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Boron and zinc pretreatment response on growth and nodulation of [*Vigna radiata* (L.)Wilczek] under salinity

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Abstract: Pot experiments were conducted to study the effect of Boron and Zinc on growth and nodulation of Vigna radiate L. Wilczek var. Pusa Vishal under salinity.Sterilized seeds of *Vigna radiata L.Wilczek* (var.Pusa Vishal)were germinated and grown under different levels of salt (10 mM – 200 mM NaCl),B($1\times10^{-3}mM-5\times10^{-3}mM$) and Zn($1\times10^{-3}mM-10\times10^{-3}mM$) under controlled conditions.NaCl treatment induced drastic reduction in growth of plant in terms of decreasing number of flowers, pods, seeds per pod, weight of seed per pod and nodules per plant. But, pre-treatment of seeds with optimum concentration of Boron and Zinc caused in the deleterious effects of salinity in all parameters of this study.

Key words: Salinity, Mungbean, Boron, Zinc.

1 INTRODUCTION

Mungbean is an important grain legume rich in proteins (Mensah and Olukoya, 2007), hence food products from the plant exhibitmany excellent nutritional attributes. Most legumes lack methionine and cysteine in adequate quantities. However, mungbean contain high quality methionineprotein (Tsou and Hsu, 2000).

Salinity became a serious problem for agriculture all over the world (Naher and Alam, 2010) and is a major factor limiting plant productivity affecting about 95 million hectares worldwide approximately 6% of land (Yeo, 1999). Salt stress unfavorably affects plant growth and productivity during all developmental stages (Munns, 2008). The adverse effect of salinity on mungbean have been proposed(Mishra et al.,1996 ; Promila and Kumar, 2000). The salinity caused decrease in dry matter, root, stem and leaf weights, plant height of mungbean plants is recorded (Raptan *et al*(2001) and Yupsanis *et al*(2001)).

Studies have indicated the significance of B, Fe and Zn on metabolism and growth of various pulse crops viz. French bean, Soybean, pigeon pea as well as mungbean under stressful environment and slight deficiencies of these micronutrients led drastic decline in the growth and yield (Hemantaranjan and Trivedi, 1997, Dar et al. 2007).

Zinc plays integral role in the synthesis of indole acetic acid and activation of enzymes ofcarbohydrate metabolism, protein synthesis and as a key constituent of alcohol dehydrogenase, carbonic anhydrase and superoxide dismutase (Welch *et al.*, 1982). Various studies regarding the micronutrient application for neutralizing the adverse effect of NaCl came in to focus and being used as an efficient tool for improving crop yield under saline conditions (Gama *et al.*, 2007).

Boron (B) is also one of the essential elements for normal life of plants. Its deficiency causes many diseases in crop plants. Boron has widespread role in plants like cell wall rigidity, sugar transport, cell division, differentiation, membrane functioning, root elongation and regulation of plant hormone level (Pilbeam and Kirkby, 1983; Romheld and Marschner, 1999; Marschner, 1995).

The present study is aimed to analyze the effect of B and Zn on number of flower/plant, nodules/plant, pods/plant, seed/pod and weight of seeds per pod in Mungbean under salinity.

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2 MATERIALS AND METHODS

Seeds of *Vigna radiata* (L.) Wilczek (var. Pusa Vishal)collected from Indian Agricultural Research Institute (IARI), New Delhi were surface sterilized with 0.1% $CaOCl_2$ for 3-5 minutes and washed thoroughly with water before sowing.

Thesand of particle size 0.25 to 0.54 mm obtained by sieving the crude sand washed with stream water and filled in the pots. The water washed sand was treated with a mixture of 1% oxalic acid (W/V) in 17% HCl (V/V) followed by thorough washing with de-ionized water.

After seed sowing the pots were irrigated with Hoagland nutrient solution (500 ml) each day containing salt, B and Znin the following combinations:

Control(T0), 3×10^{-3} mM B (T1), 4×10^{-3} mM Zn (T2), 3×10^{-3} mM B + 4×10^{-3} mM Zn (T3), 100 mM NaCl (T4), 100 mM NaCl + 3×10^{-3} mM B (T5), 100 mM NaCl + 4×10^{-3} mM Zn(T6), 100 mM NaCl + 3×10^{-3} mM B+ 4×10^{-3} mM Zn (T7)

The B and Zn optimum concentration taken based on Arora et al. (2012). There were three replicates for each treatment. Plants were harvested after 60 days. The data for number of flower, nodule, pods/plant, and seeds/podare expressed as Mean ± S.E.

Statistical Analysis: The data obtained from completely randomized design (CRD) were statistically analyzed with the help of 'INDOSTAT' statistical software package available in the department of Plant Physiology of Indian Agricultural Research Institute (IARI), New Delhi. The difference between the treatments means were compared by critical difference (CD) at 5% level of significance (Gomez & Gomez, 1993) after performing ANOVA.

3 RESULTS AND DISCUSSIONS

The results showed that reproductive growth of mungbean was affected by salinity.The number of flowers (Table 1), pods per plant, no. of seeds per pod and weight of seeds (Fig. 1-4) substantially decreased with the increasing salinity.

Increasing the salinity significantlycaused reduction in pods per plant is noted in Chickpea and Mungbean (Ram et al.(1989), Raptan (2001)).

Maximum numbers of nodules were obtained when seeds were pretreated with the combination of Boron and Zinc under unstressed condition as compared to the control (Fig.1)

Salinity significantly decreased the no. of flowers, pods as well as no. of seeds per pod and weight of seeds per pod (Fig.1-4). These results were supported with the findings obtained by Rapton et al. (2001) who reported that there was reduction in number of seeds per pod of the plants which were irrigated with 100 mM NaCl by 50% as compared to the plants which were irrigated with tap water.

Nodulation was adversely affected by salinity, the number of nodules per plant decreased with salinity as compared to the control. However, the plants pretreated with B and Zn under slaine conditions showed higher number of nodules per plant as compared to unstressed plants under salinity.

Elsheikh and Wood (1996) in soyabean and Nosheen et al. (2004) in mungbean also observed that growth and nodulation was adversely affected by salinity and that nodulation was more sensitive than plant growth to salinity.

The pretreatment of seed with B and Zn under stressed conditions resulted in increase in the no. of flower/pods/seeds as compared to unstressed plants. Zinc supply led to increase in number and weight of pods, indicative of the importance of Zn in grain yield of Lentil (Pandey et al, 2009), Verma et al. (1999) also showed that seed yield/plant, number of pods/plant, length of pods and number of seeds per pod were significantly increased by the application of Boron given through different methods.

The highest number of flowers/pods/seeds and increase weight of seeds found when B and Zn

were supplied in combination under saline conditions as compared to untreated plants.

The present study shows that the nodulation as well as number of flowers, number of pods, number of pods per seed and weight of seeds increased with the combined effect of B and Zn under salinity.

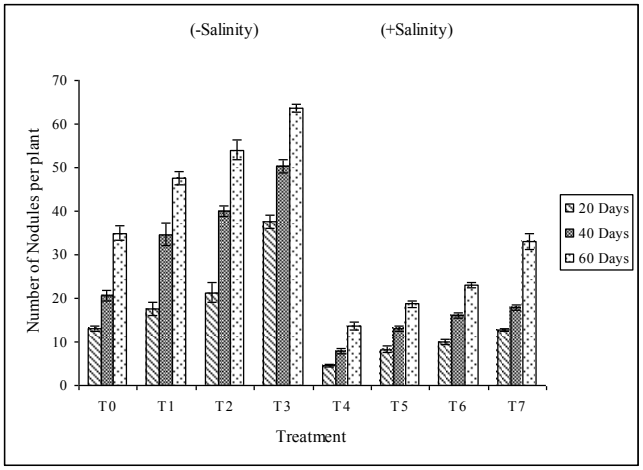

Fig. 1: Effect on number of nodules per plant in Mungbean at 20 days interval in var. Pusa Vishal
Mean ± S.E.

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	31 D		32 D		33 D		34 D		35 D		36 D		37 D		38 D		39 D		40 D	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	**Mean**	**S.E.**	**Mean**	**S.E.**	**Mean**	**S.E.**	**Mean**	**S.E.**	**Mean**	**S.E.**	**Mean**	**S.E.**	**Mean**	**S.E.**
T0	1.000	0.000	2.333	0.333	4.333	0.333	6.000	0.000	6.667	0.333	9.333	0.333	11.000	0.577	14.333	0.667	17.333	0.333	18.333	0.667
T1	2.333	0.333	3.000	0.577	5.667	0.333	9.667	0.667	9.000	0.000	9.667	0.333	12.000	0.000	17.000	0.577	18.667	0.333	20.000	0.000
T2	2.667	0.333	4.000	0.000	6.667	0.882	9.333	0.333	11.000	0.577	10.667	0.333	15.333	0.333	17.667	0.333	19.000	0.000	24.333	0.333
T3	3.000	0.577	4.667	0.882	8.000	0.000	10.000	0.577	11.667	0.333	13.333	0.667	15.000	0.577	17.000	0.000	19.667	0.333	27.667	0.333
T4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.000	0.000	5.000	0.577	7.000	0.577	8.333	0.333	9.000	0.000
T5	0.000	0.000	0.000	0.000	1.333	0.333	2.000	0.000	4.000	0.000	6.333	0.333	7.000	0.000	9.000	0.000	10.000	0.577	10.667	0.333
T6	0.000	0.000	0.000	0.000	2.000	0.577	3.333	0.333	4.333	0.667	7.667	0.333	9.667	0.667	10.333	0.333	11.000	0.577	12.667	0.333
T7	0.000	0.000	1.333	0.333	3.000	0.577	4.667	0.333	7.000	0.577	10.000	0.577	12.333	0.333	12.333	0.667	14.333	0.333	14.333	0.667

CD	0.83	1.330	1.525	1.149	1.308	1.316	1.287	1.444	1.133	1.272
SE (d)	0.383	0.614	0.704	0.531	0.607	0.607	0.594	0.667	0.523	0.588
SE (m)	0.271	0.434	0.498	0.375	0.430	0.43	0.42	0.471	0.37	0.415
CV	41.715	39.234	22.260	11.557	8.503	8.503	6.667	6.241	4.333	4.202

Table 1: Effect of Salinity on Number of flowers in *Vigna radiata* pre-treated with Boron (B) and Zinc (Zn)

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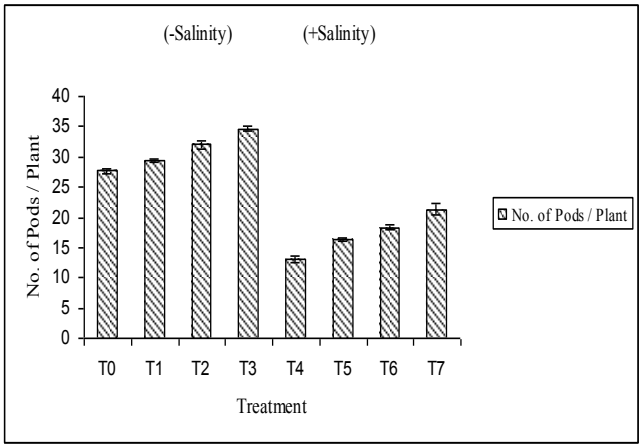

Fig.2: Effect on number of pods per plant in Mungbean Mean ± S.E.

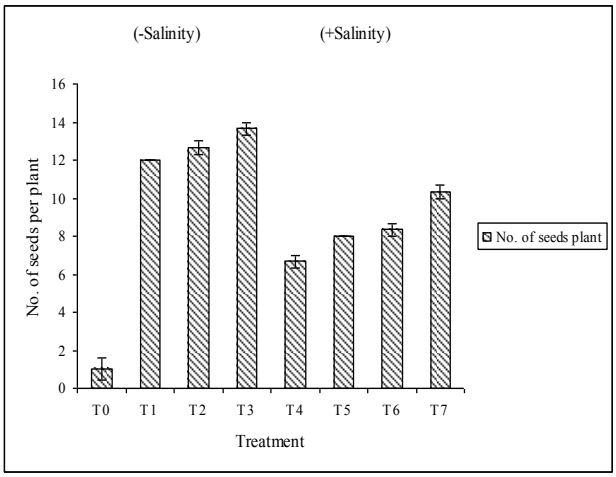

Figure 3: Effect on number of seeds per pod in Mungbean Mean ± S.E.

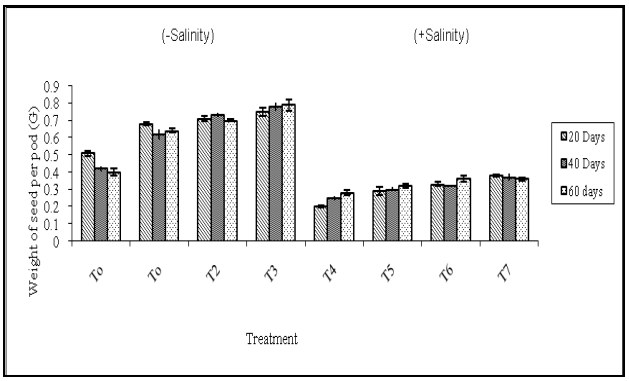

Fig. 4: Effect on seed weight (g) in Mungbean Mean ± S.E.

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