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THEORETICAL AND PRACTICAL FUNDAMENTALS OF ADAPTATION CHARACTERISTICS OF COTTON VARIETIES TO PHYSIOLOGICAL SOIL SALINITY

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Annotation: *The article deals with information on the effect of soil salinity on some physiological processes of cotton varieties. It was determined that the speed of physiological processes of the studied cotton varieties Bukhara-6, Bukhara-8, C-6524, Bukhara-102 and Okdarya-6 varies depending on the level of salinity. As a result of the effect of soil salinity, the value of the adaptation indicators of the cultivars was different depending on their biological characteristics. It is based on the fact that the Bukhara-8 and Bukhara-102 varieties have higher adaptation and resistance to salt than the C-6524 and Okdaryo-6 varieties.*

Key words: *cotton varieties, soil salinity, moisture, physiological parameters, adaptation, resistance, productivity.*

Introduction. Currently, about 20 percent of the world's cultivated land and more than half of the irrigated land are affected by soil salinity, and about 800 million hectares of irrigated land are now saline. One of the main reasons for productivity decline in plant science is the influence of various abiotic stressors, among which soil salinity takes the main place. Salinity is one of the strongest environmental stresses that reduce the productivity of plants in the world, and the ongoing scientific research in this direction is of great scientific and practical importance.

Studying the mechanisms of soil salinity resistance of plants and revealing is one of the urgent theoretical and scientific problems in the world. Indeed, by deepening the scientific and research work in this field, great attention is paid to the creation of methods of selection, transgenesis and the use of physiologically active substances to increase the salt resistance of plants, and to wide application to agricultural production. The need to carry out such work is explained by the fact that it requires the activation of various physiological and biochemical mechanisms to eliminate the stress that occurs in plants under salinity conditions.

Improving the agro-melioration condition of the irrigated lands of our republic, improving the agrotechnical measures used to prevent soil salinization, creating and putting into practice varieties of agricultural crops adapted to saline soil conditions, physiological and biochemical characteristics of cotton varieties that express the level of resistance and productivity in saline soil and climatic conditions, and specific varieties Certain results have been achieved in the scientific justification of adaptive response reactions.

Salinity is considered one of the main abiotic stressors in arid and semi-arid regions, and saline soils are widespread in all climatic regions, with more than 800 million hectares or more than 6% of the globe affected by salts [1].

Soil salinity is considered one of the main environmental factors and is inversely related to plant growth and productivity. According to some estimates, 15-23 percent of the world's total land area, including areas used for agriculture are covered by saline soils [2].

Under the influence of soil salinization, the productivity of agro and biocenoses decreases, the genetic composition of biodiversity changes, and serious economic losses are observed [3]. The decrease in the level of sufficient moisture supply of cultivated areas has recently led to an increase in soil salinity and remains one of the main reasons for the decrease in productivity [4].

One of the main reasons for the decrease in productivity in plant science is the effect of various forms of abiotic stressors, including soil salinity [5]. Salinity is one of the most important environmental problems that limit plant productivity, especially in arid and semi-arid climates [6].About 800 million hectares of arable land around the world are saline areas[7].The negative impact of this stress factor has been observed to increase in recent years, including as a result of human economic activity [8].

One of the major challenges facing the world's agriculture is that by 2050, more than 70 percent of additional food will need to be produced for an additional 2.3 billion people worldwide [9].Due to natural causes and certain agricultural practices, the proportion of agricultural land with high salinity levels is increasing rapidly worldwide. The problem of soil salinity is aggravated by the use of old methods of irrigation such as irrigation. About 20 percent of the world's cropland and more than half of its irrigated land are affected by salinity [10].

There is serious competition for clean water, so high-quality water is often used for industrial or domestic purposes, while salty and polluted water is sent to agricultural fields [11]. About 69% of the world's wheat plant grows under the negative influence of soil salinity, and as a result, the weight of the crop and its quality indicators are decreasing [12]. Global climate change, salinization of irrigated areas, and problems related to population growth and the expansion of saline areas threaten public health, national economies, and ecosystems[13].

In this regard, one of the urgent scientific problems is to study the salt tolerance mechanisms of plants and to reveal it. By deepening the knowledge in this field, it will create the necessary conditions for the development of methods of selection, transgenesis and the use of physiologically active substances in increasing salt tolerance of plants.

Object and methods of the research.A number of laboratory, vegetative and field experiments were conducted to study the effect of salinity on water exchange and productivity of cotton varieties. Bukhara-6, Okdarya-6, Bukhara-102 and C-6524, which belong to the group of medium-fiber cotton varieties, were used as objects of experiments, and Bukhara-8 and Bukhara-10 varieties were also used during further research. Currently, these varieties are planted on large areas in several regions of our republic.

The effects of salinity levels on water exchange, some physiological and biochemical indicators, growth and development, and productivity of cotton varieties were studied in the conducted vegetative experiments. Vegetative experiments were carried out in large pots that could hold 30 kg of air-dry soil. Before conducting experiments, all dishes were treated with a 0.4% solution of formalin.

To prevent the soil from overheating, the containers were wrapped with special thick cotton cloths. Meadow-alluvial soils were used for conducting laboratory and vegetation experiments. Such soils form the main areas of the region.

The moisture content and moisture capacity of the soils taken for the experiment were determined. Depending on the results of these two indicators, soil moisture in all variants was maintained at 70% moisture compared to the full moisture capacity until the cottons produced 4-5 leaves. From the 4-5 leaf stage, all pots were divided into two groups. In the first group of containers, the soil moisture was maintained at 70% until the end of vegetation, and in the second group of containers, humidity was maintained at the level of 30% from the 4-5 leaf stage until the end of vegetation.

Table salt was used to artificially create chlorine salinity in the soil and three different levels of salinity were created in the soil. All control soils were not salted. Percent salinity levels of chloride ion (0.012–0.014, 0.019–0.020, and 0.030–0.033) were artificially generated based on air-dried soil weight.

Non-saline soils were used in all laboratory and vegetative experiments. At the end of vegetation, two cotton seedlings were left in each container.

In the conducted experiments, some physiological and biochemical processes of water exchange and productivity, which characterize adaptation and resistance of plants to adverse factors, salinity, were studied. Before conducting field experiments, fields with non-saline, weak, medium and strong salinity were determined.

In the text and tables of the work, variants with weak soil salinity-experiment-1; abbreviated as medium-salinity-variants-experiment-2 and high-salinity-variants-experiment-3.

In all field experiments, soil water deficit was studied by determining soil moisture before irrigation, its volumetric weight and field moisture capacity, and irrigation was carried out. All experiments were conducted under conditions of 70 percent humidity with moderate soil moisture. The seeds were sown in rows at an interval of 60 cm. The average number of bushes in experimental areas was 90-95 thousand per hectare. The area of the experimental sites was 0.5 hectares, and the total amount of fertilizers applied per hectare was 225 kg of nitrogen, 170 kg of phosphorus and 90 kg of potassium.

Determination of all physiological indicators and phenological observations were carried out in experiments at the stages of cotton budding, flowering and budding. All parameters were taken from the tip of the stem, that is, from the third or fourth moderately developed leaves. All observations, measurements and research on plant growth and development were carried out in accordance with UzPITI methods. All the data obtained according to the results of the search were re-processed statistically. Each experiment was performed in triplicate biological and triplicate analytical levels. Statistical processing of data was carried out using MS Excel 2003 and Sigma Stat application software.

Research results and its discussion. Based on the obtained data, it was determined that the value of the stability coefficient of cotton leaves changes depending on the soil salinity levels. That is, with an increase in soil salinity, the stability coefficient of leaves increased, and its value increased from tillering to tillering. The degree of tolerance and adaptability of cotton to salinity is largely determined by the stability coefficient of the leaves[14-18].

It was noted that the value of electrical resistance of leaf tissue changes depending on soil salinity levels and cotton development stages. It was observed that the electrical resistance of the tissue in all the control variants was lower than the experimental variants, regardless of the stage of development.

Due to the low level of cytosol viscosity in non-saline options, the electrical resistance of the tissues was the lowest compared to all experimental options. During the research, the productivity level of the Bukhara-8 cotton variety was high in the experimental options. In particular, soil salinity had a strong effect on the morphophysiological characteristics of plants. In a saline environment, the growth of cotton plants slows down and the leaf surfaces become smaller. The net productivity of photosynthesis was significantly lower in the saline environment than in the experimental variants. As a result, soil salinity had a negative effect on the weight of the crop and its quality indicators.

In order to increase the resistance of cotton to salt: 1) before planting seeds only with a solution of sodium chloride salt (513mM); 2) before planting, seeds treated with solutions of sodium chloride (513mM) and copper sulfate salt in a 1/1 ratio (31.25mM) were planted. 3) seeds and cotton were treated with solutions of sodium chloride (513mM) and copper sulfate (31.25mM) in a mixture of 1/1 ratio during the growing season. Compared to the control, in all the experimental options, the value of all the above-studied indicators was higher even in saline conditions due to the increase in the level of cotton's tolerance to salt.

During the growing season, seeds and cotton were treated with solutions of sodium chloride and copper sulfate salts. Meanwhile, the additional yield increased by 13.44% compared to the control. All the control variants had lower yields than the experimental variants. In this experimental variant, fiber content was 2.8% higher, fiber length was 3.8% higher, and 1000 seed weight was 9.8% higher than the control. The quality indicators of the harvest were different directly related to the conditions of growth and development of cotton, soil salinity and the application of the method of increasing salt tolerance.

All the quality parameters of the crop were noted higher in the version treated with solutions of sodium chloride and copper sulfate salts before planting cotton seeds and during the stage of cotton vegetation. The amount of fiber is 36.5%; fiber length was 32.5 mm and weight of 1000 seeds was 127.6 grams.

The levels of soil salinity caused the slowing down of the transpiration rate and the increase of the water retention properties of the leaves in all experimental options. The ratios between the total, metabolic and bound water content in the leaves were different under salinity, and with increasing salinity, the total and bound water increased, and the metabolic water content and water potential values decreased. It was found that the concentration level of cell sap, viscosity of protoplasm and water deficit values in leaves increased under the influence of salinity in all experimental variants and cultivars.

The influence of soil salinity levels on the activity of physiological and biochemical processes in the body of cotton varieties was different. Compared to the control, the amount of total chlorophylls and the rate of photosynthesis decreased. At the same time, the rate of respiration, activity of antioxidant enzymes, albumins, phenolic compounds, bound water content, diffusion resistance of leaves and stability coefficient were higher under the influence of soil salinity compared to the control in all experimental options.

Productivity of cotton cultivars depends on salinity level, soil salinity has a great effect on the morphophysiological characteristics of cotton cultivars, growth of all cultivars in saline environment is slowed down and leaf levels are reduced. The rate of accumulation of dry matter in cotton was directly related to the level of soil salinity. The high concentration of salts in the soil caused the low absolute mass of the plant. It was found that the net productivity of photosynthesis, depending on the soil salinity level and the biological properties of the varieties, its productivity value is significantly reduced in the saline environment compared to the control options.

In salt-resistant varieties Bukhara-8 and Bukhara-102, under the influence of salinity, the decrease in net photosynthetic productivity, quantity and quality of the crop was less compared to other studied varieties. The effect of soil salinization caused a decrease in the biological and economic yield of cotton varieties. The protective adaptation characteristics of cotton cultivars to soil salinity levels varied depending on the biological and individual characteristics of the cultivars. The level of resistance and adaptation characteristics of varieties are related to the activity of water exchange and physiological processes in them.

The value of adaptation indicators of cotton varieties was different depending on their biological characteristics in the section of varieties as a result of the effect of soil salinity. Bukhara-8 and Bukhara-102 cultivars had higher adaptation and resistance to salt (bound water, diffusion resistance, stability coefficient, bound chlorophyll, albumin, phenol content and antioxidant enzyme activity) than C-6524 and Okdaryo-6 cultivars.

As a result of the effect of salinity, the adaptation level of all varieties and the yield weight and quality decreased. At the moment, in the Bukhara-8 and Bukhara-102 varieties, which are resistant to salt, there were no drastic changes in water exchange, salt tolerance and adaptation, as well as parameters characterizing the yield and its quality.

In all experiments, in the conditions of soil salinity, compared to other varieties, high and quality yield was determined in Bukhara-8 and Bukhara-102 cotton varieties. As a result of the effect of soil salinity, the yield and quality of C-6524 and Okdaryo-6 varieties decreased sharply. The weight of the crop was 40.5 centners in the variant treated with solutions of sodium chloride and copper sulfate salts before planting cotton seeds and at the stage of gross combing of cotton vegetation. At the same time, the additional yield compared to the control reached 13.4%. Fiber content was 2.8% higher, fiber length was 3.8% higher and 1000 seed weight was 9.8% higher than the control.

Rapid methods for determining salt resistance of cotton and increasing soil salinity resistance were developed, and the positive effect of these methods on cotton yield and its quality indicators were studied and proposed for production.

Conclusion. Based on the results obtained during the research, the following varieties can be recommended for planting in the areas of different levels of salinity of the Bukhara region and its neighboring regions based on the level of resistance and adaptation to salinity:

1. Salt-resistant Bukhara with a high level of resistance to unfavorable abiotic factors in the areas of different levels of salinity of the Bukhara-8 and Bukhara-102, and Bukhara-6 and Bukhara-10 varieties are recommended to be planted in medium salinity areas;
2. Due to the low degree of resistance to soil salinity and drought, it is recommended to plant cotton varieties C-6524 and Okdaryo-6 in regions with low soil salinity;
3. It is proposed to use these methods to increase the weight of the crop and improve its quality indicators by using quick methods of determining the level of salt resistance of cotton and increasing salt

resistance. When these varieties are planted in areas with different levels of salinity, it is recommended to carry out all agromelioration activities at a high level taking into account their resistance and adaptation characteristics.

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