

EFFECT OF SOIL TYPES, SALINITY AND MOISTURE LEVELS ON COTTON PRODUCTIVITY

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Abstract

The following article deals with the data obtained as a result of studying the effect of soil types, salinity and moisture levels on cotton productivity in the conditions of irrigated and saline soils of the Bukhara oasis. In the conditions of ancient irrigated meadow-alluvial, brownish-brown and newly developed desert sandy soils, the growth rate, expansion of leaf surfaces and various changes in the soft productivity of photosynthesis in the crop cross-section depend on the strength of environmental stressors and biological features of varieties.

Keywords: soil types, salinity, moisture levels, growth, leaf levels, soft productivity of photosynthesis.

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INTRODUCTION

Soil salinity affects on many irrigated areas, mainly as a result of the use of salt water. Around the world, 45 million hectares of irrigated lands are contaminated with salt and 1.5 million hectares are removed from production annually due to high soil salinity, and salinization is currently one of the most serious factors that limits crop yields, negatively affects on crop productivity and yield. In arid and semi-arid regions salinity is one of the major abiotic stressors, soil salinity is prevalent in all climatic regions, and more than 800 million hectares or more than 6 percent of the globe are negatively affected by salts [1].

Soil salinity reduces plant growth, development, and survival as well. During the appearing and developing process of salt formation, it affects all important processes such as photosynthesis, protein synthesis, energy and lipid metabolism [2].

In addition, when salt is present in the soil solution, they alter the balance of nutrients, limiting the absorption of essential nutrients through the roots [3].

There are many factors that contribute to salinity: salt content, climate, topography, and human activities. The intensity of salinization depends on the amount of salts in irrigated water, soil physics and chemistry, plant type, plant growth stages and irrigation regimes [4].

Under the influence of soil salinity, the productivity of agro and biocenoses decreases, the genetic composition of biodiversity changes, and serious economic losses can be observed. Decreased levels of adequate moisture supply to crop areas have recently led to an increase in soil salinity and a decrease in yield [5].

For normal growth and development of plants, firstly, to provide plants with the necessary amount of nutrients and moisture, secondly, to accelerate biological and physicochemical processes in soils through exposure to the microclimate, and finally to increase soil temperature. That is, in order for plants to grow normally and produce high yields, it is necessary to supply these

plants with the necessary moisture, nutrients, heat, light and air at all stages at the same time [6-8].

Thus, increasing the fertility of soils through irrigation creates a microclimate in these areas, a process that improves the chemical-physical, and thermal-biological properties of soils in hot-dry areas and allows increasing productivity. These opportunities can be realized only if we carry out irrigation work correctly, rationally, based on high agronomic techniques, paying close attention to the water regime, determining its timing, watering rate and water demand of plants grown in this area, and other factors achieving the goal set before us, to get the planned harvest in the future and at the same time increase soil fertility [9].

As the groundwater level approaches the surface, the cotton root is strongly affected by the over-moistened and soil salinity layer. The groundwater then activates evaporation processes as the water level rises closer to the soil surface layer. Besides, this condition increases soil salinity, leads to a violation of their water-salt and nutrient regimes, as well as severe damage to cotton. In such soil salinity, not only the overall photosynthetic productivity and yield weight of cotton decreases, but also the value of yield quality indicators decreases rapidly [10-12].

As we have mentioned above, in the Bukhara oasis, the irrigated meadow alluvial, salty and newly developed desert sandy soils are saline to varying degrees, which greatly impairs the normal growth and yield of cotton. Therefore, in order to combat saline soils, saline soils were washed on irrigated lands, including the Bukhara oasis.

Scientific substantiation of physiological and ecological features of the Bukhara oasis, which reflects the effect of salinity and moisture levels on the valuable characteristics of cotton varieties in the conditions of saline and different soil types that has a great theoretical and practical importance.

Subjects of the research

During the research, strong, medium and low salinity meadows - alluvial, brown and desert sandy soil types, as well as cotton

varieties Bukhara-8, Omad and C-4727 were used as the object of research.

METHODS OF THE RESEARCH

During the experiments, the study of the growth and development of Bukhara-8, Omad and C-4727 varieties in the soil-climatic conditions of the Bukhara oasis was carried out by the method of comparative analysis.

In order to study the ecophysiological effects of soil types, salinity and moisture levels on some physiological characteristics of cotton varieties, growth of varieties, leaf surface expansion [13] and net productivity of photosynthesis were taken into account during the development and flowering stages of varieties [14].

In order to improve the air-water and nutrient regimes of soils, reduce the impact of filtration and wind erosion processes, 35-40 tons of decomposed manure, 270 kg of nitrogen, 170 kg of phosphorus and 100 kg of potassium fertilizers were used for per hectare.

In all field experiments, soil water deficit was studied and irrigation was carried out by determining soil moisture before irrigation, its volumetric weight and field moisture capacity. All experiments were carried out under conditions of soil moisture 3 different and soil salinity weak, medium and strong. Under some experimental conditions, soil moisture was kept at 70-75-70%, 65-70-65%, 60-65-60% relative to the total moisture capacity. Seeds were planted in rows at 60 cm intervals. All digital data obtained as a result of the study were re-statistically analyzed [15].

RESULTS OF THE RESEARCH AND ITS DISCUSSION

Salinity has a strong effect on plant growth processes. Their growth rate is directly related to the degree of salinity and its potency. Due to the low root pressure in the 3-4 leaf stage of cotton, it does not absorb enough water from saline soils. Adult plants, on the other hand, have the ability to absorb the water they need through a developed root system and as a result of transpiration in the leaves. Harmful salts accumulated in the body of adult plants are released into the external environment using special glandular cells and feathers.

The salinity of plants varies in their ontogeny. Plants are resistant to salt in the early stages of growth. Therefore, in the early stages of growth, plants can be protected to a certain extent from the harmful effects of salts by regulating the water balance in their body.

Data on the effect of salinity and moisture on the growth of cotton varieties are given. During the cotton growing season, this figure was taken into account 2 times. The study found that the growth rate of cotton varieties studied was directly related to soil types, soil salts, as well as growth and development stages.

According to the data obtained and analyzed, for the first time in the Bukhara oasis it was found that medium-saline irrigated meadows grow in alluvial, newly developed gray-brown soils and newly developed desert sandy soils. From the data obtained, the growth and development of the plants as well as the length of the neck were different, as the studied cotton varieties had different resistance to salinization. According to the observations, depending on the type of soil, mechanical composition and moisture level, the morphological structure of cotton varieties changed, including the growth and development of their height during the growing season. In the alluvial soils of the meadow in the 70-75-70% humidity variant, the height of Bukhara-8 variety at the stage of mowing was -63.4 cm, while the height of Omad and C-4727 cotton varieties was -54.5 and -56.3 cm, respectively.

Similar changes or dependences on changes in the growth of cotton varieties during the growing season are observed in soils

with a moisture content of 65-70-65% and 60-65-60%. In meadow-alluvial soils with 65-70-65% and 60-65-60% humidity, plant height was shorter than in plants with 70-75-70% humidity. Significant slowing of growth and development has also been found under the influence of salinity.

In the newly developed red-brown soils and desert sandy soils of the Bukhara oasis, the height of the plants was shorter than the height of the plants grown in the alluvial soils. In the studied soils, the differences in growth and development of plant height in this case, according to our observations, were directly related to the type of soil, mechanical composition, soil salinity and moisture level. The variation in height of the cotton varieties studied may depend on the soil types on the one hand, and on the moisture levels on the other, as well as on the biological characteristics of the varieties.

The height of all cotton varieties studied in 65-70-65% humidity conditions of meadow alluvial soils is -58.5 in Bukhara-8 varieties, -68.4 in flowering stages, -50.8 in Omad varieties and -60 in flowering stages, respectively. C-4727 was 52.5 cm in the flowering stage and -62.1 cm in the flowering stage. A similar relationship was observed in cotton varieties grown at 60-65-60% humidity.

Bukhara-8 variety -56.3, flowering stage -66.2, Omad variety -48.8, and flowering stage 55.6, C-4727- in brown-brown soils at 65-70-65% humidity conditions. In C-4727 varieties it was -50.5 cm at the stage of mowing and -60.4 cm at the stage of flowering.

In desert-sandy soils at humidity 65-70-65 at the stage of mowing Bukhara-8 variety -52.3, at the stage of flowering -65.4, at Omad variety at the stage of mowing -46.8, at the stage of flowering -52.6, C - 4727 -48.8 cm at the stage of mowing and 59.3 cm at the stage of flowering.

It was found that the height of all cotton varieties grown in 60-65-60 humidity conditions was low in all varieties depending on soil types. High results on this indicator were found in Bukhara-8 cultivar at 70-75-70% humidity of meadow-alluvial soils. The last place was taken by Omad variety. Different levels of variation in the height of the studied varieties may depend on the biological characteristics of the varieties, soil-climatic conditions, as well as the level of water supply.

One of the main functions of leaves is assimilation. Important processes such as photosynthesis, transpiration, respiration, mineral nutrition, water regime and other physiological processes are directly related to leaf activity, which in turn affects the activity of these processes and their quality.

In addition to the indicators that characterize the productivity of plants during the study, it was found that the leaf surfaces change depending on salinity, soil types and its moisture levels. Leaf formation and their developmental stages in plants play an important role in characterizing the vital processes of plants, especially the photosynthetic properties. Leaf levels of plants vary depending on soil types and moisture levels.

As a result of the decrease in humidity, the productivity of cotton leaves also decreases. Leaves, the main photosynthetic organ, play an important role in providing nutrients to plants. Leaf formation and their developmental stages in plants play an important role in characterizing the vital processes of plants, especially the photosynthetic properties.

Under the influence of soil salinity, the performance of the leaves slows down, its overall level decreases. As a result, the synthesis of organic matter is reduced. During our experiments, the effect of different soil moisture levels on the leaf surface expansion of cotton varieties under moderately saline conditions was taken into account during the mowing and flowering stages under three different soil types.

From the data obtained, it was found that the expansion of the leaf surface depends on the moisture level in the soil. In particular, under the influence of moderate soil salinity, a decrease in leaf surfaces was observed in the variants grown in 60-65-60% humidity conditions. With the decrease in soil moisture, a decrease in leaf level was observed in all varieties. Such a decrease was observed in cotton varieties grown in desert-sandy soils with moderate soil salinity and moisture content of 60-65-60%.

It was noted that the leaf level of all varieties grown in 70-75-70% humidity conditions was higher than the leaf level of varieties grown in 65-70-65% and 60-65-60% variants.

The expansion of leaf surfaces of the cotton varieties studied varied depending on their growth and developmental stages, soil salinity, moisture levels, and the characteristics of the varieties. It was noted that in the variants grown in different soil conditions, the leaf surfaces of all varieties increase from the stage of mowing to the stage of flowering.

It was noted that the value of leaf surfaces in Bukhara-8 and C-4727 varieties is higher than in Omad variety, depending on the moisture levels in the meadow-alluvial soils.

Leaf level increases in all varieties from the stage of flowering to the stage of flowering. The smallest leaf surfaces were observed in all cultivars grown in desert-sandy soils at a moisture content of 60-65-60%.

During the study, it was also noted that one of the indicators characterizing the productivity of plants is the change of leaf surfaces depending on the moisture level. In general, the expansion of the leaf surface is also one of the indicators directly related to the overall photosynthetic productivity of plants. This is because the intensity of photosynthesis in the leaves and the resulting amount of organic matter are also important in the formation of biological and economic yields in plants. Adverse environmental factors also affect the formation of leaf surface in plants. The small size of the leaf surface leads to a decrease in the soft productivity of photosynthesis.

Soil salinity, moisture levels, and soil types had a negative effect on the expansion of leaf surfaces of all cotton varieties studied. The response of varieties to such a negative impact force varied depending on their biological characteristics.

Leaf levels in cotton varieties grown in meadow-alluvial soils at 70-75-70% humidity were as follows: Bukhara-8 variety at the stage of mowing - 1096.9, flowering stage-2015.7, Omad variety at the stage of mowing -980.0, at the flowering stage while - 1897.2, C-4727 was 998.9 cm² at the stage of flowering and 1911.5 cm² at the stage of flowering.

Leaf level in cotton varieties grown in meadow-alluvial soils at 65-70-65% humidity is 899.5 in Bukhara-8 variety, -1806.9 in flowering stages, -879.9 in Omad varieties and -1739.0 in flowering stages, C-4727 was -880.3 cm² at the mating stage and -1774.7 cm² at the flowering stage.

According to the data obtained the fact that the expansion of leaf surfaces of cotton varieties varies depending on the stages of growth and development, soil types and moisture and salinity levels may be related to the individual characteristics of varieties, as well as their adaptability to adverse factors.

The net productivity of photosynthesis is directly proportional to the biological and economic yield of plants. Organic matter makes up 95% of the dry mass of plants. The bulk of these organic matters are used for the formation of generative organs.

Under the influence of soil salinity from unfavorable factors of the external environment, the duration of the pure productivity of photosynthesis is reduced, resulting in a decrease in the assimilation productivity of plants.

During the experiments, along with a number of indicators that determine the growth and development of cotton, the effect of pure productivity of photosynthesis of cotton varieties on soil types and salinity levels was also determined. The experiments were conducted in the field.

From the data obtained, the value of the net productivity of photosynthesis varied depending on soil salinity levels as well as soil types. It was noted that the value of this indicator was higher in non-saline variants than in saline variants. It was noted that the value of the net productivity of photosynthesis decreased with increasing salinity in all varieties.

In all cotton varieties grown on grassy-alluvial soils, the value of the pure productivity of photosynthesis was higher in all variants than in brown soils and desert-sandy soils. It was observed that the value of this indicator in Bukhara-8 variety is much higher than in other varieties.

Pure productivity of photosynthesis at the stage of budding of Bukhara-8 variety grown in non-saline conditions of meadow-alluvial soils -8.1, at the stage of flowering -10.3, at the stage of Omad variety -6.5, at the stage of flowering -7.8, at the stage of C-4727 variety -7.2, at the flowering stage -9.1.

In the unsalted variants of brown soils, the net productivity of photosynthesis in the budding stage of Bukhara 8 varieties is 7.4, in the flowering stage 9.2, in the budding stage of Omad variety 5.9, in the flowering stage -7.2, in the budding stage C-4727 -6.5, at the flowering stage was 8.2.

In the unsalted variants of desert-sandy soils, the net productivity of photosynthesis at the mating stage of Bukhara-8 variety is -6.9, at the flowering stage -8.3, at the mowing stage of Omad variety -5.6, at the flowering stage -6.6, at the mowing stage of C-4727 variety - 5.8, at the flowering stage -7.1.

Similar patterns were found in weak, moderate, and strongly saline conditions of meadow-alluvial soils, brownish-brown soils, and desert-sandy soils, and it was noted that the value of net productivity of photosynthesis was highest in meadow-alluvial soils.

In our study, it was found that the value of the net productivity of photosynthesis in all three species decreases with increasing salinity compared to non-saline variants.

A sharp decrease in the value of this indicator was observed in all varieties grown, especially in strongly saline desert-sandy soils. It was noted that the value of this indicator was the lowest in the lucky variety. The accumulation activity of dry matter in the studied varieties was directly related to their salinity resistance traits, and it was found that more dry matter accumulation was more active in the salt-tolerant cotton varieties than in the non-tolerant ones.

The value of the net productivity of photosynthesis was the highest in the Bukhara-8 variety. The lowest rate was recorded in the Omad variety. Such varying variations in the value of the net productivity of photosynthesis may depend on soil types, salinity levels, and the biological characteristics of the varieties.

CONCLUSION

Soil salinity levels in all studied varieties led to a slowdown in growth rate, leaf surface expansion, and photosynthesis net productivity in all varieties, depending on soil types and moisture levels. All of the non-salinity control options reported high values of the above three indicators.

It was found that the value of the above indicators of the studied cotton varieties varies depending on the biological characteristics of the varieties, soil salinity and moisture levels, as well as soil types, stages of development. Based on the data

obtained, it was noted that Bukhara-8 variety has higher resistance to salinity than C-4727 and Omad varieties.

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