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Research Article

SALINITY AND PHYSIOLOGICAL CHARACTERISTICS OF SOYBEAN VARIETIES

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ABSTRACT

The article presents the data obtained on the study of the effect of soil salinity on some physiological characteristics of different soybean varieties. A decrease in the rate of transpiration and total water content was found in all varieties under conditions of saline soils. Based on the given results, it was noted that the above indicators change in various degrees in the section of the varieties and are related to the soil salinity and biological and varietal properties of the varieties, as well as the level of tolerance to salt.

KEYWORDS

Soybean varieties, soil salinity, transpiration rate, total water content, salt tolerance.

INTRODUCTION

Due to the growing population of the world, the demand for food products is also increasing. The world population was 7.4 billion in 2018, and it is predicted to reach 9.7 billion by 2050. Nowadays, global climate change and continuous increases in air temperature lead to the reduction of water reserves, the expansion of the level of saline lands, and the decrease in the yield and quality of agricultural crops. In order to reduce the impact of such abiotic factors, the study of the physiological basis of increasing salt tolerance, yield and quality of agricultural crops, including soybeans, is of great scientific and practical importance.

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Wide use of the existing gene pool of the main agricultural crops such as soybeans in genetic-selection research, creation of new promising lines and varieties using the physiological indicators of plant water exchange and their relationship with morpho-economic signs are urgent tasks.

At the same time, the issue of food safety has become one of the priority tasks in all countries of the world today. Because there is a worldwide food shortage due to global warming and demographic problems. The increase in natural disasters for various reasons has a negative impact on the supply of food products for the population. The main goal of the work being carried out today is to provide the population with the necessary food products.

Soy is a very old crop. Scientists have studied the variety of shapes and types of soy and noted that these types are mainly formed in 3 centres. They are South-East Asia, Australia and East Africa. According to the opinion of most scientists, the homeland of soy is the southeastern region of Asia. Soy has been cultivated as a food crop in Eastern countries since ancient times [1].

Soybean is an oil and grain crop that occupies an important place in world agriculture. The widespread distribution of soybeans on the earth is related to the quality of the grain and protein. The amount and ratio of protein, oil and other important organic substances and various macro and microelements in the grain allow it to be used in various sectors. Oil, margarine, cheese, milk, flour, confectionery products, and canned goods are produced from soybeans. Soybean oil makes up 40% of the vegetable oil produced on earth [2].

Soy (Glycine max Merr.) is one of the most important leguminous crops grown in tropical, subtropical and temperate climates. Soybean seeds contain 18-24% fat, 36-40% protein, 26-34% carbohydrates and 5-8% minerals. Therefore, it is an important source of vegetable oil and high-quality vegetable protein consumed for human and animal nutrition worldwide [3].

In recent years, researchers have been paying increasing attention to soybeans and their processed products, which are the most important sources of dietary proteins and other physiological nutrients for humans. Soybeans and their products are used for food purposes in many countries, including the USA, Canada, some countries of the European Union, Japan, China, Korea and others. In these countries, soy products are used not only for traditional purposes but also for treatment and prevention purposes [4].

The issue of studying and scientific justification of the technological properties of growing soybean varieties in saline soil and climatic conditions and using them in the food and processing industry is on the agenda. The value of soybean is the presence of all available amino acids in its composition - lysine, arginine, leucine, methionine and other non-exchangeable acids.

Growth and development are one of the most important factors in the production process of plants. Growth means an irreversible increase in the size and mass of cells of organs or the whole organism, which is associated with a neoplasm of their structures, and development means a qualitative change in the body, renewal [5].

Plants with low growth activity usually have low competition for nutrients and sunlight, which results in slow growth and low productivity.[6]. In the shade, this situation is exacerbated by their need for heat, and when left in low positive temperature conditions, the development of seedlings stops and may even lead to their death [7-8].

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It appears that the main factor affecting soybean productivity is not long, relatively cold spring periods or excessively hot summers, but rather the fact that soybeans grow slowly due to soil salinity and, as a result, are unable to compete with other crops.

One of the important limiting factors is the slow initial growth and development of seedlings, which makes heat-loving crops vulnerable to adverse weather conditions and insufficiently competitive with weeds.

In this regard, it is very important for such areas to create varieties with high activity of initial linear growth so that in the early stages of development, they can quickly form a photo assimilation apparatus to further maintain the normal life of plants. For this, the researchers suggest actively using the initial growth and development indicators of plants in selection [9-14].

METHODS

Research works were carried out on the basis of methods of vegetative and field experiments. 2 prospective (domestic Nafis and foreign Selekta-101) varieties of soybean were used as objects of research. The experiments were carried out in conditions of 1) non-saline, and 2) medium-strongly saline soils. During the experiments, certain physiological parameters of the studied soybean varieties were determined under the conditions of two variants - the rate of transpiration, the total amount of water in the leaves, etc.

The surface of the tiles is 50m2. The standards for planting seeds are 550,000 seeds per hectare, 4-5 cm deep. The sowing period is the second ten days of April. Antecedent - cotton. Planting was carried out in SPCh-6 seeders. Soil moisture was retained at 70% of soil limited field moisture capacity (ChDNS) during the plant life. Other agrotechnical activities under the pilot scheme of soybean planting methods and norms were conducted based on the cultivation technology adopted in the region.

RESULTS AND DISCUSSION

By studying the variation in initial growth parameters in soybean cultivars under study, earlier root emergence, faster soil penetration, and faster dry mass accumulation will have a major advantage in the survival battle with weeds. Another disadvantage of saline soil stress for the plant is that the cultured plant cannot outcompete the foreign plant for nutrients and light.

According to modern physiological advances, the negative effects of soil salinity on plants are related to both the high osmotic pressure of the soil solution and the toxicity of salts. Under these conditions, toxic metabolic intermediates: diamines, putrescine and cadaverine accumulate in plant tissues. Under salt stress, the formation of proteins in plants slows down, and even the breakdown of previously formed protein complexes increases. A decrease in protein synthesis is manifested in a significant decrease in the rate of growth and development of plants, and in the disruption of metabolic processes.

Transpiration is one of the main processes in managing the water balance of plants. It is known that transpiration is one of the important physiological processes and is of great importance in the water exchange of plants.

In the conditions of non-saline soils, soybean varieties have maximum transpiration. As a result, the absorption of water and nutrients from the soil increases, and the diffusion of SO_2 into the leaf mesophyll accelerates. In such conditions,

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photosynthesis accelerates and many organic substances are synthesized. During the experiments, the tillering, flowering, and poddingstageThe influence of optimal and limited humidity on the rate of transpiration was studied [15-19].

This indicator is optimal soil moisture (control option) and was determined in all soybean varieties grown in fields with limited (experimental option). The data obtained on the assessment of the effect of water salinity on the rate of transpiration at the rooting stage showed that high indicators, that is, the rate of water evaporation of plants, were determined in the Nafis variety under both conditions. And low indicatorsSelection-101was recorded. Based on the obtained data, it was determined that the rate of water evaporation of soybean varieties changes depending on the salinity in the soil and the stage of plant development.

Transpiration rates were higher in all soybean cultivars grown in non-saline soils at the flowering stage than at the tillering and podding stages. Soybean cultivars grown in non-saline conditions have a faster rate of water evaporation than plants grown in saline conditions. Soil salinity had a negative effect on the water exchange properties of all studied varieties. In optimal conditions, water consumption by plants is more active than in saline conditions.

It was found that the evaporation of water by soybean varieties in saline soils is much lower than that of plants in the optimal variant. If we compare the cross-section of varieties, even in extreme conditions, the Nafis soybean variety is distinguished by its active transpiration compared to other varieties. Most importantly, under saline conditions, salt stress has a strong negative effect on the water exchange of soybean cultivars, reducing the rate of transpiration. Under these conditions, the Nafis variety activates its metabolic processes by evaporating more water than other varieties.

By determining the amount of water in plants, it is possible to observe the changes that occur in the water balance of plants under the influence of favourable and unfavourable factors. The water contained in the plant is mainly divided into two groups. These are free and bound waters. The sum of the two forms the total amount of water. Free water is often referred to as metabolic water. Because such waters are directly involved in the metabolic processes taking place in the plant body. Bound water does not take part in metabolic processes, it is mostly combined with high molecular substances. Therefore, depending on the amount of free water in the body of plants, it is possible to draw conclusions about metabolic processes. The amount of bound water often determines the resistance of plants to unfavourable factors [20-25].

Based on the obtained data, it was observed that the total amount of water in the leaves varies depending on the growing conditions of soybean varieties. The total water content of all soybean cultivars grown under non-saline conditions was observed to be higher than that of soybean cultivars grown under saline conditions. The highest results for this indicator were found in the Nafis variety.

In the course of the experiments, high results in terms of total water content were observed in soybean varieties grown under optimal conditions of the flowering stage of all varieties. During our experiments, it was found that the flowering stage of all studied soybean varieties in plants grown in saline conditions has a much lower total water content than the varieties grown in non-saline conditions.

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Similar relationships were also noted in the tillering and podding stages of soybean varieties. However, it was observed that the total water content was less in the tillering and podding stages than in the flowering stage.

CONCLUSION

Thus, it was determined that some physiological indicators of the studied soybean varieties change depending on the biological characteristics of the varieties and soil salinity. Studies have shown that one of the important limiting factors, namely soil salinity, made it difficult for plants to take up water from the soil, causing water evaporation through the leaves and a decrease in the total water content of the leaves. This caused an increase in the water deficit in the leaves and at the same time a decrease in the productivity of the varieties.

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