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Germination Potential of Chickpeas (*Cicer arietinum* L.) Under Saline Conditions

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Abstract: The effect of different levels (0, 8, 12, 16 ds m^{-1}) of NaCl salinity has been investigated on the germination of chickpeas (*Cicer arietenum* L.) seeds. Presence of salt in the germination medium showed a negative effect on all germination studied parameters. At highest salinity level reduction in germination percentage was 66.01%. Plumule length, fresh and dry weights of plumule also decreased under salt stress. As the salinity level increased all parameters showed gradual reduction. Length of radicle, fresh weight and dry weight of radicle also decreased under saline conditions. Variety C727 showed better results under saline conditions as compared to CM72.

Key words: Salinity, chickpeas germination

Introduction

Salinity stress is a major environmental factor that drastically affects the crop productivity throughout the world. It is a menace to both agriculture and the soil body (Alam *et al.*, 1996 and Francois, 1996). Salinity is known to exercise depressive effects on germination percentage, length of shoot and root, fresh and dry weight of shoot and root (Hamdy *et al.*, 1993). Salinity, as an abiotic harzard, induces numerous disorders in seeds and propagules during germination. It either completely inhibits germination at higher levels or induces a state of dormancy at lower levels (De Villiers *et al.*, 1994 and Khan and Ungar, 1997). In Pakistan, salinity is also one of the major soil problems. Salt affected soils occur mostly in the arid and semi-arid regions of Pakistan. Chickpea (*Cicer arietinum* L.) is an important rabi pulse crop. Its grain being rich in protein (19.3%) plays a remarkable role in human diet and animal feed (Shamim and Ali, 1987).

Studies have been carried out to find out the effect of NaCl salinity on germination of chickpeas for the assessment of potential for salt tolerance.

Materials and Method

The experiment was conducted to evaluate the salt tolerance in Chickpea (*Cicer arietinum* L.). Two gram varieties C727 and CM72 were used. There were four treatments including control. The salinity levels were developed by using NaCl solution. The treatments were as follows.

T_0 = 0 dS/m (Control)
T_1 = 8 dS/m
T_2 = 12 dS/m
T_3 = 16 dS/m

Twenty four petridishes of 12 cm in diameter and 2 cm depth each were used for seed germination studies. The petridishes were washed and sterilized in autoclave before using and filter paper was placed in the bottom of each petridish. The filter papers were well soaked by adding 10 ml of respective solution. Twenty healthy seeds of each gram variety were placed on filter paper in each petridish. The petridishes were arranged in completely randomized design (CRD). Daily observations were made on the germination seeds. Seed germination was recorded daily upto seven days and their germination percentage and other parameters were recorded. The data from different observations on the two gram varieties were computed statistically by adapting analysis of variance (ANOVA) techniques (Steel and Torrie, 1980). The effects of various factors were compared with each other by applying Duncan's New Multiple Range (DMR) test at 0.01 and 0.05 level of significance (Leclarg, 1962).

Results

Seed germination was decreased by increasing levels of salinity (Table 1). In control germination percentage was 98.33% and as the salinity was increased it was decreased. At the highest level it was only 33.33%. Among varieties it was more in C727 i.e. 80.83% than CM72 exhibiting a difference of 20.62%.

There was an inverse relation between salinity and length of plumule and radicle. A significant difference in length under different salinity levels was found. The highest length of plumule and radicle 4.53 cm and 4.56 cm respectively was observed in control. 84.55% reduction in plumule length while 73.46% in radicle length were observed at highest salinity levels (16 dS/m) as compared to control. Among varieties C727 produced longer plumule and radicle than CM72 with a decrease of 55.10% and 39.37% respectively.

The data regarding fresh and dry weights of plumule and radicle showed negative effect of salinity. As the salinity increased a significant decreased in fresh and dry weights was observed. There was 53.17% decrease in fresh weight while 72.16% in dry weight of plumule at 16 dS/m as compared to control. In case of fresh and dry weight of radicle 76.90% and 82.20% respectively observed at the highest level of salinity as compared to control. Among varieties C727 produced 32.63% and 3.08% more fresh weight and 27.27% and 9.62% more dry weight of plumule and radicle respectively as compared to CM72.

Discussion

Germination is a complex phenomenon involving many physiological and biochemical changes and leading to the activation of embryo (Bewley and Black, 1985 and Mayer and Poljakoff-Mayber, 1989). However, during initial phases of germination, propagules may behave differently as compared with seed, but fundamentally embryonic tissues in both of them show more or less the same pattern of growth. Salinity first reduces imbibition of water because of the lowered osmotic potential of the medium (Bliss *et al.*, 1986 and Poljakoff-Mayber *et al.*, 1994).

Second it causes toxicity, that is, it changes enzymatic activity (Gomes Filho and Sodck, 1988 and Guerrier, 1988), hampers protein metabolism (Yupsanis *et al.*, 1994 and Dell'Aquila and Spada, 1993) and upsets plant growth regulators balance (Khan and Rizvi, 1994). Salinity interacts with certain plant and environmental factors during germination. Among the plant factors, seed coat (Eschie, 1995) dormancy (Khan and Ungar, 1997) and seed age (Smith and Dobrenz, 1987).

Table 1: Germination potential of chickpeas (*Cicer arietinum* L.) under saline conditions

Variety	Tr. dS/m	Germ (%)	Length (cm)		Fresh weights (g)		Dry weights (g)	
			Pumule	Radicle	Pumule	Radicle	Pumule	Radicle
C727	0	100.00	6.51	3.23	0.107	0.115	0.013	0.046
	8	96.67	3.15	2.25	0.066	0.086	0.012	0.016
	12	71.67	2.07	1.73	0.054	0.085	0.011	0.013
	16	55.00	0.93	1.08	0.066	0.054	0.006	0.009
CM72	0	96.67	2.55	5.90	0.053	0.147	0.13	0.022
	8	78.33	1.39	3.42	0.047	0.054	0.010	0.014
	12	70.00	1.27	3.01	0.022	0.041	0.009	0.011
	16	11.67	0.47	1.35	0.013	0.015	0.001	0.003
Significance of Variance Sources (F. values)								
S.O.V.	Df							
Variety	1	45.71**	19.21**	34.48**	7308.90**	2052.01**	27.67**	166.47**
Treatment	3	133.26**	16.70**	40.98**	1762.45**	5114.52**	90.51**	337.29**
VxT	3	15.31*	3.89*	5.24*	329.03**	130.53**	4.49*	68.86

*** = Significant at 5% probability ** = Significant at 1% probability N.S. = Non-significant

Salinity adversely affects the seed germination. As the salinity increased in the medium the germination percentage was decreased (Patel *et al.*, 1992, Ozdemir *et al.*, 1994 and Sekhar 1994). There is a significant decrease in length of plumule and radicle (Gupta and Sarabhai 1992 and Khan 1988).

When we concern with the fresh and dry weights of plumule and radicle, it is evident that as the salinity increased upto 16 dS/m, a significant decrease in fresh and dry weights were observed (Nigwekar and Chavan, 1987; Ozdemir *et al.*, 1994; Abd-Allah, 1992 and Datta and Dayal, 1991). From the above discussion it is proved that C727 gave better results as compared to CM72. So C727 is more salt tolerant than CM72.

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