

## EFFECT OF WATER SUPPLY ON TRANSPIRATION RATE OF FINE-FIBERED COTTON VARIETIES

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**Abstract.** *The article presents some data on the study of the transpiration rate in the leaves of thin-fiber cotton varieties at different levels of soil moisture. During the experiments, the aspects related to the moisture level in the soil and its water supply of cotton varieties with thin fibers Surkhan-16, Surkhan-18, Termiz-202, Termiz-208 and SP-1607 were described. It was determined that the change in transpiration rate in the section of the studied varieties is different depending on the stages of growth and development, water supply and biological characteristics of the varieties.*

**Key words:** *water supply, fine fiber cotton, varieties, moisture levels, transpiration, water regime, productivity.*

### ВЛИЯНИЕ ВОДОБЕСПЕЧЕННОСТИ НА ИНТЕНСИВНОСТЬ ТРАНСПИРАЦИИ ТОНКОВОЛОКНИСТЫХ СОРТОВ ХЛОПЧАТНИКА

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**Аннотация.** В статье представлены данные по изучению интенсивности транспирации листьев тонковолокнистых сортов хлопчатника при различных уровнях влажности почвы. В ходе экспериментов были рассмотрены особенности увлажнения почвы и водообеспеченности тонковолокнистых сортов хлопчатника Surkhan-16, Surkhan-18, Termiz-202, Termiz-208 и SP-1607. Установлено, что изменение интенсивности транспирации у исследуемых сортов различается в зависимости от фаз роста и развития, уровня водообеспеченности и биологических особенностей сортов.

**Ключевые слова:** водообеспеченность, тонковолокнистый хлопчатник, сорта, уровни влажности, транспирация, водный режим, продуктивность.

Irrigation can help address drought-related problems; however, groundwater reserves are declining, and the costs associated with irrigation are increasing. Agricultural producers must take urgent action to address these challenges in order to ensure the cultivation of important crops such as cotton and wheat. Drought poses a widespread threat to the growth and productivity of field crops, but water deficits at certain growth stages can be mitigated through re-irrigation to maintain

stable growth and yield. The efficiency of water restoration acts as a self-regulation mechanism, enabling crops to adapt to adverse environmental conditions through the effective use of limited water resources.

Abiotic stress factors negatively affect agriculture by reducing plant growth and productivity. Climate change, water scarcity, pollution, and the loss of fertile land are expected to further intensify yield declines. Therefore, mitigating the impacts of abiotic stresses remains a key challenge for sustainable food production.

Drought in agriculture is generally defined as a prolonged shortage of precipitation that results in soil moisture depletion and limits water availability to crops. Crop responses to drought depend on its severity and duration, as well as plant genotype, growth conditions, and developmental stage.

Drought stress can induce various morphological, physiological, biochemical, and molecular changes in both aboveground and belowground tissues of cereal crops. Some of the key physiological responses to drought include leaf rolling, partial or complete stomatal closure, reduced cell growth and expansion, and decreased internal CO<sub>2</sub> concentration, which leads to a decline in photosynthetic activity.

Plant growth rate is strongly influenced by adverse environmental factors, particularly water availability. Water deficit is a major limiting factor, with growth rate closely dependent on the severity and duration of drought. Plant responses to water stress occur in sequential phases, including stress perception and recovery. Soil moisture deficiency suppresses growth, reduces yield quality, and affects all developmental stages, with drought effects often persisting even after partial rehydration. Numerous studies indicate that plant growth is more sensitive to drought stress than photosynthesis.

Soil moisture deficiency is a major limiting factor for agricultural productivity in arid regions. Leaf photosynthetic activity can recover rapidly after re-irrigation and remain at a high level for an extended period, thereby improving crop yield and water use efficiency. Under water stress, the photosynthesis and root activity of *Gossypium hirsutum* L. leaves can quickly recover following re-

irrigation at certain growth stages. These findings suggest that even short-term water stress at any developmental stage can mitigate the negative effects of drought on root activity and enhance the compensatory effect of re-irrigation on photosynthesis, ultimately increasing yield under drip irrigation.

In the Bukhara region, during the hot summer months, prolonged high temperatures resulting from solar heating lead to a 10–15% reduction in daytime atmospheric moisture. Extended periods of summer contribute to atmospheric drought. Very low relative humidity, combined with further temperature increases, creates a severe moisture deficit in the atmosphere.

Transpiration is a key physiological process that plays a crucial role in understanding water exchange and water regimes in plants growing under water-deficient conditions. The majority of water absorbed by plants is lost through transpiration. High transpiration rates under water-deficit conditions can disrupt the water balance in plant tissues and exacerbate water shortages. Consequently, physiological and biochemical processes within the plant slow down, leading to reduced crop productivity.

It is well established that plant water uptake is closely linked to the rate of transpiration. Only 1.5–2% of the water absorbed by plants is retained, while the majority is lost through transpiration via the leaves. The rate of transpiration is influenced by numerous external factors, including air temperature, relative humidity, soil and climatic conditions, wind, solar radiation, soil moisture content, plant developmental stage, and varietal characteristics. Transpiration not only leads to water loss through the leaves but also facilitates water absorption and the transport of water and dissolved substances throughout the plant.

During the study, the rate of transpiration in the aforementioned fine-fiber cotton varieties was investigated under field experimental conditions. Two different irrigation regimes were applied. In the first regime, soil moisture was maintained at 65–70–65% of field capacity, whereas in the second regime it was maintained at 50–55–50%.

Transpiration rates of cotton varieties grown under 65–70–65% soil moisture conditions were observed to be higher than those of varieties grown under 50–55–50% soil moisture. Under water-deficit conditions, reductions in transpiration are closely linked to stomatal behavior. In some studied cotton varieties, transpiration increased from morning to noon and then decreased from afternoon to evening. The study also demonstrated that transpiration rates are strongly influenced by the varietal characteristics of cotton.

In field experiments with two soil moisture levels (65–70–65% and 50–55–50%), it was found that the amount of water used for transpiration varied among cotton varieties. All studied varieties consumed more water for transpiration under 65–70–65% soil moisture compared to the water-deficient 50–55–50% conditions. Furthermore, transpiration increased from the budding to flowering stages and decreased during the boll formation stage.

The transpiration rate of all studied cotton varieties varied depending on air temperature and soil moisture levels. However, the amount of water consumed for transpiration also differed according to the biological characteristics of each variety. Under moderate soil moisture conditions, the highest transpiration across all developmental stages (budding, flowering, and boll formation) was observed in the SP-1607 and Termiz-208 varieties during the morning hours. In the other varieties, transpiration rates declined in the evening.

According to the data, there is a close relationship between transpiration rate and soil moisture, which in turn regulates the rate of water uptake by the root system. A decrease in soil moisture leads to a reduction in transpiration rate, while an increase in air temperature accelerates this process. The transpiration rate of cotton varies throughout its ontogeny and also depends on the plant's metabolic activity, bound water content, and the colloidal properties of cell protoplasm.

Under field experimental conditions, the SP-1607 and Termiz-208 cotton varieties primarily exhibited increased transpiration during the morning hours, with a secondary rise during the water-deficient afternoon and evening hours. In contrast, the Termiz-202, Surkhan-16, and Surkhan-18 varieties displayed the

opposite pattern. This variation may be attributed to varietal traits related to efficient water use and conservation.

The SP-1607 and Termiz-208 cotton varieties are tolerant to fluctuations in soil moisture, as they do not rapidly alter their water balance. Consequently, these varieties can improve overall productivity through efficient soil water use. During the onset of generative organ development, the daily demand for nutrients increases, resulting in changes in the composition of essential compounds in assimilates due to biochemical and physiological processes and metabolic turnover. Under water-deficit conditions, extremely high air temperatures and hot, dry winds can lead to shortages of water and nutrients, potentially disrupting their supply to the plant.

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