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Study of soybean germination indices under salt stress with ascorbic acid pretreatment

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ABSTRACT: Salinity is one of the most important factors limit economic exploitation of the land for agricultural crops**.** Benefits of the seed preparation are included enhancing the plant resistance at salt and drought areas, increasing the seed yield with low viability, breaking dormancy and also increasing crop. Ascorbic acid is one of the most important herbal antioxidant which plays an important role in processes such as cell growth and cell division, metabolism reactions at the time of germination; remove cellular toxicity, cell protection of oxidative reactions and preventing cell death. The results showed that the salt causes to reduce the growth of germination components. On the other hand the interaction between ascorbic acid and salinity on seed germination, rootlet dry weight, shoot length, uniformity of germination and germination rate is significant at the 1% level. But it was observed no significant effect on shoot dry weight and rootlet length. The results of mean comparison at different levels of ascorbic acid showed that the increasing of ascorbic acid increased the germination of soybean and improvement of germination elements at salinity.

***Keywords*:** Germination, salinity, ascorbic acid, soybean.

INTRODUCTION

Salinity is one of the most important factors limit economic exploitation of the land for agricultural crops (Afzal et al., 2005). Salinity can affect germination through osmotic pressure increase and reducing absorption and also through toxic effects of ions such as sodium and chlorine (Abo-El-Kheir and Mekki, 2007; Arora et al., 2002). Some researchers (Afzal et al., 2005) have attributed the effect of salinity on germination of crops to reduce the osmotic potential and others it to the toxic effects of ions. Seed preparation is one of solutions to reduce the negative effects of salinity (Asada, 1992) that is widely used for enhancing the yield with the steady rise and the percentage of germination and on the other hand, reduce the seed susceptibility to external factors (Barrs, 1968). Ascorbic acid is one of the most important herbal antioxidant which plays an important role in cell processes (Dumet and Benson, 2000). Seed soaking is widely used with ascorbic acid, so that it increases performance and resistance to different external factors such as salinity (Aspinall and Paleg, 1981; Benson, 1990). Therefore, in the present study considering the antioxidant role of ascorbic acid in plants, addition to the effects of salinity on seed it is also discussed the protective role of ascorbic acid against salt stress.

MATERIALS AND METHODS

The factorial experiment in a randomized complete block design was studied in crop Physiology Laboratory, Faculty of Agriculture, Islamic Azad University of Ardabil. For this purpose was used seeds cultivar of soybean Zan. So that, the first 50 seeds per Petri dish was removed and disinfected. The seeds were placed for 24 hours at 20 ° C and at three concentrations zero, 500 and 1000 mM in ascorbic acid solution. After this period, the seeds were washed thoroughly with distilled water and were transferred to a sterile Petri dish. Then 10 ml of water or a solution of chloro sodium depending on treatment were added to the Petri dish with concentration of zero, 60 and 100 mM, and all Petri dish were transferred in a germinator at temperature 25 ± 0.5, 1500 lux of light intensity, 16 hours of daylight and 8 hours of darkness. Counting of germinated seeds were taken daily at certain hours. During the

germinated seeds counting it looks that the rootlet length be 2 mm or more. Counting continued until the number of germinated seeds was not increased and the number of germinated seeds in each Petri dish remained constant for three days. Based on the data obtained from these counts, germination rate, germination (the percentage of germinated seeds of total seeds during the experiment) and uniformity of germination (time required to reach from 10 to 90% in terms of hour) were calculated. The germination rate as time to 50%, germination it means that (1/ (D_{50})) obtained and germination uniformity as time (per hour) were calculated from 10 to 90% of final germination (ie, D_{10} and D_{90}). Rootlet length and shoot and shoot and rootlet dry weight was calculated. Software SPSS and Minitab was used for data statistical operations and the mean comparison of data was performed by Duncan's test.

RESULTS AND DISCUSSION

Analysis of variance (Table 1) showed that the different levels of ascorbic acid affected significantly on germination, shoot length, rootlet dry weight, shoot dry weight, uniformity of germination, rootlet length and uniformity of germination (P> 0.01) and salinity affected negatively on germination components (0.01>p).

Table 1. Analysis of variance for various levels of ascorbic acid on seed germination components and seedling growth of soybean under salt stress

Germination rate	uniformity of germination	shoot dry weight	rootlet dry weight	rootlet length	shoot length	Germination percentage	DF	CS
0.051**	192.48**	145033**	0.181**	178.37**	0.149**	233.08**	2	ascorbic acid
0.134**	516.148**	250.33**	9.19**	4651.59**	16.53**	796.75**	2	Salinity
0.007**	11.759**	0.667ns	0.13**	13.870**	0.005**	48.167**	4	ascorbic acid salinity
0.024	24	44.66	0.044	192.66	0.018	26.34	18	Error

**And **, respectively, a significant effect at 1% and 5% level ns: no significant effect*

Interaction of ascorbic acid and salinity on seed germination, shoot length, rootlet dry weight, shoot length, uniformity of germination and germination rate was significant at 1% level. But rootlet length and shoot dry weight did not showed significant effect. Mean comparison of different levels of ascorbic acid (Table 2) showed that increasing the ascorbic acid cause to increase the soybean resistance and improvement of germination elements. Whereas the results of mean comparison of different salinity levels (Table 3) showed that increasing the salinity reduces yield of soybean germination components.

Table 2. Means comparison of ascorbic acid effects on seed germination components and seedling growth of soybean.

Germination rate (1/50 t)	Uniformity of germination (time)	Shoot dry weight (mg)	Rootlet dry weight (mg)	Rootlet length (mm)	Shoot length (mm)	Germination percentage	Ascorbic acid
0/44c	29.77a	41c	46/4c	40.22 c	34 c	82.22c	0
0/50b	25.77b	44.33b	47/9b	45.11b	36 b	86.88b	500
0/59a	25.55c	49a	49/3a	49.11a	37 a	92.38a	1000

Table 3. Means comparison of different levels effects of salinity on seed germination components and seedling growth of soybean.

Germination rate (1/50 t)	uniformity of germination (time)	shoot dry weight (mg)	rootlet dry weight (mg)	rootlet length (mm)	shoot length (mm)	Germination percentage	Salinity (mM)
0.63a	18.11c	49.33a	57.5a	67.11a	50.2a	94.83a	0
0.52b	24.77b	46b	48.8b	45.66b	39.9b	90b	60
0.38c	33.22a	39c	37.3c	21.66c	23.2c	76 c	100

In each column, mean difference has at least a share letters based on Duncan's multiple range tests and is not significant at 5% percent.

REFERENCES

Abo-El-Kheir MSA, Mekki BB. 2007. Response of single cross-10 to water deficit during silking and grain filling stages. WorldJ Agric Sci 3:269-272.

Afzal I, Basra SMA, Ahmad N, Farooq M. 2005. Optimization ofhormonal priming techniques for alleviation of salinity stressin wheat (Triticum aestivum L.). Cardeno de Pesquisa SërBio Santa Cruz do sul 17:95-109.

Arora A, Sairam SK, Srivastava GC. 2002. Oxidative stress and antioxidative system in plants. Current Sci 82:1227-1238.

Asada R.1992. Ascorbate peroxidase-a hydrogen peroxide scav-enging enzyme in plants. Plant Physiol 85:235–241.

Aspinall, D. and Paleg, L.G. 1981. Proline accumulation: Physiological aspects. In Paleg, L.G. and Aspinall, D. (Eds.), The physiology and biochemistry of drought resistance in plants. Sidney, Academic Press, pp. 205-241.

Barrs HD. 1968. Determination of water deficits in plant tissues, pp235-368. In: Kozlowski TT (ed). Water Deficit and Plant Growth. London: Acad Pr. Basra SMA, Farooq M, Wahid A, Khan MB. 2006. Rice seed invigoration by hormonal and vitamin priming. Seed SciTechnol 34:753-75.

Benson EE. 1990. Free radical damage in stored plant germplasm.International Board for Plant Genetic Resources, Italy.

Benson, E. E. (Ed.), 1999, Plant Conservation Biotechnology, Talor and Fransis Press, London.

Dumet, D.and Benson, E. E. 2000. The use of physical and biochemical studies to elucidate and reduce cryopreservation-induced damage in hydrated / desiccated germplasm, in Engelmann, F. and Hiroko, T. (Eds.), Cryopreservation of Tropical Plant Germplasm (Current Research Progress and Application), JIRCAS Press, Tsukuba, Japan, pp. 43-56.

Golmirzaie, A. M. and Panta, A. 1997. Advances in potato cryopreservation by vitrification, CIP Program Report, International Potato Center, Lima, Peru. pp .71-76.

Kouchaki, A., M. (H). Rashed Mohassel, M. Nasiri r. Sadr Abadi 1991. Physiological basis of crop growth and development, Press Razavi. Pages 404.