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There is no conflict of interests

Effects of salt stress on growth parameters of some (*Beta vulgaris L.*) varieties

ABSTRACT

Aim. The effect of various concentrations of sodium chloride on growth parameters, the activity of antioxidant enzymes, the amount of photosynthetic pigments and total sugar beet proteins was studied.

Methods. The objects of study were varieties of sugar beets Tarifa, Taltos and Cooper. Plants were grown in a controlled greenhouse for 60 days at different salinity levels (0.2 and 0.5% NaCl and Na_2SO_4). The parameters of leaves and roots, the activity of catalase (CAT) and benzidyl-peroxidase (BPO), the content of photosynthetic pigments and total proteins during the growing season were determined.

Results. Although leaf and root parameters were stimulated or not affected at low salinity, a higher salt concentration significantly reduced all signs of growth. At a high salinity level, the Tarifa variety had a significantly higher leaf area and root with compared to other varieties. In the variety Tarifa, the activity of CAT was higher than in other varieties, but the activity of BPO, the content of total protein and photosynthetic pigments was higher in the varieties Taltos and Cooper. The salinity of the medium reduced physiological and biochemical parameters in different varieties of sugar beets to varying degrees, and these features of the varieties should be taken into account in breeding work.

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Конфликт интересов отсутствует

Влияние солевого стресса на параметры роста некоторых сортов (*Beta Vulgaris L.*)

РЕЗЮМЕ

Цель работы. Изучено влияние различных концентраций хлористого натрия на параметры роста, активность антиоксидантных ферментов, количество фотосинтетических пигментов и общих белков сахарной свеклы.

Методы. Объектом исследования служили сорта сахарной свеклы Тарифа, Талтос и Коопер. Растения выращивали в контролируемой теплице 60 дней при различном уровне засоления (0,2 и 0,5% NaCl и Na_2SO_4). Определяли параметры листьев и корней, активность каталазы (КАТ) и бензидил-пероксидазы (БПО), содержание фотосинтетических пигментов и общих белков в течение вегетационного периода.

Результаты. Хотя параметры листьев и корней стимулировались или не затрагивались при низком уровне солености, более высокая концентрация соли значительно снижала все признаки роста. На высоком уровне солености сорт Тарифа имел значительно более высокую площадь листьев и ширину корней по сравнению с другими сортами. У сорта Тарифа активность КАТ была выше, чем у других сортов, но активность БПО, содержание общего белка и фотосинтетических пигментов было выше у сортов Талтос и Коопер. Соленость среды способствует снижению физиологических и биохимических показателей у различных сортов сахарной свеклы по-разному, и эти особенности сортов должны быть учтены в селекционной работе.

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INTRODUCTION

It is known that in the world about 33 percent of irrigated lands are affected to salinization. Saline soils are common especially in semi-arid and arid regions, where rainfall is not enough for significant leaching. Salinity can severely limit yield, especially in most productive areas of the world [1].

Salt tolerance in plants has generally been emphasized in regulation of ionic homeostasis and osmotic adjustment [2]. Some authors have shown that, like other abiotic stresses, salinity also induced oxidative stress in plants [3].

Many studies have shown that under physiological stress, the physiological growth of plant is disturbed due to inhibition of photosynthesis, nutrient deficiency or mineral toxicity. Decrease of CO_2 diffusion caused by stomata closure leads to decrease of photosynthesis rate in moderate salt stress [4].

Plants have evolved various protective mechanisms to eliminate or reduce ROS, which are effective at different levels of stress-induced deterioration. The enzymatic antioxidant system, which is one of the protective mechanisms, including superoxide dismutase (SOD), is located in various cell compartments and catalyzes the disproportion of two O_2^- radicals to H_2O_2 and O_2. H_2O_2 is eliminated by various antioxidant enzymes such as catalase (CAT) and peroxidases (POD), which convert H_2O_2 into water [5].

When studying the effect of salinity on the content of photosynthetic pigments in four grape genotypes, it turned out that among them there are tolerant varieties to the action of salt [6]. Saline stress induces a decrease in dry weights of root and shoot and leaf area, but it had no effect on leaf water contents. Plant growth is ultimately reduced by salinity stress, although plant species differ in their tolerance to salinity. Reduction of plant growth under saline conditions is a common phenomenon but such reduction occurs in various ways in different plant organs [7].

MATERIALS AND METHODS

Plant material. The object of the study is the exported from Holland sugar beet varieties Taltos, Cooper and Tarifa leaves of these varieties.

The seeds of sugar beet are placed in the vegetation vessels. After receiving the primary seedlings, the objects of the subsequent stage of investigation were brought to 23–25 °C temperature of the vegetation vessels, the photoperiod was 14 hours, the humidity was 60–70% and the intensity was 10–15 klux. Conducted research experience, artificially created greenhouse chambers. In each control variant, irrigation was carried out until the end of the growing season; from the experimental variants, were cultivated in 0,2% and 0,5% concentration NaCl to one another, were cultivated 0,2% and 0,5% concentration Na_2SO_4. This created artificial salinization after 30, 45, and 60 days of periodic ontogenetic development of plants for about 12:00 hours, 3–4 hours of clarification separated the leaf samples.

Determination of catalase (CAT): activity was estimated following the method of Aebe. 1 gm of fresh tissue was ground with 10 ml, 50 mM phosphate buffer (pH 7.0) in a pre-chilled pestle and mortar. Then the ground sample was centrifuged at 8000g for 10 minutes. To start catalase reaction, 2.9 ml of phosphate buffer (pH7.0) adding 25 kl enzyme escalation. After that to this mixture adding 0,3% H_2O_2 measurement in spectrophotometry 240 nm, 1 min optical density. Equal ecstinksiya ε = 39.4 Mm^{-1} sm^{-1} coefficient is calculated basically and is expressed in mM/(q_{min}) [8].

Determination of benzidin-peroxidase (BPO): the method of Kumar and Knowles was followed for analysis of peroxidase activity. 1 gm of fresh tissue was ground with 10 ml, 50 mM phosphate buffer (pH 7.6) in a prechilled pestle and morter. Then the extracted sample was centrifuged at 1200 rpm for 10 minutes at 4 °C and the supernatant was stored as enzyme source. A reaction mixture was prepared by taking 10.4 ml of water, 4 ml of O-dianisidine, 12 ml of 0.2 M sodium acetate buffer pH 4.5 in a beaker. 2.8 ml of reaction mixture.

0.1 ml of H_2O_2, 0.1 ml of enzyme extract were pipette out of in a cuvette. For blank 0.1 ml of Tris-HCl buffer was taken instead of enzyme extract. Increase in absorbance for 1 minute was recorded at 430 nm enzyme activity was expressed as ΔA/g/min. [9].

Determination chlorophyll content: chlorophyll was estimated by the method developed by Smith and Goman. 1 gm chopped leaf tissues were crushed thoroughly in mortar with (80%) acetone. The supernatant was filtered through a filter paper in a 100 ml volumetric flask. This extraction was repeated until the green colour of the leaf became discoloured. The total volume of the extract was then centrifuged at 6000 rpm for 10 min and volume was made up to100ml by (80%) acetone. The total chlorophyll content was expressed as mg/g leaf tissue [10].

Determination of total protein in plant organs: one of the most widely methods for determining proteins is the colorimetric method of Lowry [11].

This method uses phenol-containing folin reagent. The method is simple, but also very sensitive. The measurements were carried out on the spectrophotometer (SP) at a wavelength of 750 nm. Serum albumin (BSA) was used to build a rating table. Using this method, 2 ml of liquid from each fraction were added to the proteins and 1 ml B was added. After the solution was mixed and stored at room temperature for 10 minutes, 0.1 ml of Folin's reagent was added to the test vial. After about 30 minutes, the yellow solution turns blue, and the color intensity is determined by the red filter in the spectrophotometer. Calculate of proteins was determined by the standard curve.

Biometric parameters. Determination of leaf area (width, length, diameter), weight, and other biometric readings was performed using linear, millimeter paper and ordinary scales, respectively.

DISCUSSION

Photosynthetic pigment systems and proteins localized in the leaves also play a role in the diagnosis of plant resistance to salinity. According to the result from table 1, the amount of Xla in the control variants in the leaves of the varieties of sugar beets Cooper, Taltos and Tarifa gradually decreased with increasing age of the plant. In a 30-day cultivation under the control of the Cooper variety, Xla was ranked higher than other varieties and the lowest in Tarifa, which was salt tolerant. This result can be explained by the demand for chlorophyll of species. Thus, in the Cooper variety, which is salt-sensitive in terms of biological activity, the plant does not require a large amount of chlorophyll due to its high Xla content, while the salt-tolerance variety Tarifa is highly active and can developed well, need for low amounts of chlorophyll (Table 1).

Therefore, calculation of the Xl a/b ratio in the leaves and the obtained estimates provide more information when analyzing the experimental results. With this in mind, when analyzing the results of the study, the value of Car / Xl (a+b) and the value of Xl a/b are used. The percentage of Xl a/b in Tarifa extracts decreased over time in the control samples

Table 1. **Effect of diffrent concentration of salt NaCl and Na_2SO_4 on activity of enzyms CAT and BPO of sugar beet (*Beta vulgaris L.*) leaves**

Varieties	Variation	Activity of CAT, uniol H_2O_2/mq protein mln			Activity of BPO umol benzidin/mq protein mln		
		30 davs	45 davs	60 davs	30 days	45 davs	60 davs
Cooper	control	18.21±1.01	25.23±1.17	23.21±1.16	0.23±0.01	0.32±0.01	0.28±0.01
	0.2%NaCl	20.73±1.12	27.37±1.24	25.48±1.22	0.17±0.01	0.21±0.01	0.19±0.01
	0.5%NaCl	21.51±1.10	25.32±1.18	23.35±1.17	0.20±0.01	0.26±0.01	0.23±0.01
	0.2%Na_2SO_4	16.58±0.81	20.56±0.99	19.40±0.97	0.30±0.02	0.42±0.02	0.34±0.02
	0.5%Na_2SO_4	21.78±1.20	26.80±1.25	24.83±1.24	0.18±0.01	0.23±0.01	0.20±0.01
Taltos	control	19.35±1.03	23.25±1.08	21.23±1.06	0.20±0.01	0.24±0.01	0.22±0.01
	0.2%NaCl	20.01±1.08	27.04±1.12	24.09±1.10	0.19±0.01	0.23±0.01	0.21±0.01
	0.5%NaCl	19.25±1.01	23.31±1.05	20.35±1.02	0.31 ±0.02	0.39±0.02	0.35±0.02
	0.2%Na_2SO_4	17.53±0.90	20.83±0.97	18.73±0.94	0.23±0.01	0.27±0.01	0.25±0.01
	0.5%Na_2SO_4	19.21±1.03	22.40±1.04	20.44±1.02	0.17±0.01	0.20±0.01	0.19±0.01
Tarifa	control	14.73±0.81	18.73±0.86	10.74±0.84	0.16±0.01	0.19±0.01	0.17±0.01
	0.2%NaCl	31.70±0.68	36.21±1.70	33.25±1.66	0.29±0.01	0.31±0.01	0.14±0.01
	0.5%NaCl	11.30±0.70	14.31±0.71	12.51±0.63	0.15±0.01	0.17±0.01	0.29±0.01
	0.2%Na_2SO_4	14.01±0.78	16.90±0.81	I5.80±0.79	0.18±0.01	0.22±0.01	0.19±0.01
	0.5%Na_2SO_4	16.79±0.88	20.99±0.90	18.99±0.89	0.16±0.01	0.18±0.01	0.16±0.01

Table 2. **Amount of total proteins in the leaves of sugar beet (*Beta vulgaris L.*)**

Varieties	Variant	Amount of proteins, mq mln		
		30 day	45 day	60 day
Cooper	control	11.9± 1.01	19.2±1.17	12.7±1.16
	0.2%NaCl	6.8±1.12	16.3±1.24	7.8±1.22
	0.5%NaCl	7.0±1.10	16.4±1.18	8.1±1.17
	0.2%Na_2SO_4	7.8±0.81	12.5±0.99	9.6±0.97
	0.5%Na_2SO_4	12.0±1.20	12.9±1.25	6.5±1.24
Taltos	control	16.7±1.03	15.8±1.08	13.3±I.06
	0.2%NaCl	14.2±1.08	13.3±1.12	10.9±1.10
	0.5%NaCl	4.2±1.01	13.8±1.05	8.1 ±1.02
	0.2%Na_2SO_4	8.6±0.90	12.5±0.97	8.4±0.94
	0.5%Na_2SO_4	3.4±1.03	13.8±1.04	5.4±1.02
Tarifa	control	0.28±0.81	14.7±0.86	10.6±0.84
	0.2%NaCl	10.3±0.68	9.2±1.70	8.1±1.66
	0.5%NaCl	6.2±0.70	14.4±0.71	5.2±0.63
	0.2%Na_2SO_4	6.9±0.78	13.9±0.81	9.6±0.79
	0.5%Na_2SO_4	3.7±0.88	14.4±0.90	8.4±0.89

by 0,2% and 0,5% compared with imitation of Na_2SO_4 and NaCl salts with an increase of 0,2% and 0,5% NaCl. This tendency was also observed in the quantitative analysis of carotenoids and anthocyanins with a slight deviation. In the imitation of only 0,5% NaCl the amount of carotenoids almost doubled compared to the control. In addition, the reaction against the concentration of salt from sugar beets can be considered as a sign of adaptation (table. 1). As can be seen from the tables, the amount of Xla simultaneously decreases with increasing salt content. From this point of view conclude that soil salt to increase the root system of ion exchange through mineral nutrition in water gels that delay. In addition to the drought effect, ultimately creates sheets of a breakdown of chlorophyll, degradation occurs as a result of photosynthesis rate-P n decreased and plant biology indicators — growth, weight, biometric size of leaves, etc. decreased (without results). In the scientific explanation of plant resistance to extreme factors, analysis of the salinization / Xl (a+b) ratio is of great importance. In salinization Car / XL (a+b) the rate of increase in the number of carotenoids in the context of exposure to high stress, chlorophyll due to the general decrease in the plant results in increased resistance against stress condition. As result of this tendency that this rate increased both at a concentration

of Na_2SO_4 in the Tarifa variety and in the imitation of NaCl at 0,5%, which is 5 times higher than the control. The results show that the plant responds more strongly to stress-causing compounds because NaCl causes more stress than other salts.

In our experiments, the proportion of 0,2% concentration NaCl and Na_2SO_4 in the leaves of Taltos and Cooper varieties decreased to Xl a / b in the of salt. The leaves of these varieties experienced a marked increase in salt content of 0,5%NaCl due to a significant decrease in Xl b. These results indicate that Taltos and Cooper are less resistant to salt than Tarifa. There is a lot of literature that is similar to the results we found. For example, Tauran's studies show that in experiments with salt tolerant and salt-sensitive plants, the amount of Xl a and b at the beginning of stress increases with an increase in the Xl a / b ratio, then decreases, and in salt-sensitive varieties the process becomes more intensive [12].

They also show that the pigment apparatus of different plant species exhibits different sensitivity to the effects of families of abiotic stresses, such as salt and drought. It has been established that even in most drought-resistant wheat varieties the amount of pigment does not change or does not change significantly compared to sensitive varieties [13].

An analysis of the results shows that the physiological state of the plant, its fertility and adaptive abilities also depend on the level of some biological processes that are formed under the influence of stressors in its environment.

Thus, the concentration of Na_2SO_4 in 0,2% of the Tarifa pigment is the best, slightly less than that of Taltos, and at least Cooper.

It is also important to determine the total protein content in the leaves when assessing plant salinity. The results of our experiments for this purpose are presented in Table 2. As can be seen from the table, with an increase in salinity the amount of protein in Cooper variety increases. Thus, Chao and his colleagues found in their experiments that when the salinity in the environment increases, the amount of soluble proteins in the leaf increases in accordance with the proteins [14]. Other authors show that specific molecules (25–33 kDa) of specific proteins are synthesized during stress. These proteins are involved in the regulation of osmotic pressure [15]. In the other two varieties, the amount of salt decreased, unlike the Cooper variety, due to the increased salt content. The largest decrease in the number of proteins was recorded in the variety Tarifa.

As shown in the tables, the amount of pigment in the variants with a higher protein level was significantly less. The results can be explained by the metabolic properties of plants. Thus, salt stress in the sheets proteins of the total amount of proteins gradually increase, during the first 45 days after, increased, and over 60 days, slightly, although a decrease was observed. The largest difference observed in varieties Tarifa with the influence of 0,5% salt Na_2SO_4. Thus, a decrease in total and soluble proteins is due to the action of Na_2SO_4 (table 2).

As is known, the first general nonspecific reaction of plants to stress is formed by ROS, such as superoxide radicals, oxygen, and peroxide compounds. Toxicity ROS, chemically interact with proteins and chloroplast DNA and cause serious structural and functional impairment.

It was found that the inhalation of salt stress of mitochondria, chloroplast also significantly reduces the effectiveness of phosphorylation affects the respiration power plant and oxidative phosphorylation and the relative balance between breaks, as a result of ATP synthesis in cellular metabolism weakens and disrupt the normal course. Using AFK in large — molecule times the antioxidant defense system, BPO, SOD enzymes play an important role.

In addition to ionic imbalance and hyperosmotic stress, high concentrations of NaCl also cause oxidative stress, accompanied by membrane collapse and chlorophyll degradation. The level of oxidative stress is usually determined based on the amount arising malonic dialdehyde (MDA). Many studies have shown that cultivated plant varieties with high antioxidant activity are highly resistant to oxidative and salt stress [16].

It is known that enzymes play an active role in biochemical processes in living organisms. Researchers can evaluate their endurance by studying the activity, subcellular localization of enzymes involved in plant tissue processes under stress, and the kinetics of their catalyzed reactions.

C. sugar beets three times the activity of the enzyme varieties in terms of the influence of salt stress associated with the results presented in table 3. First of all, we determined that the pH value is 7.0 times more expensive than sugar beets, grapes and an ambient temperature of 40–50 °C, if you have a maximum price. Further studies were conducted, and the results obtained are shown in table 3.

As seen from Table 3, all three kinds in leaves embodiment different control options increase in enzyme activity gradually over time. Thus, CAT activity was most active in the 45-day-old Tarifa variety with the 0,2%NaCl variant, unlike all varieties and variants. The same activity was for the 60-day plant. Unlike NaCl in the Tarifa class, the CAT activity in Na_2SO_4 was higher in 30-day-old plants than in 30- and 60-day-old plants, about 5–6 times compared to 30-day-old plants and about 10 % compared with samples of NaCl. times were low. In 30-day samples of Taltos and Cooper varieties, CAT activity was similarly increased in 0,5%NaCl and 0,5%Na_2SO_4, as in Tarifa. In these varieties, CAT was very active with 0,2% and 0,5%NaCl in 45-day-old plants and 0,5%Na_2SO_4 in 60-day-old plants.

The results show that the high CAT activity in the experimental variants of Taltos and Cooper varieties indicates that both of these variants are sensitive to stress. But Tarifa 0,2 and 0,5%Na_2SO_4 filling even end of develop stage stress does not cause such a strong. Therefore, highly concentrated NaCl have a high activity over time, from point of view allows to think this is salt-tolerance varieties. On the other hand, the behavior of the enzyme in the context of stress can be considered as a response to the resistance of plants to the effects of abiotic stressors.

There is also literature that is close to our conclusions. Kabiria M. and his colleagues. Resistance to saline was studied in the concentration of 0, 20, 40, and 60 mM NaCl in the salt-sensitive genotype, where the activity of CAT and APO was decreased and salinity increased in the saline genotypes [17].

In addition to the BPO enzyme, the optimal activity was found to be that the selected medium had a BPO value of pH 7.6, while the temperature of the reaction medium 40–50 range C has the highest activity. Enzyme activity during the investigation m determine that Cooper, Taltos and rate control and experimental variants differ from — the activity of BPO this. If we look at the changes in BPO activity over time in these variants, we will see that in all three varieties its activity increased during the first 45 days and then gradually decreased, and the activity of this enzyme in 60-day-old plants is higher than in 30-day plants 45, compared with daily plants and received a lower activety. This trend was expected in all varieties.

In this regard, BPO activity was the lowest in the Tarifa variety compared to other varieties. In our opinion, this

Table 3. **Influnce of salt strss on pigments (mmol|ml) of 30 day sugar beet**

Varieties	Variant	Xl a	Xl b	Xl (a + b)	Xl (a / b)	Antosian	Carotinoid	Car/Xl (a +)
30 days								
Cooper	control	0,04498	0,0098	0,00552	4,6	0,01004	0,46453	84,5
	0.2%NaCl	0,00279	0,00170	0,00449	1,6	0,00117	0,33907	75,2
	0.5%NaCl	0,00111	0,00328	0,00439	0,3	0,01413	0,25307	58,0
	0.2%Na_2SO_4	0,00403	0,00162	0,00565	2,5	0,00702	0,3389	60,3
	0.5%Na_2SO_4	0,00239	0,0121	0,01449	0,2	0,00082	0,16562	11,3
Taltos	control	0,00259	0,00215	0,00474	0,2	0,00440	0,24290	51,7
	0.2%NaCl	0,00323	0,00266	0,00589	1,2	0,00115	0,32260	54,4
	0.5%NaCl	0,00188	0,01111	0,00199	1,7	0,02037	0,13761	69,1
	0.2%Na_2SO_4	0,00221	0,00075	0,00296	2,9	0,00118	0,20076	67,1
	0.5%Na_2SO_4	0,00295	0,00871	0,01166	0,3	0,0252	0,37301	31,3
Tarifa	control	0,00179	0,00052	0,00231	3,4	0,00343	0,22467	97,3
	0.2%NaCl	0,00011	0,00023	0,00173	0,4	0,00192	0,09987	57,7
	0.5%NaCl	0,00226	0,00088	0,00314	2,5	0,00456	0,12497	40,8
	0.2%Na_2SO_4	0,00200	0,00071	0,00271	2,8	0,00098	0,19873	74,5
	0.5%Na_2SO_4	0,01102	0,00189	0,00191	5,8	0,02503	0,49187	41,3
45 days								
Cooper	control	0,00184	0,00181	0,00364	1.0	0,00270	0,23994	65,0
	0.2%NaCl	0,00292	0,00109	0,00401	0,3	0,00077	0,24363	60,2
	0.5%NaCl	0,00201	0,00051	0,00206	4,0	0,00017	0,09608	46,6
	0.2%Na_2SO_4	0,00852	0,00266	0,01118	12	0,00488	0,42613	38,3
	0.5%Na_2SO_4	0,00681	0,00219	0,00911	3,1	0,00360	0,39529	43,0
Taltos	control	0,00873	0,00101	0,00974	1,2	0,0195	0,2331	23,9
	0.2%NaCl	0,00184	0,00067	0,00141	2,7	0,00040	0,08941	63,4
	0.5%NaCl	0,00295	0,00280	0,00575	1,1	0,00058	0,33560	58,2
	0.2%Na_2SO_4	0,00823	0,00703	0,01526	1,2	0,00950	0,95536	62,6
	0.5%Na_2SO_4	0,00330	0,00154	0,00484	2,1	0,00589	0,07843	16,2
Tarifa	control	0,00551	0,00197	0,00748	2,8	0,00078	0,43825	59,3
	0.2%NaCl	0,00928	0,00705	0,06633	1,3	0,0314	1,99917	30,4
	0.5%NaCl	0,00161	0,00444	0,00605	0,4	0,00542	0,53647	88,7
	0.2%Na_2SO_4	0,00599	0,00190	0,00789	3,1	0,00064	0,48095	66,7
	0.5%Na_2SO_4	0,00286	0,00182	0,00466	1,5	0,0005	0,21254	45,7
60 days								
Cooper	control	0,00180	0,00150	0,00336	1,3	0,00270	0,23994	71,4
	0.2%NaCl	0,01911	0,00318	0,02029	6,2	0,02414	0,7713	38,0
	0.5%NaCl	0,00961	0,00701	0,01661	1,4	0,01565	0,65436	39,4
	0.2%Na_2SO_4	0,00722	0,00412	0,01134	1,8	0,02678	0,55787	49,2
	0.5%Na_2SO_4	0,00132	0,00105	0,00235	1,2	0,02657	0,08738	37,2
Taltos	control	0,00873	0,00301	0,01974	2,9	0,01955	0,63311	32,1
	0.2%NaCl	0,00112	0,00273	0,00382	0,4	0,00922	0,09357	24,5
	0.5%NaCl	0,00211	0,00153	0,00353	1,3	0,00131	0,06698	19,0
	0.2%Na_2SO_4	0,00332	0,00244	0,00534	1,7	0,01334	0,09587	17,9
	0.5%Na_2SO_4	0,00333	0,00583	0,00916	0,6	0,00117	0,09976	10,9
Tarifa	control	0,00551	0,00197	0,00748	2,8	0,00078	0,53825	71,9
	0.2%NaCl	0,00523	0,00181	0,00766	2,9	0,00169	0,58146	75,9
	0.5%NaCl	0,00394	0,00132	0,00527	3,0	0,00237	0,09417	27,9
	0.2%Na_2SO_4	0,00859	0,00285	0,01144	3,0	0,01488	0,90551	79,2
	0.5%Na_2SO_4	0,00541	0,00308	0,00849	1,8	0,00281	0,59498	70,1

Table 4. **Effect of sail stress on blometric paramets of sugar beet (Beta vu | garis L.)**

Varieties	Varietcs	L_i, mm	L_r, mm	L_i/ L_r	l (sm^2)	a_{wide} (mm)	P_{plant} (q)
30 days							
Cooper	control	60,0	40	1,5	10.3	32,0	28,9
	0.2%NaCl	45,0	35	1.3	8,0	28.0	28,8
	0.5%NaCl	35,0	30	1,2	4.0	12,0	28,6
	0.2%Na_2SO_4	57,0	40	1,4	10,1	30,0	28,9
	0.5%Na_2SO_4	40,0	33	1,2	7,4	27,0	27,8
Taltos	control	68,0	42.0	1,6	14,6	34,0	21,1
	0.2%NaCl	52,0	44,0	1,2	9,0	27,0	28,8
	0.5%NaCl	45,0	35,0	1,3	6,2	19,0	28,7
	0.2%Na_2SO_4	49,0	41,0	1,2	7,3	21,0	29,5
	0.5%Na_2SO_4	44,0	36,0	1,2	6,1	18,0	29,0
Tarifa	control	70,0	40,0	1,8	16,1	39,0	32,3
	0.2%NaCl	64,0	41,0	1,6	11,8	29,0	31,9
	0.5%NaCl	48,0	36,0	1,2	6,8	20,0	30,6
	0.2%Na_2SO_4	60,0	45,0	1,3	11,8	32,0	33,2
	0.5%Na_2SO_4	58,0	40,0	1,5	10,1	29,0	29,9
45 days							
Cooper	control	85,0	60,0	1,4	21,0	42,0	81,0
	0.2%NaCl	80,0	50,0	1,6	11,8	24,0	79,1
	0.5%NaCl	51,0	43,0	1,4	7,7	17,0	79,0
	0.2%Na_2SO_4	72,0	57,0	1,3	15,0	33,0	79,4
	0.5%Na_2SO_4	55,0	42,0	1,3	9,5	18,0	78,9
Taltos	control	81,0	57,0	1,4	19,2	40,0	70,9
	0.2%NaCl	69,0	56,0	1,2	13,7	30,0	78,4
	0.5%NaCl	60,0	55,0	1,1	9,6	23,0	78,1
	0.2%Na_2SO_4	62,0	54,0	1,2	11,3	26,0	71,4
	0.5%Na_2SO_4	56,0	49,0	1,1	8,5	19,0	79,0
Tarifa	control	91,0	60,0	1,5	27,0	52,0	84,8
	0.2%NaCl	70,0	55,0	1,3	15,1	32,0	82,7
	0.5%NaCl	60,0	51,0	1,2	10,5	23,0	80,5
	0.2%Na_2SO_4	75,0	62,0	1,2	17,0	37,0	82,0
	0.5%Na_2SO_4	79,0	52,0	1,5	21,2	40,0	83,5
60 days							
Cooper	control	99,0	80,0	1,3	27,4	48,0	113,9
	0.2%NaCl	75,0	64,0	1,2	13,8	27,0	111,6
	0.5%NaCl	63,0	59,0	1,1	9,3	18,0	109,7
	0.2%Na_2SO_4	88,0	72,0	1,2	18,9	35,0	110,5
	0.5%Na_2SO_4	69,0	57,0	1,2	11,1	23,0	109,9
Taltos	control	101,0	72,0	1,5	30,8	53,0	115,1
	0.2%NaCl	96,0	68,0	1,4	21,9	36,0	112,9
	0.5%NaCl	93,0	70,0	1,4	18,5	35,0	112,0
	0.2%Na_2SO_4	98,0	65,0	1,5	19,7	31,0	113,7
	0.5%Na_2SO_4	94,0	60,0	1,6	13,6	26,0	113,0
Tarifa	control	95,0	71,0	1,4	24,7	43,0	112,8
	0.2%NaCl	94,0	71,0	1,3	18,0	32,0	111,1
	0.5%NaCl	72,0	63,0	1,2	11,1	22,0	110,0
	0.2%Na_2SO_4	91,0	83,0	1,1	19,0	43,0	112,5
	0.5%Na_2SO_4	92,0	67,0	1,3	20,0	44,0	111,9

indicator is a sign that the metabolism of the Tarifa variety is normal and that the variety is stable. It is worth noting that enzymes are activated when stress begins. If BPO is so poorly activated even under stressful conditions, this means that ROS is less effective because the plant itself is salt-tolerance and therefore there is no need for high enzyme activity. When we look at the practice options in the table, we see a completely different picture. The results show that in Cooper and Taltos varieties BPO has a higher catalytic activity with 0,5%NaCl and 0,2%Na_2SO_4 in Tarifa varieties, with 0,2%NaCl and 0,2%Na_2SO_4, depending on time it has. The activity recorded in this variety is 60–80% lower than in other varieties for both salt indicators.

As you know, antioxidant enzymes function in plant organisms in harmony with a normal and stressful reaction to each other's activities. Thus, under stress, superoxide anion radicals formed in plant tissues turn into H_2O_2 ,which are then immersed in water and free oxygen by CAT. The physiological and biochemical role of APO is also a continuation of some catalytic effect, the enzyme KAT. This enzyme prevents the peroxidation of membrane lipids by the breakdown of H_2O_2. We would like to note that there are some conclusions with the results obtained by increasing the activity of BPO and CAT during the first 45 days of vegetation and then 60 days after stressful doses of NaCl and Na_2SO_4 [18].

The obtained results and the APO enzyme CAT H_2O_2 for more efficient use of plant and provided use shows salt tolerance, that many important enzymes.

Finally, we would note that the metabolic and structural changes in the subject, all kinds of stress (drought, salt, radiation, high and low temperature, high and low light intensity el. al) organisms, the conservation, the development of the future. We consider it expedient to use the obtained result as a prerequisite for clarifying the transfer mechanism and searching for ways to manage these processes in the future.

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