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Research Article

INTERACTIVE EFFECT OF BORON AND NaCl ON GERMINATINION PERFORMANCE IN SOYBEAN

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ABSTRACT: The present work was carried out to study the individual and combined effects of boron and salinity on soybean seed germination. The results revealed that all the treatments of both NaCl and boron (5 ppm) delayed the germination. However higher concentrations (50 and 100 ppm) of boron was found to be enhanced germination percentage over control by 10 %. The combinations of boron with NaCl (especially 5 and 100 ppm Boron with 200 mM NaCl and 50 ppm boron with 100 mM NaCl) effectively mitigate the adverse effects of NaCl on germination of soybean seeds. In addition to it 50 mM NaCl concentration was found to be reduced the delayed effects of 5 ppm boron on germination.

Keywords: Boron, NaCl, Soybean, Germination.

INTRODUCTION

Soybean is one of the main source of edible oil and protein. Salinity is one of the major problem in arid and semiarid region (Ashraf and Foolad, 2007). Salinity adversely affects the growth and development of soybean (Singleton and Bohllol, 1984 and Dolatabadian *et al.*, 2011). However, soybean has been considered as a salt sensitive to moderately salt- tolerant crop (Luo *et al*., 2005 and Amirjani, 2010).

Boron plays very crucial role in plant growth and development (Brown *et al*., 1999 and Asad *et al*., 2003). Several reports have been indicated growth promoting effects of boron application on soybean (Reinbott and Blevins, 1995; Rerkasem *et al*., 1997; Ross *et al*., 2006; Bellaloui *et al*., 2010; Bellaloui *et al*., 1999 and Bellaloui, 2011). However, the optimum level of boron for one species could be toxic for other species (Blevins and Lukaszewski, 1998). It is not clear that how tolerant plants avoid boron toxicity (Reid *et al*., 2004). Manchanda and Sharma, (1991) emphasized that in leguminous crops boron invariably alters the toxic effects of salinity. Several workers have reported the interactive effects of boron and NaCl on crop plants (Bingham *et al*., 1987; Edelstein *et al*., 2005). No any evidence available on the interactive effects of boron and salinity on soybean.

In view of the above the present study was designed to investigate the individual effects of boron and NaCl as well as their interactive effects on germination performance of soybean seeds.

MATERIALS AND METHODS

Morphologically healthy seeds of soybean (JS-335) were first surface sterilized with 1% of $HgCl_2$ for 2 mins and then washed with distilled water to remove toxic elements. Petri-plates were sterilized with absolute alcohol and lined with filter paper at bottom. Twenty uniform seeds were placed in each petri-plate. The desired treatments were given by adding $15cm^3$ of aqueous treatment solutions (water-control, 5 ppm, 10 ppm, 50 ppm and 100 ppm of boron), (50 mM, 100 mM, 150 mM and 200 mM of NaCl) and combine concentration applied (boron + NaCl). The petri-plates were incubated in a BOD incubator at 26 ± 2^0C in dark and investigations were covered at different stages of germination from 24 to 120 hrs.

RESULTS AND DISCUSSION

The results obtained are shown in table 1. The successive induction in germination percentage was observed with increased germination period in all treatment sets. At initial stages all applied treatments of boron except 5 ppm boron showed maximum germination percentage than control. Our results show close conformity with the findings of Rerkasem *et al.*, (1997). They reported that low concentration of boron permanently damage the embryo of soybean seeds, which gives defective seedlings.

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In contrast to it, Banuelos *et al*., (1999) found that boron adversely affects germination percentage in corn, tomato, carrots and alfalfa. The adverse effects of NaCl was found on germination of soybean seeds. In particular, poor response observed with 150 mM and 200 mM NaCl. Hosseini *et al*., (2003) have been recorded decreased germination rate and germination percentage of soybean subjected to salt stress.

Table1. Interactive Effect of Boron and NaCl on germination percentage in Soybean

Treatment		% Germination				
		24 hrs	48hrs	72hrs	96hrs	120hrs
Control		-	40	60	70	100
Boron (ppm)	5	-	30	40	60	100
	10	-	40	50	70	100
	50	-	50	60	80	100
	100	-	50	70	90	100
NaCl (mM)	50	-	30	70	90	100
	100	-	30	40	60	100
	150	-	20	40	60	80
	200	-	-	20	30	50
Boron (ppm) + NaCl (mM)	5 ppm + 50 mM	-	50	50	70	100
	5 ppm + 100 mM	-	30	40	60	100
	5 ppm + 150 mM	-	30	40	60	100
	5 ppm + 200 mM	-	30	30	80	100
	10 ppm + 50 mM	-	30	30	60	100
	10 ppm + 100 mM	-	40	50	60	100
	10 ppm + 150 mM	-	30	50	60	100
	10 ppm + 200 mM	-	20	40	70	100
	50 ppm + 50 mM	-	50	70	70	100
	50 ppm + 100 mM	-	50	70	80	100
	50 ppm + 150 mM	-	40	60	70	100
	50 ppm + 200 mM	-	30	40	50	80
	100 ppm + 50 mM	-	40	60	70	100
	100 ppm +100 mM	-	40	50	60	100
	100 ppm + 150 mM	-	30	40	50	90
	100 ppm + 200 mM	-	40	50	80	100

Each value is a mean of three replications containing 21 seeds per plate.
Due to poor performance data are left unexpressed where the mark (-) is given.

It was interesting that boron toxicity observed at the initial stages of germination. 5 ppm and 100 ppm boron treatments reduced the adverse effects of 200 mM NaCl on germination. Similarly, decrease in toxicity of 100 mM salinity was observed with 50 ppm boron. Our results are in agreement with findings of Yermiyahu *et al*., (2008). They reported that combined boron and salinity toxicity causes less toxicity effects to plants by reduced uptake of boron in presence of chloride and reduced chloride in presence of boron.
Thus it is clear that interaction of boron and NaCl mitigate the toxic effect of each other it might be beneficial to improve further metabolism of soybean.

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