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STUDIES ON YIELD ATTRIBUTES OF SOYBEAN (GLYCINE MAX (L.) MERRILL) UNDER SALT STRESS

M.G. KHAN
Plant Physiology and Biochemistry Section, PG Department of Botany, Bareilly College, Bareilly - 243 005.
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The results of a pot culture study indicated that salt stress significantly reduced the number and size of pods, number of seeds/pod and also single seed weight along with dry matter production. The magnitude of reduction was variable between the cultivars. Seed yield was most seriously affected and PK-472 was more resistant than Alankar. Na_2CO_3 salt was more toxic to both varieties.

Soybean (*Glycine max* (L.) Merrill) is an important leguminous crop, face a marked decrease at germination stage under salt stress, (Khan and Varshney, 1989). Although stress conditions cause significant depression in biological and grain yield attributes in barley (Bains *et al.*, 1970); Moong (Kumar and Bhardwaj, 1981) and sunflower (Janardhan *et al.*,1986), a variety coupled with high yield potential and improved in nutritional quality might prove ideal under abrupt salt stress conditions. Present investigation was, therefore sought on two soybean cultivars to assess their relative performance for biological and seed yield components following artificial salinization.

MATERIALS AND METHODS

The seeds of two cultivars of soybean (*Glycine max* (L.) Merrill) viz., PK-472 and Alankar obtained from GB Pant University of Agriculture and Technology, Pantnagar (India) were surface sterilized with 2% sodium hypochlorite solution and sown in earthenware pot of uniform size (25 cm x 20 cm), each containing 4 kg of garden soil. The pots were irrigated with salt solutions so as to fix their ECe at 4, 8 and 12 in mScm-^{1}. Alternative watering was done at forthnightly intervals to avoid the excessive accumulation of salts in the rhizosphere. Ordinary garden soil served as control.

The experiment was exercised in a humid growth chamber at 27 $\pm$1° C. At preflowering stage, six plants were dug out randomly from each treatment. After processing for fresh weight, shoot and root were kept at 80°C in a hot air oven for 24 hours, to have their dry weights. The number of pods/plant, size of pod, number of seeds/pod, single seed weight and seed yield/plant were recorded at maturity. The data were analyzed statistically for transformed variables.

RESULTS AND DISCUSSION

Data presented in Table I and II clearly indicate that increasing ECe levels of salts viz., NaCl and Na_2CO_3 brought about a corresponding decrease in characters studied. Among all of these, seed yield was more affected by varying levels of salts. For instance, seed yield when expressed as a percent of control was seriously affected at 12 m Scm^{-1} causing an average reduction of 52.6% and 58% by NaCl and Na_2CO_3 in cv PK-472, while reduction in other morphological characters was low and variable in magnitude. Similar observations were also noticed in case of cultivar alankar. However, both cultivars performed independently and no linear relation can be drawn on this basis. Data also reveal higher toxic effect of Na_2CO_3 salt on different yield contributory attributes as compared to NaCl (Table I and II). These results are in accordance with Torres and Bingham (1973); Jadhav *et al.* (1976) and Kumar (1978) in wheat; Patel and Dastane (1969); Bains *et al.* (1982) and Kumar *et al.* (1980) in barley and Nukaya *et al.* (1982) in green soybean, Similar observations were also observed by Giriraj *et al.* (1976) and Ayoub (1976) in various yield contributory attributes of different crops under saline conditions.

The adverse effect of salts on grain weight has been attributed to the hastening of senescence and the associated reduction in leaf area vis-a-vis photosynthetic activity (Asana and Kale, 1965; Sarin and Narayanan, 1965). Similarly, the reduction in yield and yield contributory attributes in blue panic grass has also been related to reduced leaf area due to salinity (Varshney and Baijal, 1988). It can be

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Table 1: Effect of salt stress on biological yield (dry matter production) in soybean (*Glycine max* (L.) . Merrill) cultivars, alankar and PK-472 at preflowering (45 days after Sowing).

Salt	Yield components	Coundctivity levels ($mScm^{-1}$) at 27°C ±1°C							
		Alankar				PK-472			
		Control	4	8	12	Control	4	8	12
	Fresh weight of roots (gms)								
NaCl		0.90	0.63	0.47	0.45	0.79	0.65	0.58	0.60
Na_2CO_3		0.90	0.56	0.42	0.43	0.79	0.60	0.60	0.53
		SE ± 0.10; CD at 5% P=0.24				SE ± 0.11; CD at 5% P=0.26			
	Fresh weight of shoot (gms)								
NaCl		5.82	4.01	3.80	3.58	5.51	4.78	4.21	3.88
Na_2CO_3		5.82	3.23	2.50	3.21	5.51	4.88	4.88	4.50
		SE ± 0.36; CD at 5% P=0.87				SE ± 0.8; CD at 5% P=2.09			
	Dry weight or root (gms)								
NaCl		0.09	0.08	0.06	0.05	0.11	0.09	0.08	0.09
Na_2CO_3		0.09	0.08	0.06	0.04	0.11	0.06	0.06	0.06
		SE ± 0.05; CD at 55P=0.02				SE ± 0.01; CD at 5% P=0.82			
	Dry weight of root (gms)								
NaCl		1.69	1.44	1.55	0.88	1.43	1.40	1.10	1.12
Na_2CO_3		1.69	1.09	1.03	0.70	1.43	1.36	1.34	0.61
		SE ± 0.02; CD at 55P=0.48				SE ± 0.20; CD at 55P=0.53			

ECe = 2.8, pH = 7.8

Table II: Effect of salt stress on seed yield factors of soybean (*Glycine max* (L.) Merrill) cultivars, Alankar and PK-472.

Salts	Seed yield	Conductivity levels ($mScm^{-1}$) at 27°C ± 1°C							
		Alanker				PK-472			
		Control	4	8	12	Control	4	8	12
	No. of pods/plant								
NaCl		9.50	7.60	7.20	5.83	9.40	8.00	6.33	6.33
Na_2CO_3		9.50	9.40	6.60	6.60	9.40	7.28	6.42	4.77
		SE ± 1.41; CD 5% P=3.44				SE ± 1.32; CD at 55P=3.22			
	Size of pods (cm)								
NaCl		4.50	4.00	3.00	3.00	4.50	4.20	4.42	4.47
Na_2CO_3		4.80	3.90	3.80	3.00	4.50	4.00	4.20	4.20
		SE ± 0.67; CD at 5% P=1.63				SE ± 0.88; CD at 5% P=2.14			
	No. of seeds/pod								
NaCl		3	3	2	2	3	3	3	3
Na_2CO_3		3	2	2	2	3	3	3	3
		SE ± 0.67; CD at 55P=1.63				SE ± 0.54; CD at 55P= 1.31			
	Single seed weight (gms)								
NaCl		0.97	0.97	0.95	0.40	0.90	0.85	0.75	0.75
Na_2CO_3		0.97	0.97	0.90	0.80	0.90	0.85	0.75	0.70
		SE ± 0.16; CD at 55P=0.39				SE ± 0.15; CD at 5% P=0.36			
	Seed yield/plant (gms)								
NaCl		2.76	1.76	1.18	1.05	2.53	1.63	1.77	1.35
Na_2CO_3		2.76	1.76	1.18	1.05	2.53	1.63	1.77	1.35
		SE ± 0.23; CD at 55P=0.56				SE ± 0.23; CD at 5% P=0.80			

inferred that reduction in plant growth and development due to excessive accumulation of CO_3 and its ions in rhizosphere disturb iso-osmotic relations of plant. Therefore a significant reduction in number of

seeds/plant, grain weight and size was observed during the experiment.

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