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Effects Of Drought on Growth Processes and Leaf Area of Cotton Cultivars

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Abstract:
In this article, information on the effects of drought on the growth trends and leaf area expansion of widely regionalized cotton cultivars in Uzbekistan was presented. It was found that the growth trends and the expansion of the leaf surface of the studied cotton varieties depend on the soil moisture level. It was observed that the varieties of cotton Bukhara-8, and Bukhara-102 are resistant to drought compared to the variety S-6524. According to the obtained scientific results, as a result of the effects of drought, it was found that the growth slowed down and the leaf area decreased in the studied varieties. Among the studied varieties, it was found that the growth rate of the Bukhoro-102 variety and the expansion of the leaf surface are higher than Bukhoro-8 and S-6524 varieties.

Keywords: cotton varieties, soil drought, atmospheric drought, growth, development, leaf level, growth rate, plant mass, productivity, endurance.

Introduction

Drought is a meteorological condition in which plants cannot meet their water requirements. The main causes of drought are lack of precipitation, transpiration and excessive evaporation of water from the soil surface. Strong winds cause drying of the soil layer where the roots are spread. Atmospheric drought occurs when air humidity is too low due to dry and hot weather. In this case, the plant stops growing and the leaf level does not expand, as a result, the yield of crops decreases.

Drought sharply reduces biosynthetic processes in the body of plants, and protein breakdown occurs. The amount of organic reserves decreases. This, in turn, slows down plant growth. Due to these and other conditions, the leaf begins to dry and starch disappears from it. Also, the exchange of phosphorus in the root systems of plants changes dramatically, and the speed of the phosphorization process decreases. Drought ultimately results in a drastic reduction in plant productivity.

The growth rate of plants changes dramatically under the influence of unfavourable factors of the external environment. The level of water supply to plants in combination with agrotechnical measures is of great importance in managing the growth rate. Moderate humidity activates the physiological processes of plants and makes it possible to use water efficiently. In such conditions, plant nutrition and growth processes are activated [1-3].

Several works have been carried out to study the negative effects of water deficit on growth processes [4-8]. The growth processes of plants are strongly affected by drought. Their growth rate is directly related to the degree of drought and its impact. The reaction of plants to the effect of such a stress factor consists of several stages. According to the data, the reaction of plants to adverse factors consists of individual reaction and restitution (recovery) stages [9-12].

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Drought slows down the growth of the plant and its developing organs. As a result, there is a decrease in the weight of biological and economic crops. Lack of water in the soil slows down the growth processes and negatively affects the quality of the crop. Lack of water in the soil negatively affects all stages of plant development. The adverse effects of drought are observed even after moisture is restored to moderate levels. According to many experimental data, plant growth is more sensitive to drought than photosynthesis [13-17].

Growth rate and degree of increase in plant mass have been used by most scientists to determine drought tolerance. Higher than moderate soil moisture levels also affect growth processes. It is mostly oxygen and SO_2 occurs through an imbalance in the environment. According to a number of scientific sources, under the influence of drought, the growth processes of cotton plants also slow down, and there is an imbalance in the stages of development. The accumulation of crop organs slows down, especially the shedding of pods and flowers. The overall photosynthetic productivity decreases, especially the weight of the farm crop and its quality [15-19].

When studying the effect of drought on the growth of plants, it is necessary to take into account the different characteristics of their resistance to dehydration. Also, the response reactions in the growth process of plants are related to the different resistance properties of organs and tissues.

The nature of adaptation of plants to adverse factors consists of three stages. These are excitation, resistance and exhaustion. If the stage of exhaustion lasts long, the plant will die. A decrease in the level of soil moisture slows down the rate of movement of water in the soil. As a result, the growth processes of plants slow down at first. This situation is the main reason for the decrease in productivity under drought conditions. The length of the main stem is directly related to the rate of plant growth: growth is an irreversible process, which is associated with the formation of new cells, tissues and plant organs. It is also associated with increased cell size and growth [16].

Roots are less sensitive to the negative effects of drought than stems and leaves. Root growth continues even in conditions of water shortage in the soil. When the amount of water in the soil drops to the wilting point, root growth stops. Effects of soil and atmospheric drought on plant growth and development stages have been extensively studied in cereal plants. Atmospheric drought slows cell elongation and leaf tissue differentiation. Soil drought has a less negative effect on cell division and more on its elongation [17],

Research Objects and Methods

Bukhara-102, Bukhara-8 and S-6524 varieties belonging to the group of medium fibre cotton varieties were used as the object of research. Currently, these varieties are planted in large areas in several regions of our republic. During the experiments, grassland-alluvial soils common in the region were used. Such soils form the main areas of the Bukhara region.

Experiments were conducted to study the effect of drought on growth and leaf area expansion of cotton cultivars. In the experiments, the water deficit of the soil was studied by determining the soil moisture before irrigation, its volumetric weight and field moisture

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capacity, and irrigation was carried out. All experiments were conducted under moderate soil moisture conditions of 70 per cent humidity and drought conditions of 30 per cent humidity. 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. All observations, measurements and research work on the growth and development of plants were carried out in accordance with the methods of UzPITI.

In the conducted experiments, the growth of cotton varieties and the expansion of the leaf surface were studied under conditions of moderate humidity (70 per cent) and drought (30 per cent). In the experiments, the growth of cotton varieties was determined by generally accepted methods, and the expansion of leaf surfaces was determined by the method of sections. Determination of physiological indicators and phenological observations were carried out in the experiments at the stages of cotton budding, flowering and budding. To determine these parameters, a moderately developed third leaf was taken from the tip of the stem.

Results and Discussion

Slowing down of growth in the conditions of water deficit in the soil is associated with a decrease in the rate of photosynthesis and an increase in the consumption of substances in the process of respiration. Changes in the activity of these processes affect the productivity of plants.

We studied the growth dynamics of cotton varieties and the expansion of the leaf surface under the conditions of field experiments. In these experiments, the growth of cotton varieties and their developmental stages were determined.

In these experiments, the effect of two different moisture levels on the growth dynamics of cotton varieties was studied. The growth rate of all cotton cultivars increased from heading-to-heading stage under moderate and limited moisture conditions. The highest rate for all cultivars was observed at the budding stage under two different moisture conditions. The growth rate of cotton cultivars under conditions of limited moisture was much lower than that of plants with moderate moisture (Table 1).

Table 1. Growth dynamics of cotton varieties, cm

T/r	*Varieties*	*Shonalash*	*Flowering*	Clumping
		Soil moisture, 70%		
1	Bukhara-8	35.7±0.33	59.9±0.55	86.7±0.74
2	S-6524	34.8±0.42	56.7±0.80	84.5±0.61
3	Bukhara-102	39.0±0.36	62.6±0.62	90.5±0.70
		Soil moisture, 30%		
1	Bukhara-8	31.8±0.55	57.4±0.48	81.5±0.38
2	S-6524	28.7±0.60	54.5±0.60	76.5±0.20
3	Bukhara-102	34.5±0.49	59.5±0.50	86.4±0.42

Compared to the results of field experiments, the negative effect of soil drought on the growth rate of S-6524 varieties was stronger. As a result, the height of this plant was the lowest compared to other varieties. The effect of soil drought on growth processes was

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weaker in the Bukhoro-8 and Bukhoro-102 varieties. In general, the growth dynamics of all studied cultivars were different depending on the level of water supply and development stages. The observed differences in this indicator among the cultivars were different depending on their individual, biological and physiological characteristics. The negative effect of soil drought on the growth rate of Bukhoro-102 and Bukhoro-8 varieties was weaker than that of other varieties.

In the course of research, along with indicators characterizing plant productivity, changes in leaf levels depending on drought were also determined. The formation of leaves in plants and their development levels are of great importance in characterizing the life processes of plants, especially their photosynthetic properties.

One of the main functions of leaves is assimilation. Important processes such as photosynthesis, transpiration, respiration, mineral nutrition, water regime and other processes are directly related to leaf activity. In turn, the activity of these processes affects the yield and its quality [18].

The degree of foliage of plants is an important characteristic of varieties. The growth of the leaf surface and its surface depends on the influence of many factors. In particular, the level of water supply to plants is closely related to the size of the leaf surface. According to long-term data, water deficit in the soil has a strong negative effect on the expansion of leaf surfaces [19-24].

Excessively small or large leaf area leads to a decrease in yield in a given area. One of the main factors in ensuring a high-quality harvest is the moderate growth of the leaf surface of plants. However, the lack of water in the soil causes a sharp reduction in the leaf area [25-28].

The leaf area, height growth and dry matter accumulation of the plant grown under conditions of severe soil drought were reduced by 80-85% compared to those under moderate humidity. According to the scientific works of several scientists, the rate of formation of the leaf surface was directly related to drought and high temperature.

The results of the experiments obtained on this indicator are presented in Table 2. The leaf level of cotton varieties was determined at the stages of tillering, flowering and budding. In conditions of moderate moisture, the studied varieties accelerated the expansion of the leaf surface. Under the influence of limited moisture (30% moisture), i.e., soil drought, the leaf sizes of all studied cultivars were small. The level of reduction of leaf surfaces was different depending on the biological characteristics of the varieties. At the budding stage of cotton varieties, the leaf levels of the varieties reached the highest level.

Table 2. Leaf area of cotton varieties, cm2

T/r	*Varieties*	*Shonalash*	*Flowering*	**Clumping**
Soil moisture, 70%				
1	Bukhara-8	627.4±4.5	1293.6±4.4	1787.4±3.2
2	S-6524	591.7±4.3	1110.5±3.2	1693.3±3.0
3	Bukhara-102	640.5±3.7	1341.8±4.2	1815.0±4.3
Soil moisture, 30%				
1	Bukhara-8	457.6±4.7	626.2±3.2	811.6±6.3
2	S-6524	412.1±5.1	582.0±6.1	787.5±4.4
3	Bukhara-102	493.6±5.2	681.7±3.5	874.9±6.0

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Therefore, according to the data presented above, soil drought has a negative effect on the leaf levels of cotton varieties and slows down their growth. The growth of cotton cultivars varied depending on their cultivar and biological characteristics. Similar connections and conclusions were observed in the work of many scientists.

Among the varieties studied above, the leaves of Bukhara-102 are less affected by drought than other varieties. Under the influence of drought, the value of this indicator was the lowest in S-6524 varieties.

Conclusions

In the conducted experiments, the main physiological indicators of cotton varieties that determine the level of resistance to water deficit in the soil were determined, and their direct dependence on the characteristics of the variety was scientifically substantiated. The negative effects of drought on growth and development and leaf area expansion of all cotton cultivars were higher under dry (30% moisture) conditions. Such a negative effect was stronger in the cotton variety S-6524. It was found that the drought-resistant Bukhara-102 variety has relatively low negative effects of drought due to its protective adaptation characteristics.

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