RESISTANCE INDICATORS OF FINE FIBERED “GOSSYPIUM BARBADENSE L.” COTTON VARIETIES UNDER STRESS CONDITIONS

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Annatation Water deficit and salinity stress in cotton negatively affect photosynthesis, water uptake, and plant growth. During the flowering stage, the water deficit in leaves is highest, with variation among varieties: Surkhan-16 shows the highest deficit, while SP-1607 shows the lowest. Salinity increases cell sap concentration and osmotic pressure, with more developed adaptation mechanisms in salinity-tolerant varieties. The study highlights the importance of managing water and salinity for sustainable cotton cultivation.

Keywords: cotton**,** water deficit**,** drought stress**,** photosynthesis**,** salinity**,** osmotic pressure

ПОКАЗАТЕЛИ УСТОЙЧИВОСТИ ТОНКОВОЛОКНИСТЫХ СОРТОВ ХЛОПЧАТНИКА *GOSSYPIUM BARBADENSE L.* В УСЛОВИЯХ СТРЕССОВЫХ ФАКТОРОВ

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Аннотация.Водный дефицит и солевой стресс у хлопчатника отрицательно влияют на фотосинтез, водопоглощение и рост растений. В фазе цветения водный дефицит в листьях достигает наибольших значений и варьирует в зависимости от сорта: у сорта Surkhan-16 он наиболее высокий, тогда как у SP-1607 — наименьший. Засоление приводит к увеличению концентрации клеточного сока и осмотического давления, при этом у солеустойчивых сортов более выражены механизмы адаптации. Проведённые исследования подчёркивают важность регулирования водного режима и засоления почв для устойчивого возделывания хлопчатника.

Ключевые слова: хлопчатник, водный дефицит, засухоустойчивость, фотосинтез, засоление, осмотическое давление.

Sustainable cotton cultivation requires a clear understanding of the impact of water deficit on cotton and the development of appropriate mitigation techniques. Drought stress affects physiological and biochemical processes in cotton, particularly photosynthesis. Water stress reduces water availability and carbon uptake for photosynthesis and affects plant development.

One-third of the world's cropland suffers from water scarcity. Droughts regularly reduce yields of mesophytic crops and may exacerbate the problem of global climate change. Water stress or drought can affect reproductive growth phases, which reduces agricultural productivity. Salinity and drought are two of the most important environmental problems that hinder crop productivity worldwide.

Excessive salt concentration in the soil disrupts water absorption and ion balance in cotton plants, leading to ion poisoning, growth retardation, leaf scorch, and yield reduction. Salinity stress is a major factor limiting agricultural productivity in the biosphere. Salinity significantly threatens the growth, productivity, and quality of cotton fibre.

Our study demonstrates that soil water deficit impairs plant water uptake and utilization, disrupting water balance and increasing leaf water deficit in cotton. High air temperature and low relative humidity, especially in the afternoon, exacerbate these effects. Drought induces physiological water imbalance and organ dehydration, particularly in leaves. Residual leaf water deficit was significantly greater at the flowering stage than at tillering and budding across all cultivars and moisture regimes.

Residual water deficit in leaves was also studied during the flowering phase. In the flowering phase, the value of residual water deficit in the leaves in the morning under sufficient humidity was 2.62% in the Surkhan-18 variety, 1.68% in the Termiz- 208 variety, 2.00% in the Termiz-202 variety, 1.39% in SP-1607 variety, and 2.87% in Surkhan-16 variety. In the morning, in the conditions of limited humidity, this indicator was 3.11% in the Surkhan-18 variety, 2.05% in the Termiz-208 variety, 2.46% in the Termiz-202 variety, 1.81% in the SP-1607 variety and 3.25% in Surkhan- 16 variety. When the process was studied at noon, i.e. at 1200-1400 hours, residual water deficit in leaves was equal to 2.94% in Surkhan-18 variety, 1.86% in Termiz-208 variety, 2.46% in Termiz-202 variety, 1.69% in SP-1607 variety and 3.42% in Surkhan- 16 variety under optimal humidity conditions. In the conditions of limited moisture, this indicator reached 3.25% in the Surkhan-18 variety, 2.24% in the Termiz-208 ariety, 2.89% in the Termiz-202 variety, 2.10% in the SP-1607 variety, and 3.89% in Surkhan-16 variety.

During the flowering phase, when the residual water deficit in the leaves was observed at 1600-1800 in the evening, it was equal to 3.37% in the control cultivar Surkhan-18, 2.38% in the cultivar Termiz-208, 2.89% in the cultivar Termiz-202, 1.89% in the cultivar SP-1607, and 3.82% in the cultivar Surkhan-16. In the conditions of limited moisture in the evening, this indicator was 3.86% in the Surkhan-18 variety, 2.74% in the Termiz-208 variety, 3.41% in the Termiz-202 variety, 2.46% in the SP- 1607 variety and 4.37% in Surkhan-16 variety. In all options under limited moisture conditions, the value of water deficit was much higher than in the optimal moisture options. Significant inter-varietal differences were observed in residual water deficit. The highest values occurred in Surkhan-16 plants under limited moisture at all developmental stages, while the lowest were recorded in SP-1607 under optimal humidity. Intermediate values were observed in Termiz-208, Termiz-202, and Surkhan-18 varieties, indicating a clear varietal response to soil moisture levels.

To evaluate the effect of salinity on cell sap concentration in cotton varieties, experiments were conducted across non-saline, moderately saline, and highly saline soils at the budding, flowering, and boll stages. Across all soil salinity levels and cultivars, cell sap concentration increased progressively from the boll to the budding stage.

The concentration of cell sap in all cotton varieties grown in highly saline soil conditions is significantly higher than in plants grown in non-saline conditions. It was observed that the concentration of cell sap in non-saline variants of all varieties was lower than in saline variants. With an increase in the level of soil salinity, the concentration of cell sap in all varieties also increased. The highest indicators were found in cotton varieties grown in soil salinity conditions. At the flowering stage, in non-saline conditions, the SP-1607 variety was 12.8, in the moderately saline variant 13.6, in the highly saline variant 15.8; in the control variant of the Termiz-208 variety 12.4, in the moderately saline variant 13.0, in highly saline variant 15.2; 12.0 in the control variant of the Termiz-202 variety, 12.5 in the medium salinity variant, 13.6 in strong salinity; 11.6 in the control version of the Surkhan-18 variety, 12.2 in the medium salinity version, 13.2 in strong salinity; It was found to be 11.2 in the control variant of Surkhan-16, 12.0 in the medium salinity variant, and 12.6 in the strong salinity variant.

Assessment of salinity effects revealed consistent patterns across all cotton varieties at the flowering and tillering stages, with salinity causing a marked increase in leaf cell sap concentration. Cell sap concentration was found to depend on soil salinity level, developmental stage, and varietal characteristics. Significant inter-varietal differences were observed, with the highest values in SP-1607 and Termiz-208 and the lowest in Surkhan-16.

During our observations, we also studied the effect of different levels of salinity on the osmotic pressure of the cell sap. The experiments were conducted on nonsaline, moderately saline and highly saline soils. The osmotic pressure of the cell sap of cotton varieties was determined in all phases, during the budding, flowering and budding periods.

It was noted that in non-saline environments, the osmotic pressure of the cell sap was lower than in medium and high-salinity environments. On the contrary, in soils with a high level of salinity, the osmotic pressure of the cell sap was higher. If we express this in numbers, in the Surkhan-18 variety, it was 6.08 in the control, 6.67 in the medium saline environment, and 7.68 in the high saline environment.; in the Surkhan-18 variety, it was 5.63 in the control, 6.36 in the medium saline conditions, and 7.17 in the high saline conditions.; in the Termiz-208 variety, it was 7.07 in the non-saline conditions, 7.72 in the medium saline conditions, and 8.56 in the high saline conditions.; In the Termiz-202 variety, the osmotic pressure was 6.38 in nonsaline soil, 7.14 in medium salinity, and 7.93 in high salinity conditions. In the cotton variety SP-1607, this indicator was 7.12 in non-saline conditions, 8.06 in medium salinity, and 9.26 in high salinity conditions. Similar conditions were observed in the flowering and storage phases of cotton varieties. With increasing salinity, the osmotic pressure increased significantly. In the SP-1607 variety, the highest pressure was recorded during the storage period under high salinity conditions. The lowest osmotic pressure was observed in the Surkhan-16 variety. In general, plant cells adapt to balance osmotic pressure under salinity conditions. Adaptation mechanisms are important for the stress tolerance of plants under saline conditions. Also, osmotic pressure control is better developed in salinity-tolerant varieties.

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