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Original Article

Studies on Germination Properties of Spring Wheat with Treatment by Poly Amines Under Salinity Stress

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ABSTRACT

Objective: In order to investigate effects of different concentrations of poly amines Sprimidin and Putrescine on germination of Arg cultivar under salinity stress. **Methods:** This experiment was conducted as factorial based on completely randomized design with four replicates in agronomy and plant breeding laboratory, Agricultural department, Islamic Azad University, Varamin-Pishva Branch in spring of 2014. First factor was four levels of salinity including S1: 3.87, S2: 5.95, S3: 10.25 and S4: 12.87 ds/m and the second factor was three levels of poly amines including H0: control (not application of poly amines), H1: Putrescine 2.5 m/mol and H2: Sprimidin 5 mmol/L. coleoptile and cleorhiza length, cleorhiza number, coleoptile, cleorhiza and seedling dry weight, Tissue water content (TWC), germination percent and number of damaged seeds were measured. **Results:** Analysis of variance showed that coleoptile and cleorhiza length, cleorhiza dry weight affected by salinity and hormone levels at 1% of probability level. There was no significant difference among other treatments for other properties. Results of this experiment indicated that following increasing salinity, sever reduction in germination-dependent properties were observed.

1.INTRODUCTION

Regarding that salinity is one of obvious characters of Iran, and there is no way for escape from it, and importance of sources of energy, water and nutrient. Wheat is one of the most important crops which prepare 60-65% of required energy. One of environmental limitation of wheat production in salty and semi-salty areas in Iran is salinity and water limitation. So finding new ways for solving its problem is necessary. Application of phytohormones and poly amines are from them. Different phythormones and polyamines reduced destructive effects of salinity. Gibberlic acid (GA3), Sprimidin and Putrescine are from them which paid attention by plant scientists (Basalah and Mohammad, 1999; Hisamatsu *et al*.,2000). When plants exposed to biotic or abiotic stresses, GA3 accumulated rapidly (Lehmann *et al*., 2000). GA3 biosynthesis adjusted by environmental reactions (Yamaguchi and Kamiya, 2000; Olszewski *et al*., 2002). A growth regulator made, suppressed or changed qualifications of growth and improvement in very low concentration (lower than 1 mmol).

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1.1. Pishtaz wheat

Pishtaz cultivar obtained by crossing an improved line (1-27-6275/Cf1770), which later named Alvand, with resistance to yellow rust line, A1dan/Ias58, which originated from Brazil, in 1999. Selection steps of Pishatz were implemented in two generation in year, between Iranshahr and Clardasht station. Resistance to disease and favorable baking quality, made Pishtaz named and introduced in 1381. Pishtaz had the highest yield, so that the average yield of 7396 kg and record of 9646 kg/ha reported for this cultivar.

2. MATERIALS AND METHODS

2.1. Methods

This experiment was conducted as factorial based on completely randomized design with four replicates in agronomy and plant breeding laboratory, Agricultural department, Islamic Azad University, Varamin-Pishva Branch in spring of 2014. First factor was four levels of salinity including S1: 3.87, S2: 5.95, S3: 10.25 and S4: 12.87 ds/m and the second factor was three levels of poly amines in cluding H0: control (not application of poly amines), H1: Putrescine 2.5 m/mol and H2: Sprimidin 5 mmol/L.

2.2. Germination Experiment

After weighting the above hormone, they poured in container volume: 50 ml. GA3 and Kin solved in NaOH (1N). An aliquot of control water (obtained from well) poured to each hormone treatments to reach the interested volume. Different levels of salinity were obtained from agricultural wells of Gomrod, in Gome Province. 10 seeds of Tajan cultivar were placed in Petri dishes which covered with filter paper, regularly. Then 10 ml of the treatments added to each Petri dishes. To avoid respiration and transpiration, the door of Petri dishes covered with parafilm. The samples were transferred to germinator without any light in 20 °C and 50% humidity. 7 days later, the length of coleoptile and cleorhiza, number of radicle and length of longest radicle and plumule measured. Then the coleoptile and cleorhiza of each petri placed in separated paper and placed in the pocket and all information of Petri written of it. On each pocket, the fresh weight (FW) of coleoptile and cleorhiza added, also. Then two papers pressed to each other and all samples transferred to oven at 70 °C for 48 h, then the dry weight (DW) of them measured. The cultured seeds were maintained at 25±1 and absolutely no light. After 7 days, number of germinated seeds, radicle and plumule length, coleoptile length, fresh and dry weight of seedlings measured. Tissue Water Content calculated using the following formula: TWC=((FW-DW)/FW)×100. The collected data analyzed using SPSS, SAS and MSTAT-C softwares. The means were separated using Duncan Multiple Range Tests at 5% of probability level.

3. RESULTS

3.1. Coleoptile Length:

Analysis of variance showed that coleoptile length was affected by salinity, hormone and their opposite effects at 1% of probability level (Table 1). The longest coleoptile was in salinity of 5.95 ds/m with 5.75 cm, and the shortest was in salinity of 10.25 ds/m with 4.55 cm. The longest coleoptile was in not application of hormone with 5.84 cm, and the shortest was in Putrescine 2.5 m/mol 4.71 cm (Table 2). The longest coleoptile was in not application of hormone and salinity of 5.95 ds/m with 6.88 cm, while the shortest wasin salinity of 10.25 ds/m and Putrescine 2.5 m/mol with 3.32 cm (Figure 1). These results were in agreement with (Kiseleva and Kaminskaya, 2002; Zhu *et al.,* 2006).

3.2. Cleorhiza Length

Analysis of variance showed that cleorhiza length was affected by salinity, hormone and their opposite effects at 1% of probability level (Table 1). The longest cleorhiza was in salinity of 12.87 ds/m with 6.34cm, and the shortest was in salinity of 3.87 ds/m with 2.56 cm (Table 2). The longest cleorhiza was in not application of hormone with 6.81 cm, and the shortest was in Putrescine 2.5 m/mol with 6.62 cm (Table 2). The longest cleorhiza was in salinity of 5.95 ds/m and not application of hormone with 8.42 cm, while it was shortest in salinity of 3.87 ds/m and Sprimidin 5 mmol/L with 2.35 cm (Figure 2). These results were in agreement with (Mo *et al.,* 2010; Pua and Iqbal 2002; Yoda *et al.,* 2009).

3.3. Cleorhiza Number

Analysis of variance showed that cleorhiza number affected by salinity × hormone at 1% of probability level and there were no significant differences among salinity and hormone treatments (Table 1). The most number of cleorhiza was in salinity of 12.87 ds/m and Putrescine 2.5 m/mol with 5.4, while it was lowest in salinity of 5.95 ds/m and Sprimidin 5 mmol/L with 4.57 (Figure 3). These results were in agreement with (Khan *et al.,* 2004; Urano *et al.,* 2005).

3.4. Cleorhiza Dry Weight

Analysis of variance indicated that dry weight of cleorhiza was affected by salinity and hormone at 5% and 1% of probability level, and not by salinity × hormone treatments (Table 1). The highest dry weight of cleorhiza was in salinity of 12.87 ds/m with 0.05 g while the lowest was in salinity of 3.87 ds/m with 0.03 g (Table 2). The highest dry weight of cleorhiza was in not

application of hormone with 0.05 g, but it was lowest in Sprimidin 5 mmol/L with 0.03 g (Table 2). These results were in agreement with(Iqbal and Ashraf, 2005a; Tun *et al.,* 2006).

Coleoptile and Seedling Dry Weight, TWC, Germination Percent, Number of Damaged Seeds: Analysis of variance indicated that Coleoptile and seedling dry weight, TWC, germination percent, number of damaged seeds was not affected by salinity, hormone and their opposite effects (Table 1). These results were in agreement with (Gurmani *et al.,* 2009; Alcazar *et al.,* 2006).

4. DISCUSSION

Stress is expressed so that when pressure reaches to cellular level, alarm stage started, immediately. The alarm stage started with insatiability of some structures especially membrane systems and protein, catabolism occurs more than anabolism and degradation is more than synthesize. But cell repair occurs soon and situation returns to pervious. Synthesize of protective cells started and total anabolism will be more than catabolism. This is a recovery action. Therefore, plants return to primary situation, and if the stressful condition followed, or became sever, plant protected itself severely. Then plant entered the next stage which special characters appear more than usual and named resistance which occurred with plant hardening, which is special compatibility. In compatibility, there is an induce time that is suitable for plant under stress which in it, threshold effect and external symptoms exist and compatibility by recovery or hardening occurred during it. Resistance stage maybe too long. If stressful condition more continued or became severer, caused plant eroding. In this stage, presence of predators or parasites resulted in plant death. This stages succession often are not the same. There are some complexities in stressful condition. External poly amines had no roll in growth unless levels of endogenous polyamines decreased. Poly amines had no roll in cell enlargement, but maybe required in cell fragmentation. Results of study on Pishtaz cultivar showed that poly amines failed to reduce destructive effects of salinity on metabolically and physiologically processes of seeds and following increasing in salinity level, germination properties of seeds decrease significantly.

Table 1.

Analysis of variance for studied traits of wheat variety under salt stress

S.O.V.	DF	Length of Coleoptil	Length of Coleorhiza	Number of Coleorhiza	Dried weight of Coleorhiza	Dried weight of Coleoptil	Dried weight of seedlings	Interstitial water content of seedlings	Percentage of germination	Percentage of Damage seeds
Salinity	3	4.060**	34.795**	0.203ns	0.001*	0.008ns	0.0009ns	11.259ns	261.111ns	2.611ns
Hormone	2	5.259**	43.213**	0.199ns	0.002**	0.007ns	0.008ns	247.736ns	181.750ns	0.188ns
Salinity × Hormone	6	1.515**	6.081**	0.355**	0.000ns	0.014ns	0.020ns	154.525ns	154.861ns	1.549ns
Error		0.174	0.609	0.086	0.000	0.014	0.013	127.026	137.500	1.375
%CV		8	10	12	16	9	8	9	5	11

ns: Non significant, ** and * significant at 0.01 and 0.05 probability levels, respectively.

Table 2.

Means comparison for studied traits.

S.O.V.	Length of Coleoptil (cm2)	Length of Coleorhiza (cm2)	Dried weight of Coleorhiza(g)
Salinity3.87(ds.m)	5.64a	2.56c	0.03b
Salinity5.95(ds.m)	5.75a	5.95a	0.04ab
Salinity10.25(ds.m)	4.55c	5.13b	0.04ab
Salinity12.87(ds.m)	4.9b	6.34a	0.05a
Hormone(0)	5.84a	6.81a	0.05a
Hormone(putrescin 2.5mmol)	4.71c	3.62c	0.04b
Hormone(spermidine5mmol)	5.07b	4.55b	0.03b

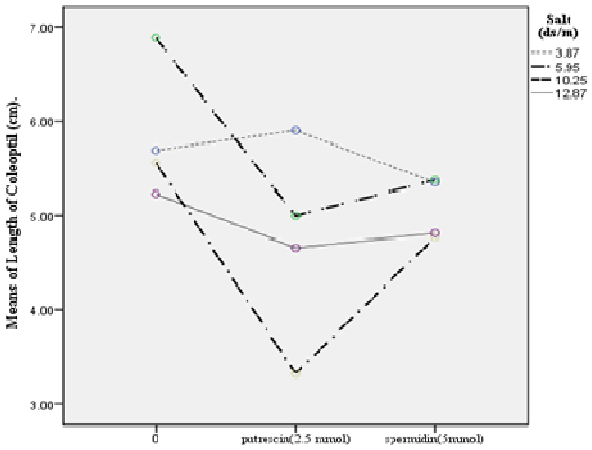

Figure1. Means comparison of interaction for Length of Coleoptil

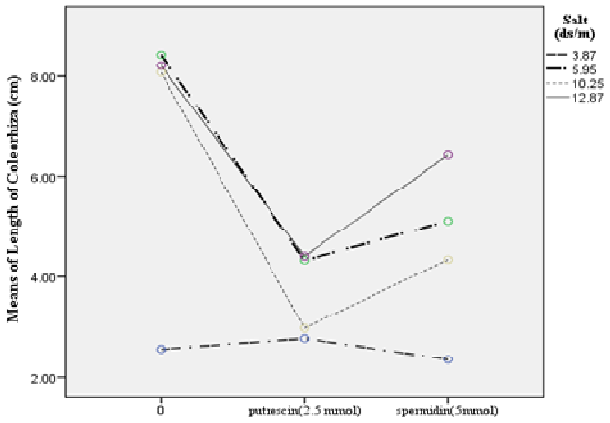

Figure 2 . Means comparison of interaction for Length of Coleorhiza

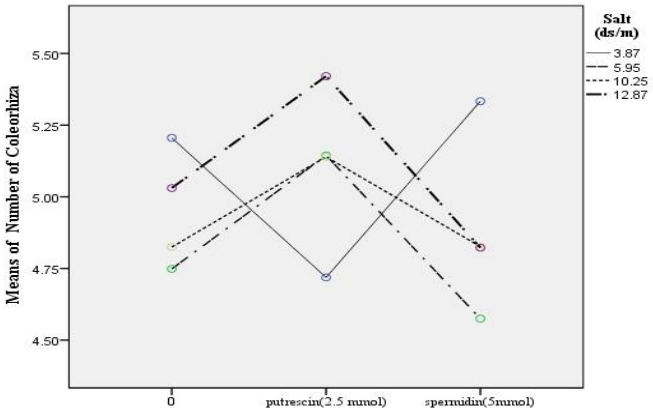

Figure 3 . Means comparison of interaction for Number of Coleorhiza

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