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INFLUENCE OF NaCl ON BIOLOGICAL PARAMETERS OF SOME VARIETIES OF SUGAR SORGHUM

Abstract. The article gives information about the biological features of the sugar sorghum from the local and foreign breeding varieties grown in the salty environment. Based on the results of the research, data on salinity resistance of various varieties of sugar cane were given. According to the obtained data, the sensitivity indicators of sorghum to NaCl salt were demonstrated by variety characteristics. It has been discovered that the effect of salt begins to influence the vegetation seeds from the time of germination. It was further determined by the level of consumption of the seeds of the grain. At the same time, the toxic effect of salt in the nutrient medium has begun to appear in the further growth of plants and data on the collection of dry biomass of plants on the surface and vascular system. However, salt resistance to plants has been brought to a specific order on the root system and growth of the plant, and tolerance ranged amongst the varieties. Among the varieties of this series, Larets ranks first in terms of the growth of the roots and the root system, while the Kazakhstanskaya-20 has been found in the second place. Salinity resistance of the remaining varieties is alternating in sequence, not showing the sequence of plant stems and roots. Therefore, it is necessary to further study the varieties of sorghum crops.

Keywords: sweet sorghum, varieties, salinity, tolerance, germination, growth, endosperm reserves, biomass.

Introduction. President of Kazakhstan N. A. Nazarbayev's Strategy of development of the country till 2050 [1], as well as EXPO-2017 in Astana will provide a great opportunity for the future development of renewable energy research in the country. As President emphasized, in the next five years, Kazakhstan should make an innovative breakthrough in the introduction and production of new types of energy [2]. Extensive use of plant biomass as an updated and alternative source of energy is a straightforward and transitional green energy. One of the ecological problems of the Earth is global climate change as a result of increased temperature, water resources depletion, decline in atmospheric precipitations, droughts and desertification [3-5]. This will help to meet the needs of the livestock and food industry in the new environment alternative renewable energy is the basis for drought and salinity, heat-resistant, high-yielding crops.

Salinization is widely known in many countries around the world. Among them are highly saline areas: Australia, China, Egypt, India, Iraq, Mexico, Pakistan, Russia, Syria, Turkey, USA [6]. Only in Africa and South Asia, the area of sorrel and solonetzes is about 183 million hectares. It is believed that these regions are likely to be used in the future as valuable, agricultural, crop areas [7]. Salt soils in North

and Central Asia cover about 200 million hectares, which is about 20% of total saline soils in the world. According to Rozanov (1984), 60-70% of Kazakhstan's agricultural lands are vulnerable to the effects of 1 million hectares of land degradation in Central Asia and reduce crop yields to 30-33% [9]. According to the latest data of the Agency for Land Resources of the Republic of Kazakhstan, sorrel and solonetzes occupy about 93.7 million hectares - 42.1%. Consequently, about 36% of the country's harvest areas are salted [10]. Another factor that aggravates the problem of soil salinization in agriculture is an increase in population. It is estimated that the annual population growth will increase from 6.3 millimeters in 2030 to 8.3 billion in 2030 and reach 9 billion in 2050 [11].

Salt resistance is a topical issue of modern physiology and agricultural practices. The salinity of the plant is the continuation of the most important physiological growth of plants, regardless of the amount of salt in the soil. The study of salt resistance of the plant is of great practical importance as it contains about 75% of the glaciers, where 3 to 4% salt salts contain salinity, and a third of the world's soil is salted and one third is highly saline-tended [12, 13].

Research results and their analysis. Objects of the research are Kuldzha, Kazakhstanskaya-20, Oranzhevoe 160, Larets, Rostovski varieties of domestic and foreign sugar sorghum.

The great value of sorghum is its ability to grow in salty and saline soils. This crop is a plant that is resistant to high concentration of soil solution. The sorghum salt concentration can also grow normally in the soil twice as high as corn.

Calcium germination of sugar sorghum varieties after 72 hours in salinity (NaCl) is given in table 1. As it is seen in the table, the effect of salt in the medium is immediately observed (table 1) for the cultivation of sorghum seeds, and it is directly dependent on the salt concentration.

Table 1 – Influence of salt concentration on sugar beet cultivation, %

Concentration, NaCl, %	Kuldzha	Kazakhstanskaya-20	Larets	Rostovski	Oranzhevoe 160
Control	100	100	100	100	100
0,3	95,1	95,2	91,6	97,3	85,1
0,6	92,4	92,6	75,0	94,6	81,4
0,9	86,4	89,0	72,0	92,3	70,3
Notes. Accuracy of practice P < 5.					

For comparison, compared with the control version, Kuldzha has dropped from 95.1 to 0.9% of the salt at a concentration of 86%. At the same time, Kazakhstanskaya-20 decreased by 0.3% to 95.2%, with a concentration of 0.9% down to 89%. Compared to the total, it was observed that the larval and Oranzhevoe salt - sensitive were 160. Because of the high concentration of concentrations of 0.9%, these varieties were only 72-70.3%. Compared to other varieties, the Rostov variety is more resistant to salt than other varieties. It showed a 92.3% developmental concentration alone.

Based on the results, it is evident that the effect of NaCl in the nutrient medium is influenced by the growth of the plant seed. This leads to the assumption that the grain has an effect on the consumption of the substance (endosperm). Therefore, we studied the rate of spraying of plant material. Consumption of inventories in the control option was assumed to be 100%.

Table 2 – Influence of saline environment on the rate of spraying of endosperm in the yield of sugar cane varieties, %

Concentration, NaCl, %	Kuldzha	Kazakhstanskaya-20	Larets	Rostovski	Oranzhevoe 160
Бақылау	100,0	100,0	100,0	100,0	100,0
0,3 мг/л	93,6	81,3	94,5	88,2	83,2
0,6 мг/л	89,3	73,9	95,1	88,2	89,6
0,9 мг/л	89,7	78,1	90,3	88,6	84,7
Notes. Accuracy of practice P < 5.					

As shown in the experiment, concentration in the center of salt increased by 94.5% (share of excise taxes), 78.1% (Kazakhstanskaya-20). This, in turn, reduces the consumption of resources as the amount of salts in the nutrient environment increases. The question will affect the plant's growth and development. Thus, the continuation of the study continued with the study of varieties of experimental varieties (table 3).

According to the data in the table, it is observed that the polluted medium with NaCl is very strongly regressed to the growth of the germination and is directly dependent on salt concentration.

Table 3 – Influence of NaCl on the growth of certain organs of gum sand varieties (10-day sprouts)

Variety Kuldzha				
Concentration NaCl	The root length, cm	Of the control, %	Length of the earth surface, cm	Of the control, %
Control	9,65±0,09	100	17,40±0,23	100
0,3 % NaCl	3,35±0,03	34,7	14,85±0,40	85,3
0,6 % NaCl	3,29±0,03	34,1	7,70±0,09	44,2
0,9 % NaCl	3,14±0,14	32,5	6,58±0,00	37,8
Kazakhstanskaya-20				
Control	6,43±0,69	100	11,53±0,29	100
0,3 % NaCl	3,17±0,02	49,3	7,65±0,19	66,3
0,6 % NaCl	2,81±0,09	43,7	5,56±0,01	47,8
0,9 % NaCl	2,23±0,02	34,7	4,94±0,00	42,8
Larets				
Control	19,65±0,07	100	12,99±0,34	100
0,3 % NaCl	7,81±0,22	39,7	10,82±0,024	83,3
0,6 % NaCl	6,98±0,06	35,5	6,57±0,18	50,6
0,9 % NaCl	6,98±0,15	35,5	5,23±0,07	40,3
Rostovski				
Control	13,63±0,43	100	13,21±0,00	100
0,3 % NaCl	4,94±0,21	36,2	7,33±0,03	55,5
0,6 % NaCl	3,71±0,08	27,2	6,50±0,01	49,2
0,9 % NaCl	3,09±0,04	22,7	5,33±0,02	40,3
Oranzhevoe-160				
Control	14,83±0,04	100	17,03±0,17	100
0,3 % NaCl	4,30±0,49	29,0	9,63±0,26	56,5
0,6 % NaCl	4,06±0,07	27,4	8,08±0,11	47,4
0,9 % NaCl	3,11±0,01	21,0	7,12±0,41	41,8

For example, if you look at the Kuldzha variety, the root length of the plant is 9.65 cm and the subject is 17.40 cm. At the 0.9% concentration of salts, this figure is only 3.14 cm, with a lesson of 6.58 cm. Compared to this percentage, the root system reduced its growth to 38.5% and less than 37.8%. This rate is also observed in all varieties of practice. However, varieties have their own specifications. For example, the roasting system of Rostovski, Oranzhevoe varieties ranged from 22.7% to 21%, and laryngeal and Kazakhstanskaya-20 varieties of root system were slightly better than other varieties by 34.7%, 35.5% also in the growth of plant work.

The data obtained show that NaCl-contaminated medium has a significant adverse effect on the growth of gum culture. This is evident from the dry plant biomass data (figure 1, 2).

For example, as we can see in figure 1, 2, the root system is very susceptible to plant stroke. It even had a significant adverse effect on the growth of plant biomass even at its lowest concentrations. As can be seen from the picture, the bull's biomass was 3.16 mg in the control variant of Kuldzha, but only 0.43 mg in the highest concentration. Such data has been observed in all the experimental varieties. Even in the Kazakhstanskaya-20, Rostovski and Larets varieties, these figures were 0.19; 0.21; 0.22 mg only.

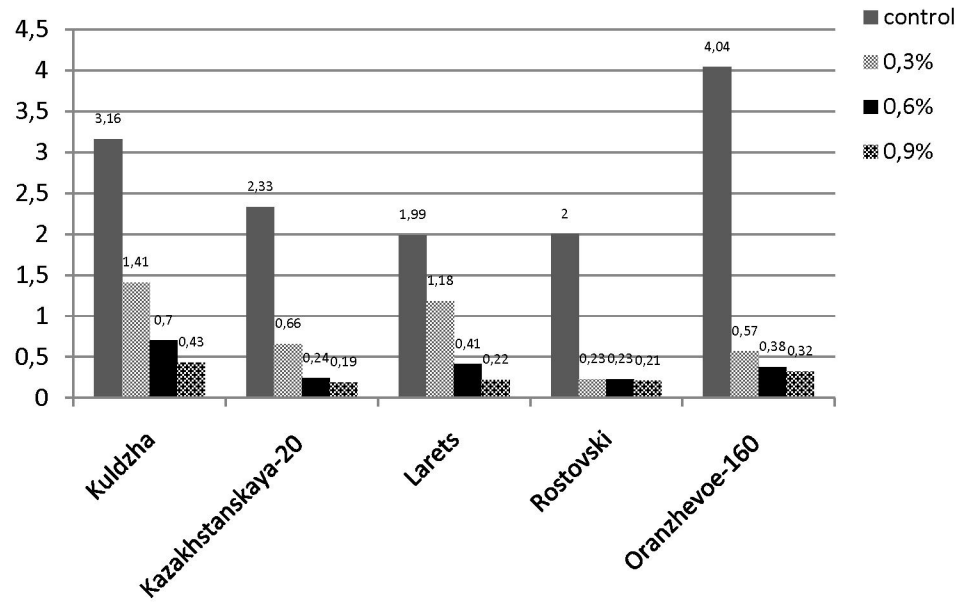

Figure 1 – The effect of NaCl on the accumulation of biomass of the rootstock of 10-day sorghum, mg/spleen

According to the data in the figures, the surface organisms of plants are much better than the root system. It defines the protective function of the root system of the plant. Because of the extent of the plant root system, the accumulation of surface biomass is relatively well maintained.

As can be seen from figure 2, 14-day shoots show that the highest biomass harvest is Kuldzha variety. However, it has been determined that each variety has a different intensity of collection of biomass.

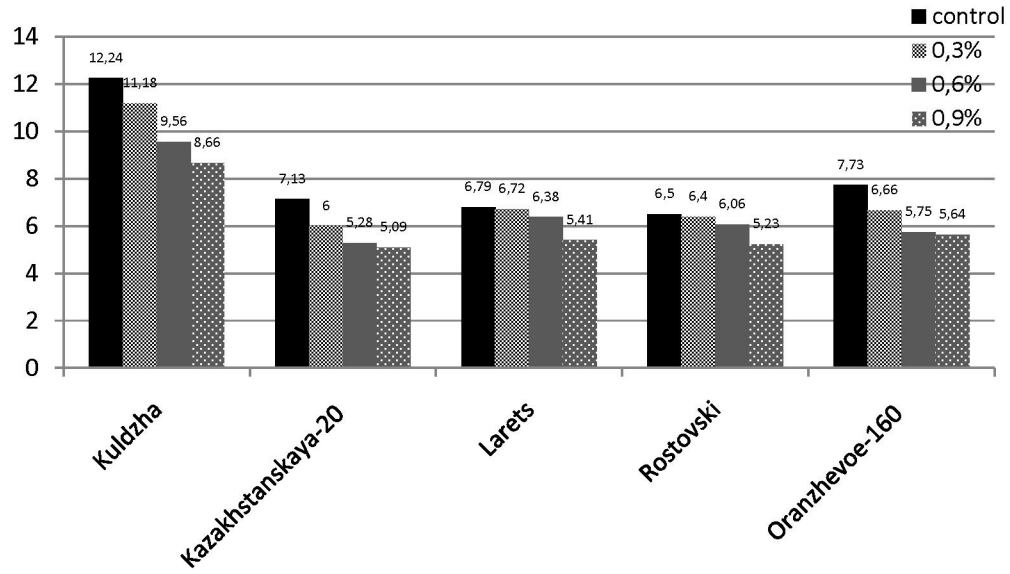

Figure 2 – The effect of NaCl on the accumulation of biomass of the earthworms on the Sunflower Sprouts, mg/spleen

Thus, the effect of NaCl salt on the growth of the varieties of sorghum crops has been evident. It has been found that it is adversely affected by the growth of the plant germination, and it has the greatest negative effect on the consumption, growth, and accumulation of dry biomass. However, the growth rates of vegetation can be summarized as percentage of the maximum salinity environment:

Growth of the yield (0.9% NaCl): Kazakhstanskaya-20 (42.8%) > Oranzhevoe-160 (41.8%) > Larets (40.3%) > Rostovski (40.3%) > Kuldzha (37, 8%).

0.9% NaCl roots (35.5%) > Kazakhstan-20 (34.7%) > Kuldzha (32.5%) > Rostovski (22.7%) > Oranzhevoe-160 (21%).

In the given series, the Lareco variety is on the foreground, the top Kazakhstanskaya-20. And the rest of the varieties are rooted in the classroom.

By analyzing these data, it is desirable to determine the type of plant biomass in a saline environment to ensure that the resistance of the variety is higher than that of other varieties. Thus, in the table below, there are clear differences between the varieties of intensive biomass collection in the saline environment (table 4).

Table 4 – Influence of various concentrations of NaCl on dry biomass collection of various varieties of sugar cane (Mg per 1 plant and %)

Variants	Kuldzha	Kazakhstanskaya-20	Larets	Rostovski	Oranzhevoe 160
Control	15,4±1,3	9,46±0,2	8,8±0,5	8,5±0,2	11,8±1,0
0,3 %	12,6±0,9	6,66±0,3	7,9±0,7	6,6±0,3	7,2±0,3
0,6%	10,3±0,2	5,52±0,1	6,8±0,3	6,3±0,1	6,1±0,2
0,9%	9,1±0,3	5,28±0,1	5,6±0,1	5,4±0,1	5,9±0,1
Control	100 %	100	100	100	100
0,3 %	82	70	90	78	61
0,6%	67	58	77	74	52
0,9%	59	56	64	63	50

As it is seen in the table, the accumulation of biomass of different varieties of sugar cane plant shows that the low amount of NaCl salt does not have any negative effect. However, it is clear from the data that there are some differences between the varieties. For example, there is a strong basis for showing the most sensitive orange varieties of salt 160. Because of the 0.3% of salt, the biomass of the plant has dropped to 61 percent, and as the amount of salt in the medium increases, this figure dropped to 52-50 percent. And there are grounds to believe that varieties are largely resistant to salt in the medium. As it is seen in the table, it is 90% higher than that of other grades in the amount of 0.3% of salt, which decreased to 77-64% when the amount of salt in the medium was increased. This indicator is significantly higher than that of other grades in these concentrations. This information can also be found on the Rostovski variety. This variety has dropped from 78% to 63% in the high salt concentration, depending on the amount of salt in the medium. These figures show that the varieties of Oranzhevoe 160 are much higher than the Kazakhstanskaya-20 and Kuldzha varieties in practice. It has been established that the Kazakhstan-20 and Kuldzha varieties have lower levels of salt than in the Rostovski and Larets varieties, although they are not sensitive to Oranzhevoe 160varieties. So, Salt sugar salt has been found to be different in each species. Among the experimental varieties, the varieties Oranzhevoe 160 have the highest sensitivity, while Larets and Rostovski varieties are more resistant. The Kazakhstanskaya-20 and Kuldzha varieties are among the most resistant and resistant to salt-resistant strains. The following sequence of salt resistance can be achieved by putting these parameters in the following order. Salinity tolerance by 0.3% and 0.9% saline medium: Larets> Rostovski> Kuldzha> Kazakhstanskaya-20 > Oranzhevoe 160.

At the same time, the low content of sodium chloride in the nutrient medium adversely affects the growth of sugar gum plants. This information is evident due to the growth of seed seeds, growth, the growth of grain stock and the collection of dry biomass. There are some exceptions for experimental varieties. For example, it was noted that the accumulation of biomass of individual plant elements does not always correspond to the biomass of the whole plant with a sensitivity range. However, if you look at the dry biomass of the entire plant in sequence, you can say that the Oranzhevoe varieties are sensitive to the salinity of the environment, and the relative tolerance is a kind of Larets

However, this indicator does not reflect the resistance of plants. It still needs to be studied and studied at the biochemical, molecular level.

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ҚАНТ ҚҰМАЙЫ СОРТЫНЫҢ КЕЙБІР ҮЛГІЛЕРІНІҢ БИОЛОГИЯЛЫҚ ПАРАМЕТРЛЕРІНЕ NaCl ТҰЗЫНЫҢ ӘСЕРІ

Аннотация. Мақалада қант құмайының жергілікті және шетел селекциясынан шыққан сорт үлгілерінің тұзды ортада өскен биологиялық ерекшеліктері жайлы деректер келтірілген. Зерттеу жұмыстары нәтижелері бойынша қант құмайының әр түрлі сорттарының ортаның тұзденуына төзімділіктері туралы алынған мәліметтер келтірілген. Алынған мәліметтер бойынша құмай дақылының NaCl тұзына сезімталдығы сорт ерекшеліктері бойынша көрсетілді. Тұздың әсері өсімдіктердің дәнінің өнуі кезінен бастап әсер ете бастайтындығы анықталды. Оны дәннің қор затының жұмсалу деңгейімен одан әрі айқындай түсті. Сонымен қатар, қоректік ортадағы тұздың улы әсері өсімдіктердің одан әрі ұзара өсу көрсеткіштерінде және олардың жер үсті, тамыр жүйесінің құрғақ биомасса жинақтау мәліметтері мен де көріне бастады. Дегенмен, өсімдіктердің тұзға төзімділіктері өсімдіктің тамыр жүйесі және сабағының өсуі бойынша белгілі бір реттілікке келтіріліп, тәжірибеге алынған сорттар арасында төзімділік қатары келтірілді. Келтірілген қатар бойынша сорттар арасында Ларец сорты жер үстінің және тамыр жүйесінің өсуі бойынша ең алғашқы орыннан көрінсе, Казахстанская-20 сорты екінші орыннан табылды. Ал қалған сорттардың тұзденуға төзімділігі өсімдік сабағы мен тамыры биомассасы бойынша бірізділік көрсете алмай кезектесіп орын ауыстыра орналасты. Сондықтан құмай дақылының тәжірибедегі сорттарын одан әрі тереңдете зерттей түсу қажет.

Түйін сөздер: қант құмайы, сорттар, тұздану, төзімділік, өну, өсу, эндосперм қоры, биомасса.

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ВЛИЯНИЕ NaCl НА НЕКОТОРЫЕ БИОЛОГИЧЕСКИЕ ПАРАМЕТРЫ СОРТОВ САХАРНОГО СОРГО

Аннотация. Работа была выполнена при поддержке КН МОН РК, по проекту 2171/ГФ4. В статье представлена информация о биометрических показателях сортов сахарного сорго местной и зарубежной селекции, выращенных в условиях засоления среды. На основании результатов исследования представлены данные о солеустойчивости различных сортов сахарного сорго. Согласно полученным данным, чувствительность сортов сорго к NaCl была различной. Было показано, что засоление начинает оказывать свое влияние на семена с момента прорастания. Это было определено всхожестью семян и уровнем потребления запасов эндосперма. Токсический эффект NaCl начал проявлятся так же при учете роста растений и данных о накопления сухой биомассы отдельными органами проростков. На оснований полученных данных можно построить ряд устоичивости изучаемых сортов к засолению питательной среды, согласно которому сорта сахарного сорго как Ларец, Ростовский и Казахстанская 20 отличаются большей степенью толерантности относительно других сортов. От засоления среды в большей мере «страдают» корневая система растений, которая выполняет защитную функцию предотвращая транспорт вредных ионов в надземную часть. Для выяснения этого предположения необходимо продолжит исследования по выявлению закономерностей накопления и распределения ионов натрия по отдельным органам сахарного сорго.

Ключевые слова: сахарная сорго, сорта, засоление, толерантность, прорастание, рост, запасы эндосперма, биомасса.

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