Study of the effect of cytokinin mediator on increasing salt resistance and germination energy of wheat varieties

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Abstract. Currently, about a third of Kazakhstan has been subjected to salinization. Improper Organization of the irrigation regime causes secondary salinization and deepens the problem. Under the influence of secondary salinization, salts rise above the layers of the soil and primarily affect the seeds of the plant, interfering with it during the most important period of plant growth. Therefore, the study of the influence of the salinity factor on the growth of plant seeds is an urgent problem.It is important to use cytokinin mediators to increase plant resistance to environmental factors such as salinization. Many plant seeds are weak and have poor germination capacity, it is very important to use a cytokinin mediator to increase the germination of these plants.In this research, we treat soft wheat grains with a cytokinin mediator to boost their resilience to salt stress and to prevent salinization. Plants respond to relatively small amounts of the bioregulatory cytokinin mediator, which controls plant growth, development, and environmental adaptability. Economically, the cytokinin mediator works well as a stress-resistance-boosting medicine for wheat growth acceleration. It was discovered that 100 ng/ml is the most ideal cytokinin mediator concentration for the spring soft wheat type.

1 Introduction

The majority of Kazakhstan's climate zone is changing extremely quickly, which has a severe effect on the flora. It will take the development of novel eco-biotechnologies to alter Kazakhstan's ecological situation. Cytokinin mediator controls plant response to stressors [1-2].

In order to restore the ecological condition, a new bioregulator is desperately needed in the field of ecology [3]. Environmental problems include drought, heat, cold, and salinization [4-5]. Plant growth, development, and adaptation are regulated by the low-concentration action of the cytokinin mediator. It is ideal and economical to use the cytokinin mediator as a medication to boost plants' resilience to stress [6-8]. In this regard, the study of cytokinin mediator to increase the resistance of plants to stress received the main attention.

Wheat varieties "Kazakhstan - 10" and "Saratov - 29" were taken as objects of research. The technique of purification and chromatographic separation of the cytokinin mediator was fully implemented by the method proposed by Gilmanov M. K. [9].

2 Materials and Methods

The object of the study was obtained wheat seeds (*Triticum aestivum*) grade "Saratov - 29" and "Kazakhstan- 10". A cytokinin mediator was isolated from the green bark of wheat ears. To isolate the cytokinin mediator, adsorption chromatography was used, obtained in a sorbent with nanowire carbon of the "Nanocarbosorb" type. The cytokinin mediator is a substance similar in nature to the plant phytohormone cytokinin. The chemical composition and structure are under study [10-12]. A UV monitor of the UVICORD S II type manufactured by LKB (Sweden) was used to control chromatographic separation. The seeds were germinated in Petri dishes at 20°C thermostat on sterile par with a high filter. Wheat germ was grown in sterile water for 1-2 weeks. The experiment was repeated 10 times.

3 Results and discussion

Concentrations of CTM of 25 ng/ml, 50 ng/ml, and 100 ng/ml were achieved to control the salt resistance of wheat; it was discovered that the most appropriate concentration is 100 ng/ml.

In Kazakhstan-10 control variant, all the seeds grown germinated, while most of the seeds with 2% NaCl did not germinate. Germination characteristics of 2% NaCl wheat seeds were studied. Table 1 presents the results of this study.

Table 1. The effect of 2% NaCl on the germination of wheat varietie "Kazakhstan - 10".

Experience options (Day 1)	**Germination dates (Day 3)**	**Germination %**	**Sprout length, cm**
Control (water)	On the 3rd day began to germinate	96%	10,1±1.1
2% NaCl	On the 3rd day began to germinate	6,4%	0,2±0,05

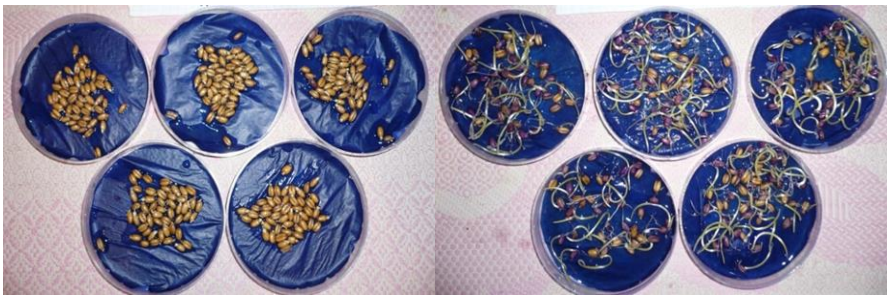
The germination of grains from chloride salinization is strongly slowed down, as shown in the table provided. Only 6.4% of the grains were germinated, and under control the germination capacity of the grains was 96%. In the presence of 2% NaCl, the length of the sprouts was small, it was only 0.2 cm on the 3rd day of germination. During salting, grain growth decreased by 94%.

Control 2%NaCl

Fig. 1. Research results of "Kazakhstan – 10"

Salinization had a detrimental effect on wheat grain germination. In this context, more research was done on the growth parameters of the Saratov-29 wheat variety during salinization. Grain of the Saratov - 29 wheat variety was taken in order to compare the experiment's outcomes. In petri plates with moist filter paper and a 2% NaCl solution, wheat seedlings were cultivated at room temperature. In the control group, however, the grains were cultivated in distilled water at room temperature. Figure 1 displays the experimental outcomes.

During the experiment, grains of summer wheat varieties "Kazakhstan - 10" and "Saratov - 29" were placed in a solution of cytokinin mediator (100 ng/ml, soaked for 12 hours, then placed on wet filter paper in petri dishes and grown in a 2% NaCl solution under normal temperature conditions (21-25^{0}C). In the control variant, the seeds were soaked in water for 12 hours, then placed on wet filter paper in petri dishes at a normal temperature (21-25^{0}C). The results of the experiment are shown in Figure 2 (A,B).



A B

Fig. 2. Effect of cytokinin mediator in the presence of 2% sodium chloride solution on growth of summer wheat variety "Kazakhstan - 10" at normal temperature.

(A)- control. Germination of wheat grain on the 3rd day of germination of wheat variety "Kazakhstan - 10" with 2% NaCl, not treated with a cytokinin mediators. (B)- 2% NaCl + cytokinin mediator. Germination of wheat grains on the 3rd germination day in the presence of a 2% sodium chloride solution of the" Kazakhstan - 10 " Variety treated with a cytokinin mediator (100 ng/mL) at normal temperature

As can be seen from Figure 3, in the control version, wheat grains did not germinate at normal temperature in the presence of 2% NaCl, and in the experimental version, seeds treated with a solution of cytokinin mediator allowed better germination in 2% NaCl. These results show that the cytokinin mediator improves the resistance of wheat sprouts to salinity stress.

Table 2 shows the growth index of wheat in the version with addition of cytokinin mediator and sodium chloride to wheat grain.

Table 2. Effect of cytokinin mediator (100 μg/L) on Salt resistance of wheat sprouts

Cultivation options	**Number of germinated seeds (from 250 seeds)**			**Length of stem, cm**
	3 days	4 days	8 days	
2%NaCl	-	16	16	0,2±0,1

(control)				
Cytokinin mediator +2%NaCl	93	110	115	4,7±1,2

The cytokinin mediator radically raises the resistance of wheat seeds to chloride salinization, as shown in the table. For example, in 2% NaCl, 93 wheat seeds germinated out of 250 seeds under the influence of cytokinin mediator. The results obtained showed that the cytokinin mediator increases the resistance of growing seeds to salt stress.

The germination vitality of seeds, the capacity of seeds to grow rapidly and together is one of the markers of the quality of sown seeds.

It is essential to decide the concentration of the cytokinin mediator, which has an compelling impact on the germination vitality of seeds. Critical within the germination of seeds ought to be the assurance of the development parameters of the grows. For this, it was found to ponder the impact of a cytokinin mediator gotten at a concentration of 25,50,100 µg/L on the germination parameters of wheat seeds. The foremost viable concentration for wheat development may be a concentration rise to 100 µg/L cytokinin mediator. The results of the conducted experiments are shown in Table 3.

Table 3. Effect of different concentrations of cytokinin mediator on germination energy of wheat seeds

Concentration of biostimulator (number of seeds 250, t=25°C)	Number of germinated seeds		Length of stem, cm		Seed germination
	Day 3	Day 5	Day 3	Day 5	
100 µg/L	72	88	2,5±0,3	3,5±0,4	35,2±2,5
50 µg/L	68	80	2,3±0,3	4,3±0,4	33,1±3,5
25 µg/L	60	72	3,0±0,3	3,5±0,3	28,8±2,2
Control	53	59	2±0,4	3,2±0,3	23,6±2,1

In the results shown in the table, the concentration of cytokinin mediator 50-100 µg/L is the most effective for the yield of the obtained varieties.

It is concluded that cytokinin mediator increases the salt tolerance of wheat cultivars and extends their development rate. It can be used as a drug that increases salt tolerance of plants. Cytokinin mediator can be used to stimulate the germination of seeds that have lost their ability to germinate or have poor germination.

4 Conclusion

One of the most pressing problems is the use of cytokinin mediator that increase the resistance of plants to salt stress. Work has been carried out related to increasing wheat salt resistance through the cytokinin mediator. In the study, seeds did not germinate at a concentration of 2% NaCl, and grains treated with a cytokinin mediator did well even with 2% NaCl. Cytokinin mediator increases wheat grain salt to suffer and yield. Cytokinin mediator has been shown to be more effective in improving germination, yield and to suffer salt stress in poor seed germination than common regulators. The cytokinin mediator increases the germination and energy of wheat grain. The germination of grains from chloride salinization is strongly slowed down, as shown in the table provided. Only 6.4% of

the grains were germinated, and under control the germination capacity of the grains was 96%. In the presence of 2% NaCl, the length of the sprouts was small, it was only 0.2 cm on the 3rd day of germination. During salting, grain growth decreased by 94%.

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