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EFFECT OF SODIUM CHLORIDE ON GROWTH AND NODULATION OF *SESBANIA SESBAN*

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Abstract

Growth and nodulation of *Sesbania sesban* were compared at eight levels (0-2.0%) of NaCl salinity in sandy clay loam soil (ECe: 1.0 dS m^{-1}). Dry weight of shoots and roots and number of nodule per plant decreased with increasing salinity levels. Nodule dry weight, however, increased at low levels of salinity (0.1% and 0.2% NaCl) and decreased at higher levels. Maximum diameter of nodules increased at all the salinity levels except in 2% NaCl. The decrease in nodule numbers was partially compensated by an increase in nodule size.

Introduction

Saline soils are common in regions of arid or semi-arid climate where transport of soluble salts to the ocean does not occur because of low rainfall (Eaglesham & Ayanaba, 1984). Generally nodulated crop plants do not like saline conditions. Adverse effects of increasing salinity on nodule number and nodule weight have been reported (Lauter *et al*., 1981; Singleton & Bohlool, 1984). Yousef & Sprent (1983) grew *Vicia faba* under salt stress and found that the number of nodules per plant decreased that was partially compensated by producing larger nodules. Buttery *et al*., (1990) studied the response of a supernodulating common bean and its parent line to *Rhizobium* concentration and hypothesized that when nodule numbers are low, compensatory increases in nodule size occur.

Saline conditions have been reported to affect nodule initiation, nodule development and growth of the host plant (Sprent & Sprent, 1990). This paper reports the response of *Sesbania sesban* to increasing concentrations of NaCl.

Materials and Methods

Seeds of *Sesbania sesban*, obtained locally, were germinated on soaked filter paper. One week old seedlings of uniform size were transplanted into pots containing sandy clay loam soil (ECe = 1.0 dS m^{-1}) with 0,0.1,0.2,0.4,0.8,1.2,1.6 and 2.0% NaCl. The salt was first dissolved in 900 ml water sufficient to soak 3 kg air dried soil in each pot. There were 16 replicates for each NaCl treatment and the experiment was arranged in a completely randomized design. The pots were watered to field capacity as required. Plants were harvested after 10 weeks and roots and nodules cleared by washing in water. The nodules were separated and their size measured. Dry weight of shoots, roots and nodules was taken. Electrical conductivity (EC) of soil samples from the root zone was determined by a conductivity meter (CM-30EF).

Table 1. Effect of NaCl concentration on growth and nodulation status of *Sesbania sesban* after 10 weeks of growth. (Values are means of sixteen replicates)

NaCl conc. (%)	ECe ($dS.m^{-1}$)	Shoot dry weight ($g\ plant^{-1}$)	Root dry weight ($g\ plant^{-1}$)	Nodule number per plant	Nodule dry weight ($g\ plant^{-1}$)	Maximum diameter of nodule (mm)
0	1.0	0.98 ± 0.06	0.22 ± 0.01	16.26 ± 1.54	0.04 ± 0.01	4.66 ± 0.41
0.1	1.2	0.59 ± 0.05**	0.17 ± 0.01**	12.29 ± 0.97	0.05 ± 0.01	5.04 ± 0.56
0.2	2.6	0.50 ± 0.06**	0.12 ± 0.02**	11.30 ± 1.28*	0.06 ± 0.02	6.63 ± 0.49*
0.4	4.2	0.46 ± 0.06**	0.11 ± 0.02**	10.11 ± 1.24*	0.02 ± 0.01*	5.85 ± 0.63
0.8	8.4	0.35 ± 0.06**	0.08 ± 0.01**	7.31 ± 1.34**	0.01 ± 0.00*	6.13 ± 1.17*
1.2	15.0	0.32 ± 0.05**	0.08 ± 0.01**	6.76 ± 1.49**	0.02 ± 0.01*	6.64 ± 0.54*
1.6	19.4	0.37 ± 0.07**	0.07 ± 0.01**	6.05 ± 1.41**	0.01 ± 0.00**	6.55 ± 0.51*
2.0	20.0	0.29 ± 0.05**	0.07 ± 0.01**	6.50 ± 3.91**	0.004 ± 0.00**	1.71 ± 0.23**

*Significantly different to the control (0% NaCl) at $P < 0.05$.

**Significantly different to the control (0% NaCl) at $P < 0.01$

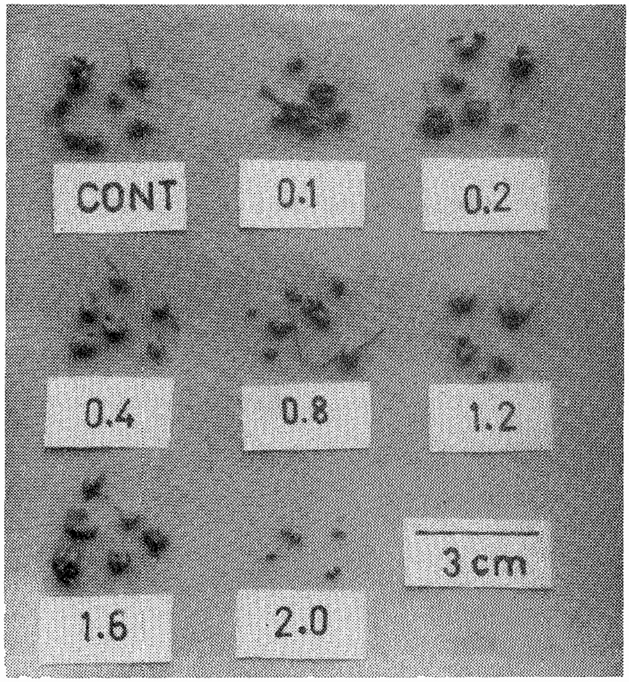

Fig.1. Effect of NaCl concentration (0-2.0%) on nodule size of *Sesbania sesban* after 10 weeks of growth

Results and Discussion

The growth response of *S. sesban* to salinity showed a gradual decrease in total dry weight with increasing NaCl levels (Table 1). At 0.4% NaCl level, the total dry weight of the plants decreased to 47% of the control, whereas at 2.0% NaCl it reduced to only 30% of the control. These results are contrary to the reports of Greenway & Munns (1980), Ng (1987) and Salim (1988) for non-halophytes that indicated growth improvements at low salinity levels.

Nodules were formed at all NaCl levels which implies that the growth of *Rhizobia* in the rhizosphere, infection and nodule development were not inhibited by the increasing salt concentrations (Table 1). Nodule numbers per plant generally decreased with increasing salinity levels. At 0.8% NaCl level, the nodule number per plant decreased to only 45% of the control. Nodule dry weight per plant, however, slightly increased at 0.1% and 0.2% NaCl levels, but decreased at higher salinity levels. At 0.2% and 2.0% NaCl levels, nodule dry weight was 150% and 10% respectively of the control. The increased dry weight of nodules at low salinity levels indicates an increase in the size of nodules. Maximum diameter of nodules increased at all salinity levels except at 2.0% NaCl salinity (Table 1). These results are similar to the reports of Yousef & Sprent (1983) and Buttery *et al*., (1990) who observed that the decrease in nodule numbers was accompanied by compensatory increases in nodule size.

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