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Evaluation of Salinity Tolerance of Rice Varieties under Laboratory Conditions

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Abstract. *In this article, in addition to various biotic stresses in rice cultivation today, abiotic stresses also have a negative effect on rice productivity. One of them is salinity stress, and the article evaluates the resistance of rice varieties and samples to this stress in laboratory conditions. Durability was analyzed in four different concentrations of NaCl salt (0.5, 1.0, 1.5 and 2.0%) and in control options. According to the results of the analysis, the salinity resistance characteristics of "Sadaf", "Tolmas + Marvarid" varieties and 4 sample rows were described.*

Keywords: *salinity, NaCl, rice, sample.*

Along with the growing world population, the demand for rice products is also increasing. Therefore, including the amount of rice cultivation, according to the data of the US Department of Agriculture (USAID), last year rice production was 496.40 million tons, and this year 503.17 million tons of rice were grown worldwide, or 6.77 million tons or increased by 1.36 percent [1]. In order to form a unified system of rice cultivation and purchase, rational use of land and water resources, as well as to fill the domestic consumer market with high-quality products, the Cabinet of Ministers of the Republic of Uzbekistan dated October 27, 2017 "On measures to organize the purchase of rice for state needs" According to the decision of the President of the Republic of Uzbekistan dated February 2, 2021 "On Measures for the Further Development of Rice Cultivation" No. implementation, and 30 percent of them are set to plant rice seeds in modern seeders [2].

The level of study of the topic: Rice (Oryza sativa L.) is the main food source for more than half of the world's population. Because rice is obtained from this crop. Therefore, rice production plays a crucial role in world food security. However, rice cultivation often develops under the influence of biotic and abiotic stresses. High salinity causes a sharp reduction in yield in rice cultivation. is one of the main stresses [3, 4, 5]. It is estimated that more than 955 million hectares of land (about 6.5% of the world's total land area), 20% of cultivated land and about 50% of irrigated land are under salinity stress [6] and this problem continues. Rice plant salinity tolerance is regulated by many genes. Identification of these genes by conducting molecular studies and genotypic evaluation of the resistance mechanism of resistant genotypes in the phenotype will lead to higher productivity. Today, molecular or DNA marker detection technologies are becoming an important task in plants and are increasingly used all over the world. Marker-based wheat breeding refers to the use of molecular markers in phenotypically determined high-yielding lines to increase productivity. So far, a number of salinity tolerance genes involved in transcriptional regulation, signaling, ion transport, and metabolic homeostasis have been identified in plants [7 , 8 , 9].

However, the molecular mechanisms underlying salinity tolerance are still not fully understood. In particular, the relationship between salinity and other stresses remains largely unknown [10, 11].

Ganapathy et al.'s research [9] suggested that rice salinity tolerance may be controlled by multiple genes or quantitative trait loci (QTL), involving complex physiological and molecular mechanisms. In order to expand the rice cultivation areas, it is considered necessary to carry out selection work on the creation of salinity-resistant rice varieties. For this, it is important to choose the initial parental forms. To date, at least 85 QTLs and genes associated with salinity tolerance in rice have been identified through traditional QTL mapping and map-based cloning from mutants [13, 14.

The aim of our study is to evaluate the phenotype of genes that provide salinity tolerance in several variations of salinity in rice varieties and to evaluate the tolerance based on traits.

Research materials and methods. The researches were carried out in the "Physiology and Biochemistry of Plants" laboratory of the Rice Research Institute. Newly created varieties and lines are used as research material at the institute. Determination of the level of seed germination of agricultural crops was carried out according to GOST 12038-84 as a research method. In the assessment of salinity tolerance of rice varieties and samples, total germination percentage was determined in four different concentrations of NaCl salt (0.5, 1.0, 1.5 and 2.0% NaCI) and in distilled water as a control. For this, 100 seeds of each variety were taken, placed in petri dishes in 4 replicates and grown in a thermostat for 14 days.

Analysis results. Determination of salt resistance was carried out by the laboratory method of germinating seeds in different saline solutions. This makes it possible to objectively evaluate the comparative salt resistance of varieties. When the resistance level of varieties and samples in 0.5% salt solution was studied, the laboratory germination was 85-100%, the number of roots was 1-5 pieces, and the length was in the range of 1.07-9.73 cm.

Table 1. Resistance level of varieties and samples in 0.5% saline solution

№	Name of variety and specimens	Productivity	Root length cm	Number of roots in cm
0,5%				
1	Guljahon	97	7,85	4
2	TSHD-16-1	100	7,70	5
3	TSHD 8-14.	95	8,62	5
4	TSHD -16 -13	98	8,90	4
5	TSHD -15-13-1-1-1-1	91	9,73	5
6	C-178	96	9,57	4
7	TSHD 13-13	93	7,87	5
8	33-09.	88	5,03	4
9	TSHD.13-13-5-1-1-1-4-1.	98	9,60	4
10	127-09	99	8,40	3
11	K-213	98	8,22	4
12	TSHD -13-5 12	96	1,98	2
13	2-1-1	93	6,33	5
14	K-94.	85	1,98	1
15	Tolmas+Marvarid	99	3,82	4
16	Sadaf	95	1,07	1
Correlation of morphological characters		**r=0,34**		
			r=0,24	
				r=0,76

Among the varieties and samples, K-94 strain was found to have 85% laboratory germination, and compared to other samples, its germination was low. This specimen is intolerant of low soil salinity and is recommended for cultivation in non-saline soils.

TShD-15-13-1-1-1-1, which showed a high result; S-178; The root length of TShD.13-13-5-1-1-1-4-1 ridges is 9.57-9.73 cm, the number of roots is 4-5 pieces, the level of germination in 0.5% saline solution is 91 -98%, the highest result was recorded.

When the correlation of characters was analyzed, there was a moderate positive between fertility and root length (r=0.34), a weak positive between fertility and root number (r=0.24) and a strong positive between root number and root length (r=0.76). a connection was noted.

Table 2. Resistance level of varieties and samples in 1.5% saline solution

№	Name of variety and specimens	Productivity	Root length cm	Number of roots in cm
1,5%				
1	TShD -13-13	14	0,0	0
2	TShD 16-13-1-1-1-1	0	0,0	0
3	K-200-2-1-1	87	1,5	3
4	TShD 20 13 1-3 -1-1	83	2,0	3
5	C-178	23	0,0	0
6	TShD 13-13-6-2-11	0	0,0	0
7	33-09	77	0,0	0
8	TShD 16-2	0	0,0	0
9	TShD 16-1	0	0,0	0
10	127-09	77	0,0	0
11	Sadaf	67	0,0	0
12	Tolmas+Marvarid	47	0,0	0

In our research, it was observed that there is no difference between 1% solution of NaCl salt and 0.5% solution. However, the 1.5% solution was found to have differences from relatively low percentage concentrations (0.5% and 1%). It was observed that the germination in 1.5% saline solution was in the range of 83-87%. K-200-2-1-1 and 20 131-13-11 samples showed relatively high germination rate of 87-83%. The number of roots of these ridges was 3, and the length of the roots was 1.5-2.0 cm.

33-09, 127-09 and 33-09, 127-09 samples were evaluated as moderately resistant, and the germination rate was 77-67%, and it was noted that the root system was not developed. This is of course a natural solution, and a 1.5% solution is a very strong solution that salt-tolerant (eugalophyte) plants can tolerate.

Table 3. Salt tolerance of rice cultivars.

Varietal name	Salt solution concentration	Productivity	Root length cm	Number of roots in cm
“Sadaf”	0,5	95	4,4	6
	1,0	90	3,8	4
	1,5	75	2,4	1
	2,0	0	0	0
Average		**65±22,07**	**2,65±0,97**	**2,75±1,37**
“Billur”	0,5	93	1,7	4
	1,0	85	1,6	1
	1,5	67	0,8	1
	2,0	5	0	0
Average		**62±19,9**	**1,03±0,39**	**1,50±0,86**
Tolmas+Marvarid	0,5	90	2,8	2
	1,0	86	4	3
	1,5	70	2,9	2

	2,0	10	0	0
Average		**64±18,5**	**2,43±0,85**	**1,75±0,62**

In our research, the fertility of varieties "Sadaf", "Billur" and "Tolmas + Marvarid" introduced into production and cultivated in different regions of our republic was studied in a 0.5% solution. 4 cm and the number of roots is 6, the average result was recorded in the "Billur" variety, the germination rate was 93%, the root length was 1.7 cm and the number of roots was 4, the lowest result was the Tolmas variety, the germination rate was 90%, the root length was 2.8 cm and the roots it was found that the number was 2. In 1% and 1.5% solutions, the highest result of the studied characters was recorded in "Sadaf" and "Tolmas+Marvarid" varieties, and the lowest result was recorded in "Billur" variety. The seeds of these varieties germinated in 2.0% salt solution, "Tolmas+Marvarid" variety 10%, Crystal variety 5%, the development of roots was not observed. Based on the obtained results, it can be concluded that different genotypes of rice respond differently to the extreme factors of the external environment and indicate the need to analyze the genetic potential of the studied genotype in the study of plant metabolism and the mechanism of physiological processes.

CONCLUSION. From the studied varieties and samples 327-01, 400-99, TShD 16-13-1-1-1-1. TShD 8-14-1-1 samples were found to have a high tolerance potential to soil salinity. According to varieties, "Tolmas+Marvarid" and "Sadaf" varieties differed positively in terms of their resistance to root development.

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