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Productivity Characteristics Of Sorghum Varieties Under Water Shortage Conditions

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Abstract
The article presents the data obtained on the basis of the study of the yield characteristics of the Karabash, Massino, Samurai and Uzbek Pakana and Uzbek-18 varieties of sorghum under water deficit conditions. Among some physiological indicators studied under water shortage conditions, it was determined that the rate of height growth of the varieties, the expansion of the leaf surfaces, and the value of the net photosynthesis productivity change in different levels in the cross-section of the varieties, depending on their resistance levels.
Keywords: sorghum, limited moisture, optimal moisture, drought, growth rate, leaf levels, photosynthetic net productivity, productivity.

Introduction

Sorghum is a valuable food and fodder crop for areas where wheat and other staple grains cannot grow or produce low yields due to arid climates. Sorghum is extremely important for arid regions as a forage crop. Sorghum, which is highly drought tolerant, surpasses barley and even maize in yield [1].

Sorghum is a very promising crop for high-quality silage production in the arid southern and southeastern regions, where it outperforms corn in terms of green mass yield and digestible protein collection. Oat grows well after harvest, the leaves and stems of the plants retain their juiciness until the grain is fully ripe [2-4].

Grain sorghum has a high nutritional value as a forage crop in addition to its drought resistance and is a good concentrated feed for all types of livestock, poultry and fish. It contains 70-75% starch, 9-15% protein, 3.5% fat. 100 kg of grain contains 118-120 kg of nutritional units. Grain contains 17 important amino acids, vitamins (E_1, B_1, B_2, B_3, carotene), minerals (P_2O_5, K_2O and MgO), and tannins [5-6].

Grain formation is the period on which the nutritional benefits of sorghum depend in many ways. Its duration is closely related to parameters such as weight of 1000 grains, protein, starch and essential amino acids. With full ripening, physiological and biochemical processes associated with post-harvest ripening continue in the grain [7-8].

Drought is the main limiting factor in major sorghum growing areas, significantly reducing yield. Effects of drought stress on grain yield and quality of sorghum at different growth and development stages under conditions of climate change and reduced water availability have been investigated. Well-planned and detailed studies covering all stages of plant growth and development are needed to gain a clearer understanding of the general effects of drought on sorghum and the characteristics of plant responses to drought. In general, to avoid the negative effects of drought stress, it is very important to develop drought-tolerant cultivars suitable for different agro-climatic conditions, especially in arid and semi-arid regions [9].

Materials and methods

Research on the ecophysiological basis of sorghum varieties in the soil and climatic conditions of the Bukhara oasis was carried out in the conditions of laboratory and field experiments. Karabash, Massino, Samurai and Uzbek Pakana and Uzbek-18 varieties of sorghum (Sorghum vulgare (Pers.)) were taken as the object of research. These varieties are currently being planted in the fields of several regions of our republic. In the course of research, the following ecophysiological parameters of the varieties sensitive to the water stress of the varieties - growth rate of plants, expansion of leaf levels, and net photosynthetic productivity were determined.

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The soil of the experimental areas belongs to the meadow-alluvial type. Pre-irrigation soil moisture was ensured to be 60-60% of field moisture capacity, 50% during tuberting, budding and flowering phase and 70% in later phases.

In all field experiments, soil water deficit was studied by determining soil moisture before irrigation, its volumetric weight and field moisture capacity, and irrigation was carried out. Irrigation rates were determined based on soil moisture deficit. All experiments were carried out in two types: 1. Control: (optimal humidity, 70%) and 2. Experiment: (limited humidity, 50%) in arid conditions.

Results and discussion

In the management of plant growth, the level of water supply together with agrotechnical measures is of great importance. Growth processes change dramatically under the influence of unfavourable factors of the external environment. 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.

In our experiments, the effect of two different moisture levels on the growth dynamics of sorghum varieties was studied. The growth rate of all sorghum cultivars increased from the tuber to the flowering stage under moderate and limited moisture conditions. In general, the growth dynamics of all studied cultivars were different depending on the level of water supply and development stages. The highest rate was observed at the flowering stage for all cultivars even under dry and moderate moisture conditions. The rate of height growth of sorghum cultivars under conditions of limited moisture was much lower than that of plants under moderate moisture conditions.

The observed differences in this indicator among the cultivars were different depending on their individual, biological and physiological characteristics. During our experiments, the height of the sorghum varieties varied. In particular, in the fruiting stage, the height of the stem is 199.8 in the Karabash variety under moderate humidity conditions, and 173.2 under limited humidity conditions, 136.6 under moderate humidity conditions in the Massino variety, 127.3 under moderate humidity conditions, 117.8 under moderate humidity conditions, and 117.8 in the Samurai variety under limited humidity conditions. in conditions of 114.6, in the Pakana variety of Uzbekistan it was 106.0 in conditions of moderate humidity, 92.6 in conditions of limited humidity, and in the variety of Uzbekistan-18 it was 121.4 in conditions of moderate humidity and 112.0 cm in conditions of limited humidity.

At the flowering stage, the height of the stem in the Karabash variety under conditions of moderate humidity is 215.0, and under limited humidity conditions is 189.1, in the Massino variety under moderate humidity conditions, 150.8, under limited humidity conditions, 137.8, under moderate humidity conditions, in the Samurai variety, 129.5, under limited humidity conditions, 120.8, in Uzbekistan Pakana variety was 115.3 in moderate humidity conditions, 105.4 in limited humidity conditions, and in Uzbekistan-18 variety in moderate humidity conditions, it was 121.4, in limited humidity conditions 121.6 cm.

According to the rate of growth of the varieties, the highest rate was taken by the Karabash and Massino varieties, the intermediate place was occupied by the Samurai and Uzbekistan-18 varieties, and the lowest place was occupied by the Pakana variety of Uzbekistan. It can be seen that the Massino and Samurai cultivars showed higher adaptability and endurance compared to other cultivars under limited moisture conditions.

The formation of leaves in plants and their development levels are of great importance in characterizing all life processes in the body of plants, especially photosynthetic properties. During the experiments, the change of the leaf level, which is one of the parameters characterizing the productivity of the plants, depending on the moisture level, was also studied.

One of the main functions of leaves is to form organic substances from inorganic substances. Leaf activity is directly related to the most important processes, i.e. photosynthesis, transpiration, respiration, mineral nutrition, water regime and other processes, and the activity of these processes, in turn, affects the yield and its quality. According to the data of many years of scientific experiments, water shortage in the soil has a strong negative effect on the expansion of the leaf surfaces, and the leaf surface of the plants that are resistant to water shortage has become smaller and the plate has become very thin.

All sorghum cultivars accelerated leaf expansion under moderate moisture conditions. Under the influence of limited moisture, a significant reduction of leaf surfaces was noted in all varieties. It was observed that the level of reduction of leaf surfaces was different depending on the biological characteristics of the varieties.

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When studying the leaf level in the stages of tuberization, flowering and flowering in sorghum varieties under the moderate conditions of the experiment, it can be observed that the expansion of the leaf level in the period from the tuberization stage to flowering has increased to a high level in all varieties and ridges, the expansion of the leaf level continues in the period from the tuberulation to the flowering stage, and the largest leaf level is fertilization and in the flowering stage, it was recorded in the Karabosh variety, its leaf level in the fruiting stage was on average 1318.7; 1403.9 cm^2 ha and 1389.5 in the flowering stage; It was equal to 1489.3 cm^2.
The smallest leaf area was recorded in the Samurai variety, their leaf area was 1143.8-1215 cm^2 in the fruiting stage, and 1239.5-1308.4 cm^2 in the flowering stage, while in the Massino variety, the leaf area was 1239, 1239, It was equal to 0-1318.2 cm^2, and in the flowering stage it was equal to 1331.2-1422.0 cm^2. It was found that the indicators of the leaf level of Uzbekistan Pakana and Uzbekistan-18 varieties were close to each other. It was found that the leaf area in the tuber stage of all studied varieties was smaller compared to the budding and flowering stages.
In conditions of moderate humidity, the expansion of the leaf surface of all varieties accelerated. Under the influence of limited humidity, i.e., water shortage, a small number of leaf surfaces was noted in all varieties. It was observed that the level of reduction of leaf surfaces was different depending on the biological characteristics of the varieties. It was noted that the leaf levels reached the highest level in the flowering stage of all sorghum cultivars under moderate moisture conditions. It was observed that the leaf area and dry matter accumulation of plants grown under the influence of water deficit decreased compared to those under moderate humidity. The obtained data show that the leaf levels of all sorghum varieties are directly related to soil moisture levels. Leaf levels of all cultivars were observed to have higher values in moderate moisture options. The degree of foliage of plants is an important characteristic of varieties. It was observed that the growth of the leaf surface and the size of its surface are inextricably linked to the influence of many factors, especially the level of water supply to plants. During our experiments, the leaf levels of all studied cultivars were large under conditions of moderate soil moisture. According to the results of the conducted research, water deficit has a negative effect on the leaf layers of sorghum varieties and slows down its formation. It was also noted that sorghum varieties have different sizes of leaf surfaces depending on biological characteristics.
Plant tissues must be supplied with sufficient water for normal physiological processes. The sum of these physiological processes is inextricably linked with plant productivity, and its level depends on the water regime and drought resistance of plants. The importance of net photosynthetic productivity in plant life, growth and development, and productivity is immeasurable. The basis of the dry mass of plants is organic matter. A certain part of these organic substances is sorted into the formation of generative organs.
Due to the lack of water in the soil due to unfavourable factors of the external environment, the duration of the net productivity of photosynthesis is shortened, as a result, the assimilative productivity of the plant also decreases. In the course of our scientific research, along with a number of indicators that determine the growth and development of the studied corn varieties, moderate and limited moisture effects on the net photosynthetic productivity were also determined.
Based on the data obtained on the net productivity of photosynthesis, it was found that the value of this indicator is different depending on the development stages of corn varieties and moisture levels. It was noted that the value of this indicator increases from the budding stage to the flowering stage. A decrease in the net productivity of photosynthesis was also noted in all varieties with a decrease in humidity. This process has become of great importance in the formation of biological and economic crops mainly in plants. The rate of accumulation of dry matter in sorghum varieties is directly related to the level of soil moisture, its decrease led to a decrease in dry mass.
When all the conditions for the growth and development of plants are sufficient, a small amount of water is used for the synthesis of dry matter, that is, an increase in the coefficient of effective use of water was noted. It was determined that the net productivity of photosynthesis in the tuber stage of the studied corn varieties was 3.35-4.61 g/m^2 day within the varieties under moderate humidity conditions. In conditions of limited humidity, the net productivity of photosynthesis was 3.00-4.13 g/m^2 day, respectively. It was found that the value of the net productivity of photosynthesis increases from the budding to the flowering stage. In particular, 3.51 g/m^2 in moderate moisture conditions of the fruiting stage of the Karabash variety, 3.71 in flowering, 3.33 in the fruiting phase in limited moisture, and 3.43 g/m^2 in the flowering phase. a day

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5.24 g/m^2 per day in the Massino cultivar at moderate humidity, 6.86 at flowering, 4.73 at limited humidity, 6.21 g/m^2 per day at flowering, 4.42 at moderate humidity at flowering stage, 5.42 at flowering in Samurai variety 03, it was 4.05 and 4.74 g/m^2 day in flowering phase in limited humidity. 4.16, 4.39 at flowering, 3.88 at limited moisture, 4.22 g/m^2 day at flowering, and 3.77 at moderate humidity at flowering, 4.22 g/m^2, 06, 3.39 g/m^2 day in the budding phase, 3.17 g/m^2 day during flowering in limited humidity.

Conclusions

According to our scientific results, there is an organic relationship between the rate of growth of varieties, the expansion of leaf levels, the net productivity of photosynthesis and the biological yield, and it was determined during the experiments that water shortage causes a sharp decrease in the value of these indicators. According to this indicator, high results for all varieties were observed at moderate humidity. With a decrease in the level of humidity, a decrease in the value of the above indicators was found in all varieties, and the lowest results were found in plants grown in conditions of limited humidity of the tuber phase. With a decrease in the number of irrigations, that is, an increase in the level of water deficit in the soil, a decrease in the value of all indicators was noted in all varieties. It was noted that the productivity characteristics of the studied varieties depend on the level of water supply.

References

1. Кадралиев, Д. С., & Григоренкова, Е. Н. (2008). Орошаемое земледелие дельты Волги в решении проблемы производства кормов для развивающегося животноводства. In *Орошение земель в обеспечении продовольственной безопасности России: Материалы Международной научно-практической конференции, г. Волгоград* (p. 77).
2. Алабушев, А. В. (2000). Уникальные возможности сорго. *Земледелие*, (3), 20-21.
3. Жученко А. А. (2009). Адаптивное растениеводство (эколого-географические основы) теория и практика. М.: Агрорус, Т. II 863 с.
4. Кадралиев Д. С. (2005). Сорго - культура многостороннего использования. Актуальные проблемы современных аграрных технологий: Материалы международной научно-практической конференции. Астрахань, С. 22.
5. Морозов, Е. В., Субботин, А. Г., & Сафонова, Н. Н. (2017). Народно-хозяйственное значение сорговых культур. In *Аграрные конференции* (No. 1, pp. 30-32). Федеральное государственное бюджетное образовательное учреждение высшего образования Саратовский государственный аграрный университет имени НИ Вавилова.
6. Алабушев, А. В., Ковтунов, В. В., & Лушпина, О. А. (2016). Сорго зерновое-перспективное сырьё для производства крахмала. *Достижения науки и техники АПК*, *30*(7), 64-66.
7. Д.С. Кадралиев, Е. Н. Григоренкова. (1999). Сорго на орошаемых землях дельты Волги. Естественные науки. № 1. С. 252-257.
8. Алабушев А.В., Анипенко А.Н. (2002). Эффективность производства сорго. Ростов-на Дону, 190 с.
9. Abreha, K. B., Enyew, M., Carlsson, A. S., Vetukuri, R. R., Feyissa, T., Motlhaodi, T., ... & Geleta, M. (2022). Sorghum in dryland: morphological, physiological, and molecular responses of sorghum under drought stress. *Planta*, *255*, 1-23.