SIMULATED SODIUM CHLORIDE SALINITY STRESS ON BIOMETRIC PARAMETERS ON DIFFERENT GENOTYPES OF BRINJAL. (*SOLANUM MELOGENA*)

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ABSTRACT

Seedling vigour evaluation study was conducted to assess the tolerant range of different genotypes of Brinjal under different Sodium chloride salinity stress conditions. The salinity stress was simulated by using different concentration of sodium chloride solution viz., 0.25,0.50, 0.75, 1.0 % concentration along with 8 ml of 0.1 milli molar (mM) calcium sulphate as control. Germination percentage and seedling vigour were declined with increasing levels of salinity stress in all the twenty genotypes. Among the twenty genotypes five genotypes namely IC112589, IC126784, IC203585, IC90774, IC112960 showed maximum tolerance for salinity stress at 0.25 % level. The performance of the line IC 111589 alone was found to be better by recording higher germination percentage of 64,26,and 14 and seedling vigour index of 150.3; 40.6 and 6.2 at 0.25 %; 0.50% and 0.75% sodium chloride concentration respectively.

Key words: seedling vigour, genotypes, salinity stress.

I. INTRODUCTION

With an increasing pressure of population, urbanization and industrialization, the cropped area is shrinking every year as a result the production level is declining, besides the soil salinity causing concern in over 7.0 million hectares in India. (Palaniyappan and yerrisamy, 1999).

The saline soil contains large quantity of soluble salts of Ca, Mg, and Na in association with chlorides and sulphates. Excess Na destroys the soil structure leading to an adverse effect on the aeration of roots. Soluble salts interfere with the uptake of water in plants and cause osmotic stress as well as create toxic levels of specific ions in various parts of the plants.

Though India stands seconds in vegetable production, the average consumption is 180/day/adult as against the recommended dose of 300/day/adult.vegetables are the important source of supplying all essential nutrients and vitamin for balanced diet to overcome the problem of malnutrition. In India vegetable are grown in 5.0 million ha. with 14 tonnes /ha productivity. But 0.5 million ha .area under vegetable production is affected by various water and soil constraints in many states. Therefore evolving suitable genotypes in vegetables crops for growing in coastal saline areas will increase the production. Brinjal is considered as poor man's vegetable and its having inherent potential of growing well in saline soils having the EC range 4-6dSm-1, there is enough scope for enhancing the production level of the crop in the coastal saline belts. Keeping this in view, this study was carried out to evaluate the genotypes of brinjal for their tolerance to various salinity stress condition.

Screening of different genotypes of brinjal for salinity stress tolerance under Laboratory conditions

In the first phase 20 number of brinjal genotypes were taken for salinity screening studies under laboratory condition and the details of the experiment are given below.

II. MATERIALS AND METHODS

Twenty accessions of different genotypes of brinjal, obtained from vegetable division National Bureau of Plant Genetic Resources, New Delhi, were surface sterilized with 0.01% $HgCl_2$ for three minutes followed by repeated washing in tap water and finally with distilled water. Fifty numbers of surface sterilized seeds were placed on Whatman No.1 filter paper; contained in a UV rays sterilized Petri dishes of 14cm diameter. The seeds were soaked by using 8ml of sodium chloride solution of 0, 0.25, 0.50, 0.75, and 1% concentration along with 8ml of 0.1mM $CaSO_4$ (Farida Begum, *et al.,* 1996). All the treatments were replicated three tines. The germination percentage was recorded

on 7^{th} and 14^{th} day after sowing. The last count alone was considered for the determination of vigour index.

Twenty seedlings per replication were taken from each treatment to record seedling length and seedling dry weight. The dry matter production of the seedling on the 14^{th} day was measured after oven drying for 24 hr at 40 C. The seedling vigour was calculated as per Perry's formula as

$$\text{vigour index} = \frac{\text{Seeding length}}{\text{Germination percentage}} \times \text{Dry weight.}$$

III. RESULT AND DISCUSSION

Germination: The study revealed that there was significant reducation in germination percentage with increasing levels of NaCl concentration in all the twenty genotypes studied. The reduction in germination percentage is due to accumulation of excess amount of Na+ and Cl ions and increased level of abscissic acid (Mizrahi et *al.,* 1971 and Begum *et al.,* 1992). The germination of seeds was not affected much at salinity level of 0.25 percent in (equivalent EC of 4 dSm-1) five genotypes viz., IC 207585; IC 207585; IC 112589; IC 112960 and IC 90774. At 0.50 percent of NaCl salinity (equivalent EC of 8 d5m-1) the genotype IC 112589 was found to be better and showed a germination of 26 percent followed by IC 126784, IC 112960 and IC 90774 with a germination percent of 20; 10 and 6 respectively. At 0.75 percent level (equivalent EC 12 dSm-1) of NaCl salinity IC 112589 recorded the maximum germination of 14 percent followed by IC 203600 . The genotype IC 111332 was not germinated even at low salinity stress (0.25 percent NaCl). Therefore, this genotype can be identified as check line for further study on brinjal under saline conditions.

Seedling growth

The shoot length of brinjal significantly decreased with increasing levels of NaCl concentration. Among the genotypes, IC 126784 showed maximum reduction in shoot length of 93.1 percent, as compared to control, followed by IC 112960, IC 90774 and IC 112589 with a rate of reduction of 86.4, 8204, and 57.9 percent respectively.

Similar results were observed in case of root length also. In all genotypes the root length was no affected much at lower salinity level except in IC 203586. The Fact that lower salinity did not affect growth of the seedlings, but higher salinity reduced the length of root and shoot. The same was established in the case of barley (Kumar, et at., 1998). Further Mondal, et al., (1988) observed that plumule and radicle length gradually decreased with increasing salinity.

Vigour Index:

The vigour index is also considered as criteria for screening the brinjal genotypes for the saline tolerance. The vigour index and seedling length showed a gradual decrease under salinity ranging from 0.25 to 0.75 percent NaCl concentration. At 0.25 percent NaCl concentration maximum seedling vigour of 150.25 was observed in IC-112589 followed by IC 126784 (132.25). The vigour index of IC 112589 at 0.50 percentage (40.56) and 0.75 percent (6.20) level of NaCl concentration was found to be maximum. The vigour index of the genotype IC 111332 was found to be zero even at 0.25 percent NaCl concentration, as evidenced by the no germination at that level, followed by IC 203586 with a value of 0.69.

IV. CONCLUSION

Considering the germination percentage and seedling vigour it was concluded that the genotype IC 112589 was relatively more tolerant towards simulated salinity stress condition and can be further used for the development of saline tolerant variety in brinjal and IC 111332 was found to be susceptible among the twenty genotypes.

Table 1. Effect of NaCl salinity stress on germination and seed vigor of different genotypes of Brinjal. (Each value is a mean of 20 replicates means for standard error)

Sl.No	Variety/ Accession	NaCl Conc. (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Dry weight of Seedling (mg)	Vigour Index
1	IC 90980	0.00	96 ± 1	3 ± 2	2 ± 1.7	2.500 ± 9	192.00
		0.25	48 ± 1	96 ± 1.8	0.3 ± 1.4	2.614 ± 7	23.87
		0.50	31 ± 2	.9 ± 1	0.1 ± 1	2.857 ± 2	10.85
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
2.	IC 089910	0.00	84 ± 1.4	2.6 ± 2	1.2 ± 1	1.562 ± 1.5	204.35
		0.25	14 ± 2	0.7 ± 1.5	0.3 ± 2	0.769 ± 2	18.20
		0.50	–	–	–	–	–
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
3.	IC 126784	0.00	96 ± 1	2.45 ± 2	1.45 ± 1.6	2.667 ± 2	140.38
		0.25	88 ± 1	2.55 ± 1	0.8 ± 1.7	1.875 ± 2	132.25
		0.50	20 ± 0.9	0.85 ± 3	0.2 ± 1	5.714 ± 1	3.68
		0.75	2 ± 0.6	0.20 ± 2	0.1 ± 1	10 ± 1.9	.06
		1.00	–	–	–	–	–
4.	IC 203599	0.00	90 ± 6	3.5 ± 2	1.55 ± 2	2.75 ± 0.8	165.27
		0.25	34 ± 0.7	1.75 ± 1	0.25 ± 1.8	2.110 ± 0.6	32.23
		0.50	4 ± 0.7	1.75 ± 2	0.35 ± 1	5.655 ± 0.3	1.48
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
5.	IC 203585	0.00	98 ± 0.6	3.45 ± 1	1.05 ± 1.2	1.685 ± 2	267.06
		0.25	70 ± 1	2.10 ± 2	0.35 ± 1.2	2.248 ± 1.8	76.29
		0.50	–	–	–	–	–
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
6.	IC 112908	0.00	88 ± 1	2.85 ± 1	0.35 ± 0.8	4.087 ± 1	68.90
		0.25	50 ± 2	2.65 ± 1	0.65 ± 1.6	3.542 ± 0.8	46.58
		0.50	2 ± 1.6	0.20 ± 2	0.10 ± 1.8	2.000 ± 1	0.30
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
7.	IC 112589	0.00	96 ± 1	3 ± 2	0.95 ± 1.7	1.068 ± 0.9	355.06
		0.25	64 ± 1	3.05 ± 1	0.30 ± 1.4	1.427 ± 0.7	150.25
		0.50	26 ± 2	1.75 ± 1	0.20 ± 2	1.250 ± 2	40.56
		0.75	14 ± 1.6	0.5 ± 1.8	0.4 ± 1.8	2.147 ± 0.5	6.20
		1.00	–	–	–	–	–
8	IC112960	0.00	92 ± 1.4	4.75 ± 2	1.1 ± 2	2.500 ± 2	215.28
		0.25	72 ± 1.2	1.10 ± 1	0.3 ± 1.7	4.236 ± .1	23.80
		0.50	10 ± 0.9	0.65 ± 1	0.15 ± 1.4	4.576 ± 1.9	1.75
		0.75	2 ± 0.6	0.20 ± 1	0.15 ± 2	1.429 ± 1	0.49
		1.00	–	–	–	–	–
9.	IC 144525	0.00	62 ± 0.7	2.95 ± 1	1.32 ± 0.8	4.450 ± 0.8	50.25

Sl.No	Variety/ Accession	NaCl Conc. (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Dry weight of Seedling (mg)	Vigour Index
		0.25	18 ± 0.6	2.20 ± .8	0.35 ± 1.4	4.145 ± 0.6	11.07
		0.50	–	–	–	–	–
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
10.	IC 90774	0.00	88 ± 1	2.1 ± 0.8	0.85 ± 2	2.833 ± 2	91.63
		0.25	62 ± 2	1.35 ± 2	0.75 ± 1.8	4.273 ± 1.8	30.47
		0.50	6 ± 1.8	0.85 ± 2	0.15 ± 1.4	4.583 ± 2	1.31
		0.75	2 ± 1	0.10 ± 1	0.15 ± 2	2.058 ± 1.9	0.24
		1.00	–	–	–	–	–
11.	IC 203602	0.00	68 ± 1.8	2.04 ± 2	1.20 ± 2	1.149 ± 2	181.72
		0.25	26 ± 1.5	2.05 ± 1	0.06 ± 1	0.916 ± 1	59.89
		0.50	4 ± 2	0.4 ± 1	0.15 ± 2	0.200 ± 1.8	11
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
12.	IC 089922	0.00	60 ± 2	2.75 ± 1	1.25 ± 1.8	2.742 ± 2	87.52
		0.25	28 ± 2.1	1.15 ± 1	0.30 ± 1	3.666 ± 1.2	11.07
		0.50	–	–	–	–	–
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
13.	IC 089951	0.00	62 ± 1.8	2.5 ± 1.7	0.85 + 2	3.54 ± 11	49.20
		0.25	30 ± 2	1.65 ± 1	0.40 ± 1.8	3.393 ± 1	18.13
		0.50	6 ± 1	1 ± 0.8	0.15 ± 2	1.429 ± 0.5	4.83
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
14.	IC 203589	0.00	88 ± 2	3.4 ± 1.8	2.25 ± 1.6	1.639 ± 0.8	303.36
		0.25	18 ± 1	2.1 ± 1	0.30 ± 1.8	2.48 ± 1	17.78
		0.50	2 ± 1	0.50 ± 2	0.10 ± 1.2	1.250 ± 1.5	0.96
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
15	IC111332	0.00	62 ± 1.4	1.75 ± 1.7	0.65 ± 1.2	4.444 ± 1.8	33.51
		0.25	–	–	–	–	–
		0.50	–	–	–	–	–
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
16	IC 203586	0.00	66 ± 2	2.5 ± 2	0.35 ± 1.8	7.501 ± 1.4	25.08
		0.25	4 ± 1.8	0.65 ± 1.8	0.10 ± 0.9	4.286 ± 1.8	0.69
		0.50	–	–	–	–	–
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
17	IC 203600	0.00	66 ± 1	1.65 ± 2	0.4 ± 12	3.74 ± 32	36.15
		0.25	30 ± 0.8	1.15 ± 1.8	0.25 ± 2	6.458 ± 2	6.50
		0.50	8 ± 1.5	0.7 ± 2	0.20 ± 0.8	5.643 ± 1	1.28
		0.75	6 ± 2	0.4 ± 0.8	0.35 ± 1	5.555 ± 1.2	0.81
		1.00	–	–	–	–	–

Sl.No	Variety/ Accession	NaCl Conc. (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Dry weight of Seedling (mg)	Vigour Index
18	IC 111468	0.00	92 ± 1.9	2.25 ± 1.7	0.75 ± 2	5.16 ± 2	53.43
		0.25	22 ± 0.9	0.35 ± 1.2	0.15 ± 2	6.833 ± 1.5	1.61
		0.50	8 ± 1.2	0.90 ± 0.8	0.15 ± 0.8	9.375 ± 1.8	0.89
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
19	IC 111292	0.00	94 ± 1.6	2.75 ± 1.4	1.75 ± 2	4.686 ± 2	90.27
		0.25	54 ± 1.8	1.9 ± 2	0.25 ± 1	5.857 ± 1.7	11.07
		0.50	4 ± 1	0.55 ± 0.7	0.15 + –1	6.889 ± 1	0.41
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–
20	IC 203591	0.00	64 ± 2	1.75 ± 1.8	0.65 ± 1.8	5.398 ± 2	24.01
		0.25	6 ± 1.1	1.25 ± 2	0.3 ± 1	7.738 ± 1.6	1.20
		0.50	–	–	–	–	–
		0.75	–	–	–	–	–
		1.00	–	–	–	–	–

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