

Impact of Hydro-Priming and Osmo-Priming on Germination Indexes of Rye (*Secale Cereal*)

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Abstract This study was conducted in order to study the effect of hydro-priming by distilled water and osmopriming by KNO₃ on indexes germination of *Secale Cereal* in triplet in factorial design and based on fully randomized plan. Factors consisted distilled water for 4 hours and KNO₃ 1% and 2% were composed the second factor. Germinated seeds were counted daily for eight days. Then the percent of germination, germination speed, the averagedaily germination, the length of the shoot, root and the weight of dry plant were measured. Regarding mean data resulted from the experiment the results showed that distilled water influent on the percent of germination, germination speed, the average daily germination, the weight of dry plant, the length of the shoot and the root on the level of one percent ($p>0/01$) significantly. In sum the results showed that hydro priming by the distilled water is able to assist to develop suitable rye plant in real condition.

Keywords Distilled water, Hydro priming, Germination indices, Rye

1. Introduction

Rye is one of the most important agricultural plants and increase in germination percent of the rye seed is an important factor in improving the plant (Kafi et al 2005). Although among the plants, rye is one of the best adjusted agricultural categories but amount of production and performance of this plant as other agricultural plants is hardly affected by environmental factors and constantly there is a concern that whether produced rye can be enough for growing population in the world (Satorr and Slafar 2001). Harris et al 2001 reported that priming the seed causes the powerful development, more rye branch fills the rye better; increase the products and length of the branches of the rye. In India the effect of priming in decreasing the development duration caused that farmers can have 3 products in a year [13]. Karaki [15] reported the increase of the wet weight and the length of the shoot and the root of the rye and barley along with priming. Determining a suitable time of priming prevents a negative effect of it. Penalosa and Eira 1993 reported that the suitable time of priming prevents a negative effect of priming on the germination seed of tomato. Seed germination has extra importance in determining the final density of the plant in the square unit so that the enough density of the plant in square unit will be achieved that cultivated seeds erupt completely with enough speed [6]. The

advantages of priming the seed is reported so that include increasing the resistance of the plant in the salty areas, Asada 1992, and under dry condition [1], seed cultivation, [7], increasing the performance of the seeds with low naming power, [2], and also increase the products [11].

2. Material and Methods

To study the effect of distilled water on germination indices of rye seed this experiment was studied in terms of full randomized blocks factorial design in Plants Physiology Laboratory, faculty of Agriculture of Saveh Azad University. For this reason, rye's cultivar *Secale Montanum* was used, namely, first, 50 seeds were separated and disinfected for each Petri dish and in order to disinfect, the seeds were drenched in KNO₃ 1% and 2% for 8 hours then they were washed with water. Related seeds were treated in Hydro-priming with distilled water for 4 hours in 20°C. After this time the seeds were transferred to the sterilized pottery dish in which bottom there was a paper filter. The diagonal of all pottery dishes was 9 cm. Then, 10ml distilled water or KNO₃ solutions in concentration 1% and 2% was added after that all of them were transferred to a germinator with 25±1 and duration of day light 16 hours and darkness was 8 hours. Light intensity was 1500 lux. Counting the germinated seeds was done daily in a specific time. In the time of counting, the seeds were considered germinated that the length of their roots was 2mm or more. Counting will be continued till the increase in the number of germinated seed won't be observed and the number of the seed in pottery dish will be fixed. According to the data, in order to calculate the percent and

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speed of germination, the following equation is used.

$$\text{Germination Percentage} = S/T \times 100$$

$$\text{Germination Speed} = N1/D1 + N2/D2 + \dots + Ni/Di$$

Where s is the number of germinated seeds, T is the total seeds and Ni the number of germinated seed in day Di .

$$\text{The average of daily germination (MDG)} = \sum Cpsgt/T$$

Where $Cpsgt$ is the percent of the germinated seed during the period and T is the total germination period. In order to achieve the length of the shoot and the root, 1ml ruler was used then the dry plant was measured. All samples were dried in an oven at 70°C for 72 h, and then weighed for dry matter.

3. Results and Discussion

Variance analysis results (table 1) showed that KNO_3 has meaningful effect on germination percent, germination speed, the average of daily germination, dry weight of plant, the length of the shoot and the root, moreover, according to

results, distilled water has significant effect on germination percent, germination speed, the average of daily germination, dry weight of plant, the length of the shoot and the root on the one percent probable level ($p > 0.01$). Interfering of distilled water with KNO_3 has significant effect on germination percent, germination speed, the average of daily germination, dry weight of plant, the length of the shoot and the root on the one percent probable level ($p > 0.01$). The results of the average of comparison effect of different level of distilled waters showed that increase of the distilled water improve the situation of germination components related to witness. The most germination indicator is related to the distilled water and KNO_3 2% concentration.

The results of the averages of the KNO_3 (table 1) showed that the increase of KNO_3 improves the situation of germination components related to the witness. KNO_3 doesn't have much effect on the germination percent and the average of daily germination. The most germination speed, dry weight, length of the shoot and the root is related to KNO_3 2% treatment.

Table 1. the results of the effect of the variance analysis of seed priming on germination indexes of rye

Resources	Germination percentage	Germination speed	Average daily germination	Dry weight of the plant	Shoot length	Root length
distilled water	110.528 **	337.733**	4.421**	0.167**	23.956 **	17.052**
KNO_3	2.306 ^{ns}	170.674**	0.92 ^{ns}	0.737**	70.997**	34.517**
distilled water× KNO_3	5.269 **	24.082 **	0.2111 **	0.005 **	0.345**	0.923**
Error	1.5	0.435	0.06	0.001	0.097	0.012
c.v	1/28	1.9	1.25	6.57	4.62	2/3

Table 2. Comparison the average effect of different level of KNO_3 on the bioactive indicators of the rye

KNO_3	Germination percent	Germination speed	Average daily germination	Dry weight of the plant	Shoot length	Root length
0	^b 98.5	^d 27.71	^b 19.7	^c 0.315	4.93 ^c	^d 3.14
1%	99.3 ^{ab}	^b 35.19	^{ab} 19.866	^b 0.513	^b 6.8967	^b 5.06
2%	^a 100	^a 40.66	^a 20	^a 0.593	^a 8.38	^a 6

The same letters in every column don't have significant statistical difference

Studying the effect of distilled water on germination percentage shows that distilled water increases germination percentage improve the situation of germination components related to the witness. The most germination speed, dry weight, length of the shoot and the root is related to 4 hours treatment that this treatment consumes more energy to gain a certain amount of water. The issue can be an explanation for acceleration of germination and reduction of mean germination time which the results are in accordance with the results of Baalbaki and *et al*[7], Khan and Samiullah[20] and Dowlatabadian and *et al*[11]. Results from the mean comparisons of different levels of KNO_3 showed that the KNO_3 increase leads to the increase of seed resistance against normal situation and improvement in the status of germination components' growth.

Table 3. Comparing the average interaction of the KNO_3 with distilled water on the studied adjectives

		Treatment		Adjective average			
Distilled water	KNO_3	Germination percent	Germination speed	Average daily germination	Dry weight of the plant	Shoot length	Root length
4 hours	1%	82 b	24 b	17a	0.21 b	2. 24 b	1.7 b
4 hours	2%	93 a	21 a	16/3 b	0.16 a	2.1 a	2.8 a

The average in which a column at least has one common letter with Donken test on the level of 5% is in the similar statistical group

The results of comparing the interaction effects of different levels of KNO_3 (table 3) showed that level of KNO_3 2% with Distilled water has the most germination speed, dry weight of the plant, the length of the shoot and the root. Also the most germination percent and the amount of daily germination related to the lack of KNO_3 existence and distilled water. KNO_3 can act as a new type of plant antioxidants and also are involved in a wide range of biochemical reactions, including the metabolism of glycogen and amino acid synthesis and nucleic and the synthesis and metabolism of hemoglobin, also this material in synthesis is involved, *Sphingomilin* and other sphene lipids neurotransmitters. 5-phosphate KNO_3 is involved in acid metabolism of gamma - amino butyric. The reason of the increasing the germination in KNO_3 application is for stimulating the respiratory inhibitor. The similar results were reported [26]. The probably, the reason of increasing the length of the root and the shoot is KNO_3 application because of root and shoot system development by using this material that increase the nutrients attraction of in result increase the performance in agricultural plants. The similar results were reported by Eradatmand Asli and Houshmandfar [13] Khan and *et al* [20], Pierik [24] and Karaki [19]. Also Chen and Xiong [9] by studying the effect of KNO_3 on plants, confirmed the vital role of KNO_3 on the development of the plants. Based on the research done by Khan and *et al* [20] and the increasing role of KNO_3 in the amount of root drawing, cause to appear the leaf soon. It changes the ability of photosynthesis and natural attraction rate NAR. Based on the research of treating the seed with KNO_3 will have nitrogen attraction increase and phosphor in **Safflower** plan, vetch and lentil [17], rye [20] and canola [19] and Dolatabadian and Saleh [11] reported that priming the seed of the sunflower for 3 to 5 days increase the germination speed and improve the plant development. They also declare that the reason of this reaction in respiratory activity is producing ATP, stimulating the activity of RNA and making protein in the primed seeds. Probably the reason of decreasing the germination percent because of eliminate the free radicals directly, which reduces the damage caused by reactive species, so membrane lipid per oxidation will be decreased. Similar results on the other materials have been reported by Dolatabadian and *et al* [11] and Baalbaki *et al* [7].

4. Conclusions

According to the results in this experiment and the different level of treating the chemical KNO_3 and Distilled water of this matter we can conclude that probably, KNO_3 by increasing the root development and raising the ability of nutrient attraction by the plant represents this possibility in order to use the potential of the water and nutrient in the soil. The results of this research showed that seed treatment with KNO_3 can be as an economic simple way and also be effective on increasing the plant output.

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