Sharipova Kh., Partoev K., Abdullaev A.

**Influence of sodium chloride on seed germination and seedling growth of wheat
(triticum durum desf.)**

*Institute of Botany, Plant Physiology and Genetics, Academy of Sciences of the Republic of
Tajikistan
(Tajikistan, Dushanbe)*

doi: 10.18411/lj-09-2019-40

idsp: ljjournal-09-2019-40

Abstract

It was found that under the influence of 0.5 and 1.0% concentration of sodium chloride (NaCl) there is an increase in germination of wheat seeds (respectively 19.3 and 17.9%), and 1.5% concentration of NaCl leads to a decrease in seed germination by 7.8% than in the control. Under the influence of 0.5 % concentration of NaCl there is a positive effect on the length of wheat germ compared to the control (4.5%), when 1.0 and 1.5% concentration of NaCl lead to a significant decrease in the length of the germs compared to the control (respectively 29.5 and 68.8%).

Key words: wheat, variety, seeds, sodium chloride, concentration.

1. Introduction

The study of the features of growth and development of wheat varieties in the laboratory is of great scientific interest. Salinization is one of the most common factors that adversely affect the growth and development of many crops [1,2]. According to the Food and Agriculture Organization of the United Nations (FAO), more than 20% of the global acreage and 50% of irrigated land are subject to salt stress [3]. High concentration of salts in the soil impedes the flow of water, violates the structure of the soil and impairs its water-consuming properties. The plant responds to salinization not only at the cellular level, but also at the level of the organism [2-4].

Currently, in connection with climate change, the effects of different salt concentrations on the growth of seedlings, gas exchange and plant tolerance to salinization [5], salinity levels using biofertilizers on mobilization of accumulation of reserve substances in grain, and yield are widely studied [6]. Salt tolerance [7].) and frost resistance of some varieties of winter wheat [8].are estimated, and the effect of salinization on the behavior of wheat starch is also studied to ensure the quality of products [9,10].In addition, the effect of salinity is studied by applying nitrogen fertilizer to wheat to mitigate the effects of salt stress [11]. Cultivated plant species and varieties vary in sensitivity to salinity. The main criteria for salt tolerance include plant productivity on saline soils, but the assessment of this indicator is long and laborious. At the initial stages of ontogenesis, the resistance of plants to salinization can be determined by the activity of growth function. The effectiveness of the action of salinization on plants depends on many factors, but their combined effect is still poorly understood [12-14]. In the fight against salinization, breeding work on breeding new varieties of crops resistant to salinity is of particular importance [15].

In this regard, we studied the effect of different concentrations of sodium chloride on the germination of seeds of mapped wheat forms, on the length of the aerial parts of plants and roots in laboratory conditions.

2 Material and methods

For the study, we used seven varieties of wheat, which in 2018 were grown in the conditions of the Khatlon region of the Republic of Tajikistan. The source material of wheat varieties ITMI-36; ITMI-49; ITMI-57; ITMI-63; ITMI-70 and ITMI-84 were obtained from the VIR collection in 2017, and the seeds of the standard Ormon wheat variety (Tajik variety) were obtained from the Agricultural Research Institute of the Tajik Academy of Agricultural Sciences.

From each grade we allocated 60 pieces of grains (in triplicate) to determine the seed mass. Under laboratory conditions, various salt concentrations were made to germinate seeds of wheat varieties: NaCl-0.5%; NaCl-1.0% and NaCl-1.5%.

In the control used distilled water (without salt). The germination of wheat grains conducted in laboratory conditions at a temperature of 18-20°C. Every two days, such parameters as metering of germinated seeds, length of sprouts and length of plant roots for each wheat variety were measured. Periodically, Petri dishes with grains were filled with an aqueous solution, given the concentration of NaCl and distilled water, and the laboratory air temperature was recorded. The repetition of experiments is threefold. Statistical data processing was carried out according to Dospekhov B.A. [16] using the computer program Excel.

3. Results and discussion

As can be seen from Figure 1, in the control version the grain weight was 8.3 and 16.7% more than in the options NaCl-0.5; 1.0 and 1.5%.

Thus, in terms of the mass of grain between varieties and variants of the experiment, certain differences were observed. By weight 20 pcs. seeds also observed the difference between the variants of the experiment (Fig. 3).

As shown by our studies, different concentrations of NaCl had different effects on seed germination (grain) in the experiment (Fig. 4).

Figure 1. Weight 20 pcs. seed between experience variants

As can be seen from Figure 2, on the second day after sowing the seeds between the control options and the NaCl salt in concentrations of 0.5; 1.0% noticeable there is no difference.

Figure 2. The effect of an aqueous solution of NaCl on the germination of wheat seeds on the second and seventh day from sowing, %

However, the option of salt NaCl in a concentration of 1.5% leads to a decrease in the germination of wheat seeds than in other variants by 1.1-1.8%. However, on the seventh day

from the beginning of sowing, there is a change in the process of seed germination in different variants of the experiment.

As can be seen from the data of Figure 2, the variants of NaCl-0.5 and NaCl-1.0% have a positive effect on the germination of wheat seeds than in the control and NaCl-1.5%. For example, if the germination of seeds on the seventh day from sowing in the options NaCl-0.5 and NaCl-1.0% is 100.0 and 96.6%, respectively, this is 19.3 and 17.9% more compared to the control variant. The NaCl-1.5% variant leads to a decrease in seed germination by 7.8% than in the control.

Thus, under the influence of NaCl concentration in 0.5 and 1.0%, an increase in the germination of wheat seeds is observed, and under the influence of NaCl concentration - 1.5%, on the contrary, a decrease in the germination energy of wheat seeds relative to the control. Concentrations of NaCl in doses of 0.5 and 1.0% have a stimulating effect on the process of seed germination in wheat than the control variant. Different concentrations of NaCl have a different effect on the length of wheat germ (Fig.3).

Figure 3. The effect of NaCl concentration on the length of wheat germ on the ninth day from sowing, cm

As can be seen from the data of Figure 3, on the basis of the length of the shoots between the control variant and the 0.5% NaCl concentration variant, no special differences are observed. However, variants of salt NaCl in concentrations of 1.0 and 1.5% negatively affect the length of wheat germ.

Figure 4. The effect of NaCl concentration on the length of wheat germ on the ninth day from sowing, %.

As can be seen from Figure 4, under the influence of NaCl in concentrations of 1.0 and 1.5%, a significant decrease in the length of wheat germ plants is observed compared to the control (by 29.5 and 68.8%, respectively).

CONCLUSIONS .Thus, if the concentration of NaCl - 0.5% has a positive effect on the length of sprouts compared to the control (by 4.5%), then 1.0 and 1.5% concentration of NaCl, on the contrary, inhibits the length of the sprouts of wheat plants. As we found, a decrease in the length of the roots of wheat is observed under the influence of NaCl concentration. **The work was performed in the framework of the project “Biowat”.**

1. Aliyeva Z.M., Suleymanova Z.M., Khabiyeva N.A., Yusufov A.G. The complex effect of temperature factor and salinization on triticale seedlings. Modern problems of adaptation. Part II. Collection of scientific papers of the International Scientific and Practical Conference September 24–26, 2018, Belgorod, 2018.- p. 27-30.
2. Flowers T. J., Leo A. R. Breeding for Salinity in Crop Plants // Aust. J. Plant Physiol, 1995. V.22. p.875-884.
3. Gogue D.O. Physiological mechanisms of salt tolerance of two species of plants of the genus *Nigella* and some characteristics of the quality of their raw materials. Diss. ... kand biol.nauk. Moscow, 2014. -123p.
4. Gulyaev B.I. Photosynthesis and plant productivity: problems, achievements, research prospects // Physiology and Biochemistry cult. plants. - 1996. - 28, № 1.- p. 15-35.
5. Zulfiqar Ahmad , Shermeen Tahir , Muhammad Abid , Muhammad Amanullah. Salt-Induced Variations in Physiological Parameters and Nutrient Concentrations of Two Wheat Cultivars. Communications in Soil Science and Plant Analysis, 45:29–41, 2014,p.29-41.
6. Razieh Khalilzadeh, Raouf Seyed Sharifi , Jalal Jalilian. Growth, physiological status, and yield of salt stressed wheat (*Triticum aestivum* L.) plants affected by biofertilizer and cycocel applications \ Arid land research and management 2018, vol. 32, N. 1, p.71–90.
7. Ami ullah jan , Muhammad Jamil , Hadi Alipour , Muhammad Faraz Bhatti ,Aalvina Gul. Analysis of salinity tolerance potential in synthetic hexaploid wheat .Pak. J. Bot., 2017,49(4), p. 1269-1278.
8. Shailja Trivedi , Gfabor Galiba , Narendra Sankhlao , Erdei. Responses to osmotic and NaCl stress of wheat varieties differing in drought and salt tolerance in callus cultures \Plant Science, 1991,73 , p. 227—232.
9. Li Day, Claire Fayet, Stephen Homer, Effect of NaCl on the thermal behaviour of wheat starch in excess and limited water\ Carbohydrate Polymers ,94 ,p. 31–37.
10. E.E.J. van der Zalm, A.J. van der Goot , R.M. Boom Influence of sodium chloride on shear flow induced starch–gluten separation from Soissons wheat dough \ Journal of Food Engineering 2010, 99 , p.366–372.
11. Muhi Eldeen Hussien Ibrahim, Xinkai Zhu, Guisheng Zhou. Nitrogen Fertilizer Reduces the Impact of Sodium Chloride on Wheat Yield \ Published in Agron. J. 2018, 110, p.1731–1737 .
12. Plotnikova L.Ya., Knaus Yu.K., Shtubey T.Yu. Cytological mechanisms of manifestation of the action of promising genes of wheat resistance to leaf rust // Actual problems of agricultural science and education: Coll. V. II Intern. scientific-practical conf. - Samara, 2005 - p. 237– 240.
13. Shevelukha V.S. Growth as an indicator of the adaptive capacity of plants and crops and the use of its characteristics in plant breeding and plant breeding // Regulation of adaptive reactions of agricultural plants. Kishinev , Shtiintsa, 1987. P. 3-11.
14. Strogonov B.P., Klyshev L.K., Azimov R.A. et al. Problems of salt tolerance of plants / Tashkent: FAN, 1989. 184s.
15. Zhuchenko A. A. The genetic nature of the adaptive potential of cultivated plants // Identified plant gene pool and selection: monograph. SPb: SSC RF VIR, 2005. p. 36-101.
16. Dospikhov B.A. Armor B. A. Methodology of field experience // - M .: Kolos. - 1985. - 368 p.