineering methods. Before sowing, one of the current challenges is to conduct research in the areas of increasing the resistance of plants to biologically active substances by treating them with biologically active substances [8-11].

Soil salinity is one of the main factors of the environment, its inverse relationship with plant growth and productivity, 15-23% of the world's total land area, including agricultural lands are covered with saline soils, the decline inadequate moisture supply to arable lands is one of the main reasons for the increase in soil salinity and decrease in productivity over time [12-15].

Soil salinity levels are one of the unfavourable factors that reduce the growth and development of plants, the intensity of photosynthesis, and negatively affect agricultural production [16-19].

Therefore, in the creation of salt-tolerant varieties, it is important to determine the morphological and physiological responses of plants and varieties to salinity, as well as the degree of adaptation.

**Objectives and tasks of the research** - on the basis of physiological, biochemical properties of water exchange, salinity and adaptation of cotton varieties in the conditions of soil salinity, development of methods of rapid adaptation of cotton to soil salinity and determination of salinity.

#### **Objectives of the study:**

- Soil salinity and moisture levels in early growth and morphophysiology of cotton varieties, water exchange characteristics: transpiration rate, leaf water retention rate, leaf water content, cell sap density, leaf and residual water deficit, leaf water potential, and protoplasmic viscosity study the effects;
- Comparative analysis of total and bound chlorophyll content in leaves, photosynthesis and respiration rate, albumin and bound water content in leaves, antioxidant enzyme activity, phenol

content, leaf diffusion resistance, turgor center stability coefficient and other indicators;

- The effect of soil salinity on the productivity of cotton varieties: scientific substantiation based on the study of growth dynamics of cotton varieties, leaf surface expansion, net productivity of photosynthesis, yield and its quality;
- Development of rapid methods for determining the salt resistance of cotton and methods to increase its resistance, as well as the study and application of these methods in practice and its impact on quality indicators;
- Recommend scientifically based varieties that are resistant to soil salinity and other extreme factors and have high yields and quality indicators.

The object of research Bukhara-6, Bukhara-8, Bukhara-10, Bukhara-102, S-6524 and Aqdarya-6 varieties of medium-fibre cotton were used as Physiological, morphological, biochemical, biometric, statistical, comparative analysis, phenological, plasmolytic, gasometric methods were used during the research. The soil of the experimental field belongs to the alluvial meadow type, and the depth of groundwater is 2-3 meters. Based on the pre-irrigation soil moisture, bulk density, and moisture capacity, the degree of moisture depletion in the soil was determined and irrigation standards were set. Options-Experiment-1 where soil salinity is weak in the text of the work and tables; variants with moderate salinity were considered experiment-2 and variants with high salinity were experiment-3.

The experimental sites were divided into 3 sections. The experiments were performed in four repetitions. The experiments were carried out on the basis of agro-technical measures

taken on the farms. Fertilizers were applied during ploughing, along with planting, and during plant growth (3 times). The total amount of fertilizers applied per hectare was: nitrogen-250, phosphorus-175, potassium-100 kg. Phenological observations, calculations and research on plant growth and development were carried out in accordance with the methods of UzPITI.

Determination of all physiological parameters and phenological observations were carried out in the experiments at the stages of flowering, flowering and germination of cotton. A fourth leaf developed from the third part of the main stem was taken for the study.

## RESULTS AND DISCUSSION

For the first time, changes in physiological and biochemical parameters such as bound chlorophylls, antioxidant enzyme activity, bound water in leaves, residual water deficiency in leaves, diffusion resistance of leaves, stability coefficient of turgor center level were proved as a result of soil salinity and moisture levels [20].

In addition to the physiological processes that take place in the body of plants, adverse factors of the external environment, especially salinity, have a negative impact on their growth, development, productivity and yield and quality. As a result, a sharp decline in biological, especially farm yields was noted [21,22].

The importance of the pure productivity of photosynthesis in the process of growth and development in plant life and in ensuring productivity is immeasurable. During the experiments, the effect of soil salinity levels on the net productivity of photosynthesis was taken into account during the mowing,

flowering and budding stages of cotton varieties.

In the control options, it was observed that the net productivity of photosynthesis of all cotton varieties was higher than in the experimental options. There are also differences in the cut of varieties. In Bukhara-8 and Bukhara-102 varieties, it was noted that the value of this indicator is high at all stages of development of cotton. Low results were observed in cotton varieties C-6524 and Aqdarya-6 [23-25].

As soil salinity levels increased, the net productivity of photosynthesis decreased in all studied varieties. In the moderately saline variants, the net productivity of photosynthesis of all varieties was slightly reduced compared to the control variant. In this variant, there are also differences in the value of this indicator in the section of varieties. High results were observed in Bukhara-8, Bukhara-10 and Bukhara-102 varieties.

It was found that the yield of cotton varieties depends on the level of salinity in the soil. In particular, a decrease in yield weight was noted in all experimental options as a result of the effect of soil salinity. The yield rate of the studied cotton varieties was the highest in the control options compared to other experimental options [15-18].

A sharp decrease in yield was noted in variants with strong soil salinity. In all experimental options, a decrease in yield weight relative to control was observed. Such a decrease was higher in strongly saline options. The lowest results in terms of yield of cotton varieties were recorded in strongly saline variants [1-8].

In the control variant, the yield of Bukhara-6 cotton variety is 37.36; Bukhara-8 variety – 40.06; Bukhara-10 variety – 37.76; Bukhara-102

variety – 40.03; C-6524 variety - 36.30 and Akdarya -6 variety - 35.53 quintals.

Yields of all cotton varieties studied in the moderate salinity variant were observed to be lower than in the control variant. In particular, the yield of Bukhara-6 variety is 34.73; Bukhara-8 variety – 38.03; Bukhara-10 variety– 35.70; Bukhara-102 variety– 37.93; C-6524 variety - 33.26 and Akdarya -6 variety - 32.6 quintals.

In the experiments, along with the weight of cotton varieties, the quality of the crop was also analyzed. In this case, the amount of fiber in different saline variants, the length of the fiber and the weight of 1000 seeds were determined.

According to the data, soil salinity also had a negative impact on crop quality. In all experimental variants, varying degrees of crop quality were noted as a result of soil salinity negatively affecting the value of these indicators. It was observed that the value of quality indicators in the control options was higher than in the experimental options.

In the control variant, high results on the above three indicators were recorded in cotton varieties Bukhara-8 and Bukhara-102. In variants with moderate soil salinity, a decrease in fiber content, fiber length, and weight of 1000 seeds relative to control was noted. Under such conditions, especially in cotton varieties C-6524 and Aqdarya-6, the quality indicators decreased compared to other varieties.

The protective adaptive properties of cotton to salinity were determined, and the physiological and biochemical aspects of the salinity resistance of varieties depending on the soil moisture level were substantiated [9-13].

The impact of soil salinity and drought on the yield of cotton varieties: growth dynamics of

cotton varieties, expansion of leaf surface, net productivity of photosynthesis, indicators determining the yield and its quality were determined as well [11-14].

For the first time, rapid (determination of electrical resistance and stability coefficient) methods for determining the resistance of cotton plants to soil salinity were developed. Methods were developed to increase the resistance of cotton to soil salinity (treatment of seeds before sowing and during the growing season), and the positive effect of these methods on yield and its quality was analyzed [15-19].

Varieties resistant to soil salinity levels and other extreme factors and with high yields and quality indicators were identified [16-21].

In cotton farms in Bukhara region and other regions where soil salinity is observed, planting of salt-resistant and high-yielding varieties of cotton Bukhara-8 and Bukhara-102 has been proven to be effective for high and high-quality yields [22-25].

The scientific significance of the results of the study is explained by the fact that the protective response of cotton varieties to soil salinity and adaptation depends on the level of soil salinity, the development of a method for rapid determination and increase of salt resistance.

The practical significance of the results of the study is determined by the possibility of obtaining high-quality crops of saline-resistant varieties Bukhara-8 and Bukhara-102 in areas with saline and arid soils. The implementation of the recommendations will serve to improve the agrotechnology of cotton growing in saline and arid regions [26-29].

Soil salinity levels in all experimental variants led to a slowing of transpiration intensity and

an increase in the water-retaining properties of the leaves. Under the influence of salinity, the ratios between the total, metabolic, and bound water content in the leaves varied, with increasing salinity levels increasing total and bound water and metabolic water content and water potential value decreasing. It was found that the density of cell sap, the viscosity of the protoplasm, and the water deficit values in the leaves increased under the influence of salinity in all experimental versions and varieties [9, 15].

Cotton varieties varied depending on the scope of influence of soil salinity levels on the activity of physiological and biochemical processes in the body. At the same time, the total amount of chlorophyll and the rate of photosynthesis decreased relative to control. At the same time, respiration rate, antioxidant enzyme activity, albumins, phenolic compounds, bound water content, leaf diffusion resistance, and stability coefficient were high in all experimental variants under the influence of soil salinity compared to control [21-25].

The productivity of cotton varieties depends on the degree of salinity, soil salinity had a major impact on the morphophysiological properties of cotton varieties, in saline environments the growth of all varieties slowed down and leaf levels decreased. The intensity of dry matter accumulation in cotton was directly related to the level of soil salinity. The high concentration of salts in the soil led to a low absolute mass of the plant. The net productivity of photosynthesis was found to be significantly lower than the control options in a saline environment, depending on the degree of soil salinity and the biological properties of the varieties [28,29].

In the salt-tolerant varieties Bukhara-8 and Bukhara-102, the decrease in the net productivity of photosynthesis, yield and



quality under the influence of salinity was less than in other studied varieties. The effect of soil salinity has also led to a decrease in the biological and economic yield of cotton varieties. The protective adaptive properties of cotton varieties relative to soil salinity levels varied depending on the biological and individual characteristics of the varieties. The degree of resistance and adaptability of varieties is related to the activity of water exchange and physiological processes in them [19-23].

The value of adaptation indices of cotton varieties varied depending on their biological properties in the cut of varieties as a result of the effect of soil salinity. Bukhara-8 and Bukhara-102 varieties had higher adaptation and resistance to salinity (bound water, diffusion resistance, stability coefficient, high content of bound chlorophyll, albumins, phenols and high activity of antioxidant enzymes) compared to C-6524 and Akdarya-6 varieties.

As a result of salinization, the degree of adaptation of all varieties, as well as the weight and quality of the crop decreased. At present, Bukhara-8 and Bukhara-102 varieties, which are resistant to salt, do not show any significant changes in water exchange, salt resistance and adaptation, as well as in the indicators characterizing the yield and its quality.

In all experiments, high and high-quality yields were detected in Bukhara-8 and Bukhara-102 varieties of cotton under soil salinity conditions. As a result of soil salinity, the yield and quality of C-6524 and Akdarya-6 varieties decreased radically.

The average weight of cotton seeds in the variant treated with solutions of sodium chloride and copper sulfate salts before sowing and during the general mowing stage

of cotton vegetation was 40.5 quintals. At the same time, the additional yield compared to control reached 13.4%. The fiber content was 2.8% higher than the control, the fiber length was 3.8% higher, and the weight of 1000 seeds was 9.8% higher.

Rapid and salt-increasing methods for determining the salt resistance of cotton have been developed, and the positive effects of these methods on cotton yield and its quality have been studied and proposed for production.

## CONCLUSION

Based on the results of the study, the following varieties can be recommended for planting in different saline areas of Bukhara region and adjacent areas on the basis of the degree of resistance and adaptation to salinity:

1. It is recommended to plant Bukhara-8 and Bukhara-102 varieties with high resistance to adverse abiotic factors in different saline areas of Bukhara region, and Bukhara-6 and Bukhara-10 varieties in moderately saline areas.
2. Due to low salinity and drought resistance, cotton varieties C-6524 and Akdarya-6 are recommended for planting in areas with low salinity and low salinity.

## REFERENCES

1. Ergashovich, K. A., Toshtemirovna, N. U., Rakhimovna, A. K., & Abdullayevna, F. F. (2020). Effects of Microelements on Drought Resistance of Cotton Plant. *International Journal of Psychosocial Rehabilitation*, 24(2).
2. Ergashovich, K. A., Davronovich, K. Y., Toshtemirovna, N. U., & Azamatovna, B. Z. (2020). Effect of soil types, salinity and

- moisture levels on cotton productivity. *Journal of Critical Reviews*, 7(9), 240-243.
3. Davronovich, K. Y., & Ergashovich, K. A. (2019). Growing of cotton varieties and hybrid to the height under the ecological conditions of soil salinity and washed soil salinity. *Asian Journal of Multidimensional Research (AJMR)*, 8(9), 84-89.
  4. Holliiev, A. E., & Safarov, K. S. (2015). Effect of different soil moisture on the physiology of water exchange and drought-resistant varieties (*Gossypium hirsutum* L.) of cotton. *Europäische Fachhochschule*, (9), 7-9.
  5. Toshtemirovna, N. U., & Ergashovich, K. A. (2019). Physiology, productivity and cotton plant adaptation under the conditions of soil salinity. *International Journal of Recent Technology and Engineering*, 8(2 S3), 1611-1613.
  6. Toshtemirovna, N. U., & Ergashovich, K. A. (2019). Regulation of the water balance of the cotton varieties under salting conditions. *ACADEMICIA: An International Multidisciplinary Research Journal*, 9(8), 5-9.
  7. Holliiev, E. (2011). Drought and Cotton Varieties in Zaravshan Valley of Uzbekistan. *International Journal of Applied*, 6(3), 217-221.
  8. Kholliyev, A. E., Norboyeva, U. T., Kholov, Y. D., & Boltayeva, Z. A. (2020). Productivity Of Cotton Varieties In Soil Salinity And Water Deficiency. *The American Journal of Applied sciences*, 2(10), 7-13.
  9. Ergashovich, K. A., Azamatovna, B. Z., Toshtemirovna, N. U., & Rakhimovna, A. K. (2020). Ecophysiological effects of water deficiency on cotton varieties. *Journal of Critical Reviews*, 7(9), 244-246.
  10. Холлиев, А. Э. (2011). Физиологические особенности влияния засухи на водообмен и засухоустойчивость хлопчатника. *Международные научные исследования*, (1-2), 109-111.
  11. Холлиев, А., Махмудова, Ш., & Иргашева, Н. (2019). Меры борьбы против зерновок на зернобобовых культурах. *Наука, Производство, Бизнес*, 192.
  12. Норбоева, У. Т. (2019). Ecophysiological peculiarities of cotton varieties in soil salinity conditions. *Scientific Bulletin of Namangan State University*, 1(5), 103-108.
  13. Холлиев, А. Э., Норбоева, У. Т., & Ибрагимов, Х. М. (2016). Водообмен и солеустойчивость сортов хлопчатника в условиях почвенной засоления и засухи. *Ученый XXI века*, 9.
  14. Холлиев, А. Э. (2011). Physiological features of influence of a drought on waterrelation and droughtstability of cotton. *International scientific researches*.
  15. Kholliyev, A., (1991). Osobennosti vodoobmena i produktivnost' sortov hlochatnika v zavisimosti ot vodosnabzheniya (Doctoral dissertation, Ин-т физиол. и биофизики растений). (in Russian).
  16. Kholliyev, A., & Boltayeva, Z. (2020). Resistance of cotton varieties to water deficiency. *Збірник наукових праць Л'ОГОС*, 70-72.
  17. Kholliyev, A., Boltayeva, Z., & Norboyeva, U. (2020). Cotton water exchange in water deficiency. *Збірник наукових праць Л'ОГОС*, 54-56.
  18. Kholliye, A., Norboyeva, U., & Adizova, K. (2020). About the negative impact of salination on cotton. *Збірник наукових праць Л'ОГОС*, 50-52.
  19. Kholliyev, A., Norboyeva, U., & Adizova, K. (2020). Methods of using microelements to increase salt resistance of cotton. *Збірник наукових праць Л'ОГОС*, 57-60.
  20. Kholliyev, A., & Teshaeva, D. (2021). Soil salinity and water exchange of autumn

wheat varieties. Збірник наукових праць Л'ОГОΣ.

21. Kholliyev, A., Nazarova, F., & Norboyeva, N. (2021). Cotton resistance indicators in the conditions of water deficiency. Збірник наукових праць SCIENTIA.
22. Kholliyev, A., & Isayeva, M. (2021). Flora of bukhara desert ecosystem and its protection. Збірник наукових праць SCIENTIA.
23. A.E., R Kholliyev, T., Norboyeva U., D., Kholov Yo., A., Boltayeva Z., & K., Adizova (2021). Effects of abiotic factors on the ecophysiology of cotton plant. International Journal of current research and review, 13(4), 4-7.
24. Kholliyev, A., & Teshaeva, D. (2021). Soil salinity and water exchange of autumn wheat varieties. Збірник наукових праць Л'ОГОΣ.
25. Kholliyev, A., Nazarova, F., & Norboyeva, N. (2021). Cotton resistance indicators in the conditions of water deficiency. Збірник наукових праць SCIENTIA.
26. Норбоева, У. Т. (2019). Ecophysiological peculiarities of cotton varieties in soil salinity conditions. Scientific Bulletin of Namangan State University, 1(5), 103-108.
27. Норбоева, У. Т. (2018). Водный обмен и солеустойчивость сортов хлопчатника. Mechanisms of resistance of plants and microorganisms to unfavorable environmental, 563-566.
28. Norboyeva, U. (2019). Increasing degrees of harvest and quality of cotton varieties in the condition of soil salinity. Scientific Bulletin of Namangan State University, 1(2), 104-109.
29. Norboeva, U. T. (2017). On water resources of the biosphere and the effective use of. Ученый XXI века, (1-1), 33-36.