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Effect of soil salinity on germination and survival of brinjal (*Solanum melongena* L.)

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Abstract

The present investigation was conducted at vegetable research farm, Department of Vegetable Science, Punjab Agricultural University, Ludhiana. The desired levels of salinity were induced using sodium chloride, magnesium sulphate and calcium chloride in ratio of 2:1:1. Seeds of 102 brinjal genotypes were sown in plug trays. Each brinjal genotype was sown in two (Plug trays) sets. In each plug tray, 28 plants were sown. In one set of plug tray, normal water was applied. When seedlings attained 2 leaf stage (after 10–12 days of sowing), saline water treatment was applied to evaluate seedling survival under salt stress conditions. While in the second set of plug tray, saline water was applied immediately after sowing to evaluate germination percentage under salt stress conditions. It has been observed from the investigation that these genotypes were categorized as 19 genotypes under tolerant, 39 as semi-tolerant and 44 were susceptible to salinity on the basis of nursery and morphological screening trials. Out of these 19 tolerant genotypes, brinjal genotypes (SL-8-PB-1-3-1-4 (Small Long), KBSR-343-1 (Small round) and BL-215 (Long)) may be recommended for future studies in salt-affected area of Punjab.

Keywords: Brinjal, *Solanum melongena*, Genotypes, Salinity tolerant

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Introduction

Brinjal (*Solanum melongena* L.) is also known as "aubergine" in France and UK, eggplant in USA and "baingan" in India. It is cultivated for immature fruits used for cooking or as processed products. It is a good source of minerals like potassium, calcium, sodium and iron as well as dietary fibre (Raigon *et al.* 2008). Brinjal is cultivated on an area of 7.27 lakh ha with 123.23 lakh Mt production in India (Anonymous 2019). Punjab occupies an area of 5.47 thousand ha with 139.79 thousand Mt production (Anonymous 2021). Abiotic stresses arise from change in environmental, soil and water conditions around the plant. The major abiotic stresses (drought, flooding, salinity, cold and heat) negatively affect the plant survival, biomass production and yields of staple food crops up to 70% (Thakur *et al.* 2010). Salinity is the major abiotic stress reducing the growth and productivity of economically important crops all over the world. Soils having high concentrations of soluble salts in the soil moisture of the root zone are known as saline soils. Plants modify several aspects in their metabolic and morphological cascade to survive under stress conditions (Reis *et al.* 2012). In India, more than 8 mha area is salt affected. By reaching 2050, half of the cultivated area will be salt affected; salinity will pose a big problem in the future. As the water table is declining day by day in India, a deeper layer of soil high concentration of soluble salts is available, which make water saline and ultimately, through irrigation, an upper layer of soil gets affected. Therefore, screening of tolerant genotypes to salinity at the germination stage will ensure the growth and production of crops in future (Jogeswar *et al.* 2006).

Salinity affects various aspects of plants such as seed germination, seedling growth, seed vigor and respiration that reduce total yield (Sairam and Tyagi 2004). During the onset and development of salt stress within a plant, all the major processes such as photosynthesis, protein synthesis and lipid metabolism, are affected (Parida and Das 2005), affecting its survival rate. Brinjal is a moderately salt-sensitive crop. It can tolerate salinity up to 1.1 dS/m^{-1} (Jain *et al.* 1987). There are several strategies to alleviate the salinity affect viz developing salt-resistant cultivars, leaching excess soluble salts from upper to lower soil depths and flushing soils that contain salt crusts at the surface (Qadir *et al.* 2000). Information of variability within crop germplasm is essential for crop improvement and to meet diverse goals like cultivars with high yield, wider adaptability, desirable quality, abiotic stress tolerance, pest and disease resistance, etc. Many studies on genetics and breeding for yield and its contributing traits have been studies in brinjal on heterosis, combining ability and gene action (Rameshkumar and Vethamonai 2020, Kasera *et al.*. 2020, Mondal *et al.* 2021), mutation breeding (Singh *et al.* 2021) and parthenocarpic lines (Sarangal *et al.* 2021) . It is important to check the salt tolerance level at the germination stage so that best genotypes will be screened on further stages of growth and development. Therefore, the present study was planned to evaluate brinjal germplasm for salinity tolerance at the germination stage.

Material and Methods

The experiment was conducted at the Vegetable Research Farm, Department of Vegetable Science, Punjab Agricultural University, Ludhiana. A total of 102 genotypes of varying texture, shape and size were selected for study from available brinjal germplasm. Magnesium sulfate and calcium chloride were used for artificial salinity sodium chloride in ratio 2:1:1. There were four salinity levels (2ds/m, 4ds/m, 6 ds/m and control). Seeds of 102 brinjal genotypes were sown in plug trays. Each brinjal genotype was sown in two (Plug trays) sets. In each plug tray, 28 plants were sown. In one set of plug tray, normal water was applied and when seedlings attain 2 leaf stage (after 10-12 days of sowing) then saline water treatment was applied to evaluate seedling survival under salt stress conditions. While in second set of plug tray, saline water was applied immediately after sowing to evaluate germination percentage under salt stress conditions. Data of plug tray experiments was collected during November 2016 and November 2017. Saline water of different levels was given immediately after sowing and a number of plants germinated with the saline water was counted and their percentage was calculated. Further, saline water of different levels was applied to the plug tray when plants attained two leaf stages and number of plants that survived after 21 days of this treatment was count and their percentage was calculated.

Results and Discussion

Germination is the first basic step of plant growth which refers to the emergence of plant stature from seed. Germination is the key factor for the successful cultivation of any crop. Germination refers to the process by which an organism grows from a seed. Germination rate and seedling quality provide an estimation of yield of any crop. The survival rate is the second essential step of plant growth. Survival rate determines the seed quality and that genotype's stress-bearing ability. Good quality seed which has high stress bearing ability has maximum survival rate.

Germination percentage of seedlings

For screening of genotypes against salinity at nursery stage, 102 genotypes were sown in plug trays in two sets. Twenty-eight plugs of one tray were sown for each genotype. In one set of plug trays, saline water was immediately given after sowing to determine the germination percentage. It was observed from the results that SL-8-PB-1-3-1-4 genotypes germinate well at control (100 percent) followed by 2 ds/m (96.42%). 4 ds/m (96.42%) and at 6 ds/m (85.71 %). This genotype performs superior at all levels of salinity followed by KBSR-343-1, BL-215 and BL-235 genotypes during 2016 (Table 1); whereas, during 2017, SL-8-PB-1-3-1-4 and SL-8-PB-11-1-2 followed by KBSR-343-1 performs superior at each salinity level among the 102 genotypes. Similar results were observed in Average of both years.

Survival percentage

In the 2nd set of plug trays, saline water was applied to seedling when they reached 2 leaf stage. Their survival percentage was calculated after 21 days of the treatment with saline water. It was observed that SL-8-PB-1-3-1-4 genotype performs superior at the germination stage and as well as survival rate at all levels of salinity. At 6 ds/m salinity level, its germination was 53.57% and its survival rate was 39.29 % followed by BL-215 and BL-235 (Table 2) during 2016. Similar trends were reported in the confirmation trial of November 2017. Similar results were observed in Average of both years. From the results of nursery trial, it was concluded that SL-8-PB-1-3-1-4, KBSR-343-1, BL-215 and BL-235 genotypes perform superior as compared to other genotypes.

It was observed that 19 genotypes were tolerant (Table 3) to all the salinity levels (upto 6ds/m) while 16 genotypes (excluding 19 genotypes which were tolerant at 6 ds/m level of salinity) were tolerant upto 4 ds/m level of salinity (Table 3) and did not survived at 6 ds/m. Whereas 23 (excluding 35 genotypes which were tolerant at 4ds/m or 6 ds/m level of salinity) genotypes were tolerant to 2 ds/m level of salinity (Table 3) and did not survive at 4ds/m or 6 ds/m level of salinity. These 39 genotypes were considered semi-tolerant salinity genotypes (at 2 ds/m or 4 ds/m). The remaining 44 genotypes (Table 3) were considered susceptible because these genotypes were not survived at lower salinity and survive only at control level.

Table 1: Effect of different salinity level on germination percentage of brinjal genotypes

Genotype	*November 2016 trial*				*November 2017 trial*				*Average of Both Years*			
	Control	*2ds/m*	*4ds/m*	*6ds/m*	*Control*	*2ds/m*	*4ds/m*	*6ds/m*	*Control*	*2ds/m*	*4ds/m*	*6ds/m*
CB-9991-6	71.43	60.71	53.57	50	75	57.14	50	35.71	73.22	58.93	51.79	42.86
CB-9991-214-1-3	71.43	60.71	50	57.14	82.14	64.29	53.57	42.86	76.79	62.50	51.79	50.00
S-324-465-2-2	85.71	78.57	71.43	67.86	82.14	57.14	42.86	39.29	83.93	67.86	57.15	53.58
BL-2013-4-3-1	89.29	89.29	78.57	71.43	75	64.29	46.43	39.29	82.15	76.79	62.50	55.36
BL-216	75	71.43	50	39.29	75	60.71	50	32.14	75.00	66.07	50.00	35.72
BL-219	82.14	78.57	71.43	67.86	78.57	53.57	46.43	39.29	80.36	66.07	58.93	53.58
BL-220	78.57	67.86	60.71	42.86	75	64.29	46.43	32.14	76.79	66.08	53.57	37.50
BRG-232	71.43	64.29	53.57	42.86	75	64.29	53.57	42.86	73.22	64.29	53.57	42.86
GL-412	71.43	64.29	53.57	42.86	78.57	57.14	35.71	28.57	75.00	60.72	44.64	35.72
BSR-PB-123-3	71.43	64.29	57.14	53.57	75	64.29	53.57	39.29	73.22	64.29	55.36	46.43
BR-WR-11-1	75	67.86	57.14	46.43	78.57	60.71	39.29	32.14	76.79	64.29	48.22	39.29
GL-415	82.14	75	57.14	46.43	78.57	60.71	42.86	32.14	80.36	67.86	50.00	39.29
CB-9991-215-1-1	71.43	64.29	53.57	46.43	75	67.86	46.43	32.14	73.22	66.08	50.00	39.29
CB-9991-121-1	71.43	64.29	53.57	46.43	82.14	71.43	57.14	42.86	76.79	67.86	55.36	44.65
BSR-PB-123-1	71.43	64.29	53.57	46.43	71.43	67.86	50	39.29	71.43	66.08	51.79	42.86
MOH-3-11-3	78.57	75	67.86	71.43	82.14	71.43	60.71	46.43	80.36	73.22	64.29	58.93
S-324-94-1-2	85.71	78.57	53.57	39.29	82.14	71.43	60.71	39.29	83.93	75.00	57.14	39.29
BL-2011-14-1	71.43	64.29	50	42.86	82.14	67.86	53.57	35.71	76.79	66.08	51.79	39.29
MRG-332	85.71	85.71	75	71.43	82.14	57.14	46.43	42.86	83.93	71.43	60.72	57.15
BRG-224	71.43	64.29	50	42.86	82.14	67.86	50	32.14	76.79	66.08	50.00	37.50
BR-W-124-1	71.43	60.71	46.43	39.29	82.14	64.29	42.86	28.57	76.79	62.50	44.65	33.93
JIFF-1201-9	71.43	60.71	50	42.86	71.43	64.29	53.57	42.86	71.43	62.50	51.79	42.86
GL-217	67.86	53.57	46.43	35.71	75	57.14	42.86	28.57	71.43	55.36	44.65	32.14
GL-405	67.86	57.14	57.14	42.86	78.57	64.29	46.43	25	73.22	60.72	51.79	33.93
GL-403	67.86	57.14	53.57	39.29	75	60.71	50	28.57	71.43	58.93	51.79	33.93
93-PSB-2-2-1-2	82.14	78.57	71.43	67.86	78.57	60.71	42.86	35.71	80.36	69.64	57.15	51.79
93-PSB-1-1-2-1	71.43	67.86	57.14	50	75	71.43	57.14	39.29	73.22	69.65	57.14	44.65
42324-121-2-1	78.57	75	67.86	75	71.43	60.71	53.57	39.29	75.00	67.86	60.72	57.15
SL-8-PB-11-1-2	78.57	71.43	64.29	71.43	85.71	75	67.86	53.57	82.14	73.22	66.08	62.50
SL-218-1-1-1-2	71.43	67.86	60.71	57.14	82.14	67.86	57.14	46.43	76.79	67.86	58.93	51.79
R-889-122-21-1	71.43	60.71	53.57	46.43	75	64.29	46.43	35.71	73.22	62.50	50.00	41.07
LH-1-4-3	71.43	64.29	53.57	46.43	85.71	67.86	50	39.29	78.57	66.08	51.79	42.86
BMR-494-13-1	67.86	53.57	46.43	39.29	75	60.71	46.43	21.43	71.43	57.14	46.43	30.36
LH-1-5-2	71.43	67.86	57.14	50	82.14	57.14	42.86	32.14	76.79	62.50	50.00	41.07
GL-408	85.71	64.29	50	35.71	78.57	64.29	46.43	21.43	82.14	64.29	48.22	28.57
SLV-359-11-1	71.43	60.71	50	42.86	82.14	57.14	42.86	32.14	76.79	58.93	46.43	37.50
93-PSB-2-1-1-2-2	71.43	60.71	50	42.86	75	57.14	42.86	28.57	73.22	58.93	46.43	35.72
BR-332-2	67.86	64.29	53.57	46.43	78.57	60.71	46.43	35.71	73.22	62.50	50.00	41.07
BR-123	89.29	60.71	46.43	32.14	71.43	57.14	42.86	21.43	80.36	58.93	44.65	26.79
BR-122	82.14	67.86	53.57	39.29	71.43	53.57	39.29	21.43	76.79	60.72	46.43	30.36
BR-116	82.14	78.57	71.43	64.29	75	53.57	42.86	35.71	78.57	66.07	57.15	50.00
BR-101	78.57	75	64.29	71.43	71.43	64.29	50	39.29	75.00	69.65	57.15	55.36
SR-301	67.86	64.29	53.57	50	82.14	64.29	53.57	39.29	75.00	64.29	53.57	44.65
B-668-5	82.14	78.57	67.86	64.29	82.14	53.57	42.86	32.14	82.14	66.07	55.36	48.22
KBSR-343-1	96.43	92.86	92.86	82.14	85.71	71.43	64.29	53.57	91.07	82.15	78.58	67.86
BB-93-C	78.57	64.29	50	35.71	71.43	57.14	35.71	21.43	75.00	60.72	42.86	28.57
SC-15-2	78.57	71.43	64.29	57.14	71.43	64.29	50	42.86	75.00	67.86	57.15	50.00
KANYA-6-1	75	53.57	46.43	35.71	71.43	60.71	39.29	17.86	73.22	57.14	42.86	26.79
SR-306	75	57.14	46.43	32.14	71.43	60.71	46.43	17.86	73.22	58.93	46.43	25.00
SOV-328	71.43	67.86	50	42.86	85.71	53.57	39.29	32.14	78.57	60.72	44.65	37.50
SR-327	71.43	64.29	46.43	32.14	71.43	53.57	35.71	17.86	71.43	58.93	41.07	25.00
SR-334	75	64.29	67.86	71.43	82.14	71.43	64.29	50	78.57	67.86	66.08	60.72

Genotype	November 2016 trial				November 2017 trial				Average of Both Years			
	Control	2ds/m	4ds/m	6ds/m	Control	2ds/m	4ds/m	6ds/m	Control	2ds/m	4ds/m	6ds/m
SR-333	71.43	67.86	50	42.86	78.57	57.14	42.86	28.57	75.00	62.50	46.43	35.72
BLW-2001-1-2	75	67.86	67.86	64.29	75	57.14	50	42.86	75.00	62.50	58.93	53.58
BL-208	71.43	50	42.86	28.57	75	64.29	57.14	39.29	73.22	57.15	50.00	33.93
BL-210	75	57.14	46.43	35.71	78.57	64.29	57.14	35.71	76.79	60.72	51.79	35.71
BL-211	75	64.29	67.86	60.71	78.57	64.29	53.57	39.29	76.79	64.29	60.72	50.00
BL-213	75	64.29	53.57	28.57	82.14	60.71	50	28.57	78.57	62.50	51.79	28.57
BL-214	75	67.86	71.43	53.57	75	57.14	50	35.71	75.00	62.50	60.72	44.64
BL-215	92.86	92.86	82.14	78.57	75	64.29	57.14	50	83.93	78.58	69.64	64.29
BL-235	92.86	89.29	89.29	82.14	75	60.71	57.14	50	83.93	75.00	73.22	66.07
BR-332-1	78.57	67.86	50	35.71	85.71	57.14	46.43	28.57	82.14	62.50	48.22	32.14
SR-317	78.57	75	57.14	50	82.14	64.29	46.43	39.29	80.36	69.65	51.79	44.65
SR-320	75	71.43	60.71	50	82.14	60.71	50	28.57	78.57	66.07	55.36	39.29
MR-325	85.71	78.57	67.86	57.14	82.14	57.14	50	32.14	83.93	67.86	58.93	44.64
SR-324	78.57	71.43	60.71	42.86	82.14	64.29	53.57	32.14	80.36	67.86	57.14	37.50
SR-322	75	71.43	57.14	64.29	82.14	60.71	50	35.71	78.57	66.07	53.57	50.00
SR-318	75	64.29	60.71	42.86	78.57	60.71	50	35.71	76.79	62.50	55.36	39.29
MR-319	71.43	60.71	53.57	39.29	75	60.71	50	35.71	73.22	60.71	51.79	37.50
BL-240	78.57	67.86	50	39.29	75	60.71	50	28.57	76.79	64.29	50.00	33.93
P-71	67.86	57.14	42.86	35.71	78.57	64.29	42.86	28.57	73.22	60.72	42.86	32.14
BL-2011-219-8-1	89.29	89.29	71.43	82.14	75	57.14	53.57	46.43	82.15	73.22	62.50	64.29
BL-2011-473-2	67.86	50	42.86	32.14	71.43	57.14	46.43	17.86	69.65	53.57	44.65	25.00
V-320-42-66-1-3	75	64.29	42.86	32.14	71.43	57.14	50	17.86	73.22	60.72	46.43	25.00
SR-312	71.43	67.86	53.57	39.29	78.57	57.14	42.86	32.14	75.00	62.50	48.22	35.72
SR-313	78.57	71.43	46.43	35.71	78.57	67.86	57.14	39.29	78.57	69.65	51.79	37.50
BL-218-1-1-1-2	67.86	57.14	39.29	25	75	57.14	35.71	17.86	71.43	57.14	37.50	21.43
BRG-114	75	67.86	57.14	57.14	78.57	57.14	46.43	35.71	76.79	62.50	51.79	46.43
BMR-494-10	75	64.29	42.86	35.71	78.57	60.71	35.71	17.86	76.79	62.50	39.29	26.79
JG-1	75	67.86	57.14	50	71.43	53.57	42.86	32.14	73.22	60.72	50.00	41.07
BL-222	67.86	53.57	42.86	35.71	71.43	53.57	35.71	17.86	69.65	53.57	39.29	26.79
SR-302	85.71	85.71	78.57	71.43	85.71	53.57	46.43	39.29	85.71	69.64	62.50	55.36
SL-309	67.86	57.14	39.29	28.57	71.43	57.14	32.14	14.29	69.65	57.14	35.72	21.43
GL-417	67.86	64.29	50	35.71	82.14	64.29	42.86	14.29	75.00	64.29	46.43	25.00
SL-8-PB-1-3-1-4	100	96.43	96.43	85.71	85.71	82.14	75	67.86	92.86	89.29	85.72	76.79
BL-204	64.29	53.57	46.43	28.57	78.57	60.71	39.29	14.29	71.43	57.14	42.86	21.43
BL-207	78.57	75	64.29	57.14	75	67.86	57.14	39.29	76.79	71.43	60.72	48.22
BL-205	64.29	53.57	46.43	28.57	75	57.14	35.71	14.29	69.65	55.36	41.07	21.43
SR-321	85.71	75	57.14	46.43	78.57	64.29	57.14	39.29	82.14	69.65	57.14	42.86
WO-406	85.71	82.14	71.43	67.86	82.14	57.14	42.86	35.71	83.93	69.64	57.15	51.79
SL-310	75	64.29	53.57	50	71.43	57.14	50	35.71	73.22	60.72	51.79	42.86
GM0-409	64.29	53.57	46.43	28.57	78.57	64.29	42.86	28.57	71.43	58.93	44.65	28.57
SR-303	78.57	75	64.29	71.43	71.43	57.14	46.43	42.86	75.00	66.07	55.36	57.15
CH-275-2-1-4-1	75	57.14	42.86	25	71.43	57.14	46.43	25	73.22	57.14	44.65	25.00
AE-1370-3-3	75	60.71	50	53.57	75	53.57	50	35.71	75.00	57.14	50.00	44.64
SLV-360-1	82.14	75	53.57	42.86	78.57	60.71	50	32.14	80.36	67.86	51.79	37.50
SLV-352-3	78.57	53.57	42.86	25	71.43	57.14	50	28.57	75.00	55.36	46.43	26.79
PSB-64-23-101-1	75	71.43	50	42.86	78.57	57.14	42.86	32.14	76.79	64.29	46.43	37.50
PSB-64-23-25-1	75	75	57.14	50	75	64.29	50	42.86	75.00	69.65	53.57	46.43
LH-1-7-8	71.43	67.86	53.57	46.43	75	64.29	50	42.86	73.22	66.08	51.79	44.65
BR-113	67.86	57.14	50	35.71	85.71	67.86	42.86	17.86	76.79	62.50	46.43	26.79
BL-2013-41-1	82.14	78.57	60.71	50	75	60.71	57.14	39.29	78.57	69.64	58.93	44.65
Mean	76.02	67.68	56.72	48.49	77.52	61.48	48.32	33.68	76.77	64.59	52.52	41.09
SEm	0.70	0.98	1.12	1.47	0.44	0.54	0.73	0.97	0.44	0.59	0.80	1.16

Table 2: Effect of different salinity level on survival percentage

Genotype	*November 2016 trial*				*November 2017 trial*				*Average of Both Years*			
	Control	*2ds/m*	*4ds/m*	*6ds/m*	*Control*	*2ds/m*	*4ds/m*	*6ds/m*	*Control*	*2ds/m*	*4ds/m*	*6ds/m*
CB-9991-6	92.86	67.86	42.86	35.71	75	39.29	39.29	39.29	83.93	53.58	41.08	37.50
CB-9991-214-1-3	92.86	71.43	50	39.29	78.57	39.29	39.29	39.29	85.72	55.36	44.65	39.29
S-324-465-2-2	92.86	75	53.57	46.43	85.71	60.71	53.57	53.57	89.29	67.86	53.57	50.00
BL-2013-4-3-1	89.29	64.29	50	35.71	92.86	67.86	60.71	67.86	91.08	66.08	55.36	51.79
BL-216	75	53.57	35.71	17.86	89.29	39.29	35.71	28.57	82.15	46.43	35.71	23.22
BL-219	92.86	71.43	50	39.29	89.29	57.14	46.43	50	91.08	64.29	48.22	44.65
BL-220	82.14	64.29	35.71	25	82.14	35.71	32.14	17.86	82.14	50.00	33.93	21.43
BRG-232	82.14	60.71	39.29	32.14	71.43	46.43	35.71	32.14	76.79	53.57	37.50	32.14
GL-412	78.57	64.29	42.86	21.43	85.71	42.86	39.29	21.43	82.14	53.58	41.08	21.43
BSR-PB-123-3	85.71	67.86	46.43	35.71	82.14	39.29	39.29	39.29	83.93	53.58	42.86	37.50
BR-WR-11-1	75	57.14	39.29	28.57	75	39.29	28.57	28.57	75.00	48.22	33.93	28.57
GL-415	75	50	42.86	17.86	71.43	35.71	28.57	10.71	73.22	42.86	35.72	14.29
CB-9991-215-1-1	82.14	64.29	35.71	28.57	89.29	39.29	39.29	39.29	85.72	51.79	37.50	33.93
CB-9991-121-1	82.14	60.71	35.71	32.14	71.43	39.29	39.29	39.29	76.79	50.00	37.50	35.72
BSR-PB-123-1	85.71	67.86	42.86	35.71	85.71	39.29	39.29	39.29	85.71	53.58	41.08	37.50
MOH-3-11-3	82.14	60.71	46.43	28.57	78.57	46.43	42.86	42.86	80.36	53.57	44.65	35.72
S-324-94-1-2	71.43	53.57	35.71	25	75	35.71	39.29	17.86	73.22	44.64	37.50	21.43
BL-2011-14-1	71.43	57.14	32.14	21.43	82.14	35.71	42.86	14.29	76.79	46.43	37.50	17.86
MRG-332	85.71	67.86	28.57	39.29	82.14	64.29	57.14	57.14	83.93	66.08	42.86	48.22
BRG-224	85.71	64.29	17.86	25	78.57	39.29	50	17.86	82.14	51.79	33.93	21.43
BR-W-124-1	82.14	60.71	32.14	17.86	85.71	46.43	46.43	10.71	83.93	53.57	39.29	14.29
JIFF-1201-9	85.71	57.14	35.71	25	82.14	39.29	39.29	32.14	83.93	48.22	37.50	28.57
GL-217	82.14	57.14	39.29	17.86	75	39.29	35.71	17.86	78.57	48.22	37.50	17.86
GL-405	85.71	60.71	39.29	14.29	82.14	35.71	39.29	21.43	83.93	48.21	39.29	17.86
GL-403	82.14	57.14	42.86	17.86	89.29	35.71	32.14	25	85.72	46.43	37.50	21.43
93-PSB-2-2-1-2	85.71	64.29	50	35.71	89.29	60.71	50	50	87.50	62.50	50.00	42.86
93-PSB-1-1-2-1	89.29	60.71	39.29	28.57	82.14	39.29	39.29	32.14	85.72	50.00	39.29	30.36
42324-121-2-1	89.29	71.43	42.86	25	85.71	53.57	46.43	42.86	87.50	62.50	44.65	33.93
SL-8-PB-11-1-2	85.71	67.86	39.29	25	82.14	46.43	42.86	42.86	83.93	57.15	41.08	33.93
SL-218-1-1-1-2	89.29	60.71	46.43	28.57	85.71	39.29	42.86	35.71	87.50	50.00	44.65	32.14
R-889-122-21-1	82.14	67.86	42.86	28.57	78.57	39.29	53.57	28.57	80.36	53.58	48.22	28.57
LH-1-4-3	82.14	57.14	39.29	25	75	39.29	50	35.71	78.57	48.22	44.65	30.36
BMR-494-13-1	82.14	57.14	46.43	17.86	71.43	35.71	32.14	32.14	76.79	46.43	39.29	25.00
LH-1-5-2	78.57	64.29	42.86	21.43	78.57	42.86	46.43	28.57	78.57	53.58	44.65	25.00
GL-408	78.57	60.71	53.57	17.86	75	42.86	28.57	39.29	76.79	51.79	41.07	28.58
SLV-359-11-1	78.57	57.14	42.86	17.86	78.57	46.43	53.57	35.71	78.57	51.79	48.22	26.79
93-PSB-2-1-1-2-2	78.57	60.71	35.71	14.29	82.14	42.86	42.86	25	80.36	51.79	39.29	19.65
BR-332-2	78.57	57.14	32.14	14.29	78.57	39.29	39.29	25	78.57	48.22	35.72	19.65
BR-123	78.57	60.71	46.43	14.29	75	39.29	28.57	28.57	76.79	50.00	37.50	21.43
BR-122	75	53.57	39.29	14.29	78.57	46.43	35.71	21.43	76.79	50.00	37.50	17.86
BR-116	89.29	67.86	46.43	35.71	82.14	60.71	46.43	50	85.72	64.29	46.43	42.86
BR-101	85.71	71.43	42.86	32.14	85.71	50	46.43	42.86	85.71	60.72	44.65	37.50
SR-301	82.14	64.29	32.14	25	78.57	35.71	35.71	35.71	80.36	50.00	33.93	30.36
B-668-5	85.71	64.29	39.29	21.43	82.14	57.14	46.43	50	83.93	60.72	42.86	35.72
KBSR-343-1	89.29	67.86	50	39.29	85.71	71.43	71.43	75	87.50	69.65	60.72	57.15
BB-93-C	75	57.14	42.86	10.71	71.43	32.14	35.71	7.14	73.22	44.64	39.29	8.93
SC-15-2	89.29	67.86	39.29	28.57	82.14	50	42.86	42.86	85.72	58.93	41.08	35.72
KANYA-6-1	78.57	60.71	32.14	25	71.43	32.14	39.29	25	75.00	46.43	35.72	25.00
SR-306	75	53.57	42.86	21.43	71.43	39.29	35.71	17.86	73.22	46.43	39.29	19.65
SOV-328	82.14	67.86	35.71	28.57	82.14	46.43	35.71	39.29	82.14	57.15	35.71	33.93
SR-327	71.43	50	39.29	10.71	89.29	32.14	28.57	10.71	80.36	41.07	33.93	10.71

Genotype	November 2016 trial				November 2017 trial				Average of Both Years			
	Control	2ds/m	4ds/m	6ds/m	Control	2ds/m	4ds/m	6ds/m	Control	2ds/m	4ds/m	6ds/m
SR-334	85.71	67.86	35.71	21.43	82.14	46.43	42.86	42.86	83.93	57.15	39.29	32.15
SR-333	85.71	67.86	35.71	25	82.14	50	39.29	42.86	83.93	58.93	37.50	33.93
BLW-2001-1-2	82.14	60.71	35.71	25	78.57	46.43	42.86	42.86	80.36	53.57	39.29	33.93
BL-208	75	57.14	32.14	14.29	85.71	32.14	28.57	28.57	80.36	44.64	30.36	21.43
BL-210	82.14	60.71	39.29	14.29	71.43	35.71	35.71	32.14	76.79	48.21	37.50	23.22
BL-211	85.71	67.86	39.29	28.57	85.71	42.86	42.86	42.86	85.71	55.36	41.08	35.72
BL-213	85.71	60.71	42.86	17.86	82.14	42.86	35.71	7.14	83.93	51.79	39.29	12.50
BL-214	89.29	64.29	46.43	39.29	85.71	42.86	42.86	39.29	87.50	53.58	44.65	39.29
BL-215	92.86	60.71	50	35.71	89.29	71.43	64.29	71.43	91.08	66.07	57.15	53.57
BL-235	85.71	64.29	42.86	39.29	92.86	67.86	64.29	71.43	89.29	66.08	53.58	55.36
BR-332-1	82.14	53.57	35.71	14.29	78.57	35.71	28.57	10.71	80.36	44.64	32.14	12.50
SR-317	85.71	57.14	32.14	25	82.14	39.29	46.43	46.43	83.93	48.22	39.29	35.72
SR-320	75	53.57	32.14	21.43	78.57	42.86	35.71	32.14	76.79	48.22	33.93	26.79
MR-325	75	57.14	32.14	21.43	78.57	35.71	35.71	32.14	76.79	46.43	33.93	26.79
SR-324	82.14	57.14	35.71	25	75	35.71	32.14	28.57	78.57	46.43	33.93	26.79
SR-322	82.14	60.71	42.86	39.29	78.57	42.86	39.29	39.29	80.36	51.79	41.08	39.29
SR-318	82.14	64.29	35.71	17.86	78.57	35.71	32.14	25	80.36	50.00	33.93	21.43
MR-319	75	57.14	32.14	21.43	85.71	35.71	42.86	32.14	80.36	46.43	37.50	26.79
BL-240	78.57	57.14	35.71	14.29	75	32.14	32.14	28.57	76.79	44.64	33.93	21.43
P-71	82.14	53.57	35.71	14.29	78.57	35.71	32.14	17.86	80.36	44.64	33.93	16.08
BL-2011-219-8-1	85.71	64.29	46.43	39.29	85.71	67.86	60.71	67.86	85.71	66.08	53.57	53.58
BL-2011-473-2	78.57	57.14	39.29	14.29	78.57	32.14	39.29	21.43	78.57	44.64	39.29	17.86
V-320-42-66-1-3	75	57.14	35.71	17.86	82.14	35.71	39.29	35.71	78.57	46.43	37.50	26.79
SR-312	75	57.14	42.86	25	89.29	50	39.29	17.86	82.15	53.57	41.08	21.43
SR-313	78.57	60.71	35.71	21.43	82.14	42.86	32.14	21.43	80.36	51.79	33.93	21.43
BL-218-1-1-1-2	71.43	53.57	32.14	14.29	75	39.29	28.57	32.14	73.22	46.43	30.36	23.22
BRG-114	85.71	57.14	50	39.29	75	42.86	39.29	39.29	80.36	50.00	44.65	39.29
BMR-494-10	71.43	53.57	32.14	17.86	85.71	32.14	28.57	21.43	78.57	42.86	30.36	19.65
JG-1	85.71	60.71	42.86	35.71	75	42.86	39.29	39.29	80.36	51.79	41.08	37.50
BL-222	71.43	50	32.14	14.29	85.71	35.71	32.14	7.14	78.57	42.86	32.14	10.72
SR-302	92.86	60.71	50	35.71	82.14	67.86	57.14	57.14	87.50	64.29	53.57	46.43
SL-309	71.43	53.57	35.71	10.71	78.57	42.86	35.71	14.29	75.00	48.22	35.71	12.50
GL-417	75	53.57	35.71	10.71	82.14	32.14	32.14	28.57	78.57	42.86	33.93	19.64
SL-8-PB-1-3-1-4	96.43	57.14	50	35.71	92.86	78.57	78.57	82.14	94.65	67.86	64.29	58.93
BL-204	75	50	32.14	14.29	78.57	32.14	28.57	28.57	76.79	41.07	30.36	21.43
BL-207	82.14	50	35.71	17.86	78.57	46.43	42.86	42.86	80.36	48.22	39.29	30.36
BL-205	75	46.43	35.71	14.29	75	39.29	35.71	28.57	75.00	42.86	35.71	21.43
SR-321	82.14	60.71	39.29	10.71	85.71	39.29	35.71	10.71	83.93	50.00	37.50	10.71
WO-406	85.71	64.29	42.86	28.57	85.71	64.29	53.57	57.14	85.71	64.29	48.22	42.86
SL-310	82.14	64.29	39.29	25	75	42.86	39.29	39.29	78.57	53.58	39.29	32.15
GM0-409	75	53.57	39.29	14.29	78.57	35.71	32.14	21.43	76.79	44.64	35.72	17.86
SR-303	82.14	67.86	35.71	28.57	85.71	53.57	46.43	46.43	83.93	60.72	41.07	37.50
CH-275-2-1-4-1	82.14	60.71	42.86	14.29	82.14	42.86	35.71	25	82.14	51.79	39.29	19.65
AE-1370-3-3	85.71	57.14	35.71	17.86	75	39.29	39.29	39.29	80.36	48.22	37.50	28.58
SLV-360-1	78.57	60.71	39.29	17.86	82.14	46.43	32.14	17.86	80.36	53.57	35.72	17.86
SLV-352-3	82.14	60.71	32.14	17.86	75	32.14	28.57	21.43	78.57	46.43	30.36	19.65
PSB-64-23-101-1	78.57	57.14	35.71	14.29	89.29	35.71	35.71	28.57	83.93	46.43	35.71	21.43
PSB-64-23-25-1	85.71	60.71	39.29	17.86	85.71	35.71	28.57	28.57	85.71	48.21	33.93	23.22
LH-1-7-8	85.71	64.29	46.43	14.29	82.14	42.86	35.71	21.43	83.93	53.58	41.07	17.86
BR-113	78.57	53.57	35.71	17.86	78.57	35.71	32.14	17.86	78.57	44.64	33.93	17.86
BL-2013-41-1	75	57.14	39.29	14.29	78.57	39.29	32.14	35.71	76.79	48.22	35.72	25.00
Mean	81.86	60.40	39.53	23.71	80.99	43.49	40.30	33.47	81.43	51.95	39.92	28.59
SEm	0.58	0.57	0.61	0.88	0.53	1.02	0.95	1.52	0.45	0.69	0.65	1.12

Table 3: Salt tolerant and susceptible genotypes of brinjal

Salinity level	*Genotypes*
Tolerant at salinity level up to 6 ds/m (19 No.)	SL-8-PB-1-3-1-4, KBSR-343-1, BL- 215, BL 235, BL-2011-219-8-1, BL-2013-4-3-1, SR-302, MRG- 332, WO-406, S-324-465-2-2, 93-PSB-2-2-1-1, BR-116, B-668 5, BL-219, SR-303, BR-101, SC-15-2, 42324-121-2-1 and BL-207
Tolerant at salinity level up to 4 ds/m (16 No.)	MOH-3-11-3, SL-8-PB-11-1-2, SR-334, BLW-2001-1-2, BL-211, BL-214, SR-322, BRG114, JG-1, SL-310, AE-1370-3-3, CB-9991-6, CB-9991-214-1-3, BSR-PB-123-3, CB-9991-215-1-1 and CB9991-121-1
Tolerant at salinity level up to 2 ds/m (23 No.)	BSR-PB-123-1, JIFF-1201-9, 93-PSB-1-1-2-1, SL-218-1-1-1-2, R-889-122-21-1, LH-1-4-3, LH-1-5-2, SLV-359-11-1, 93-PSB-2-1-1-2-2, BR-32-2, SR-301, SOV-328, SR-333, SL-317, SR-320, MR-325, SR-324, SR-318, MR-319, SR 312, SR-313, SR-321 and SLV-360-1
Susceptible to salinity (44 No.)	PSB-64-23-101-1, PSB-64-23-25-1, LH-1-7-8, BL-2013-41-1, BL-216, BL-220, BRG-232, GL-412, BR-WR-11-1, GL-415, S-324-94-1-2, BL-2011-14-1, BRG-224, BR-W-124-1, GL-217, GL-405, GL-403, BMR-494-13-1, GL-408, BR-123, BR-122, BB-93-C, KANYA-6-1, SR-306, SR-327, BL-208, BL-210, BL-213, BR-332-1, BL-240, P-71, BL-2011-473-2, Vl-320-42-66-2-1-3, BL-218-1-1-1-2, BMR-494-10, BL-222, SL309, GL-417, BL-204, BL-205, GMO-409, Ch-275-2-1-4-1, SLV-352-3 and BR-113

Plant germination and survival rate decreased as the salinity level increased as the salt inhibited the seed from germinating by altering their favorable environment conditions. Salt limits the ability of seed to receive water or other essential metabolites for germination. Ahire and Nikam (2011) reported decreased germination percentage and biomass production in brinjal genotypes. This may be due to osmotic potential due to salinity that prevents water uptake or by toxic effects of ions on embryo viability. Jan *et al.*(2016) observed a reduction in brinjal seed germination and their survival under high level of soil salinity due to a decrease the osmotic potential to such a point that retard or prevent the uptake of water necessary for the mobilization of nutrients required for germination. Aloui *et al.* (2014) reported that as the salt (NaCl) increases, there was a decrease in germination percentage due to toxic effects of Na^+ and Cl^- in brinjal. Demir and Mavi (2008) reported that higher salt and osmotic stress concentrations reduce the germination percentage, seedling survival and seedling fresh weight in chili, which may be due to the increase in seed imbibing period and increase the seed dormancy. Tehseen *et al.* (2016) evaluated the germination test of chilli genotypes under petri dishes and reported that germination percentage, germination index and embryo axis length decreased with the salinity levels due to osmotic stress near the seed. Seth and Kendurkar (2015) reported that under the influence of salt stress, the days required for germination increased while the germination percentage and survival rate was decreased in tomatoes which may be due to lower respiration rate of seed that made the seed unable to utilize the secondary metabolites. Similar results were reported by Sardoei *et al.* (2013) in tomatoes.

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सारांश

वर्तमान परीक्षण में सब्जी अनुसंधान प्रक्षेत्र, सब्जी विज्ञान विभाग, पंजाब कृषि विश्वविद्यालय, लुधियाना (पंजाब) में की गयी। लवणता स्तर बनाये रखने के लिये सोडियम क्लोराइड, मैग्नीशियम, सल्फेट और कैल्शियम क्लोराइड का उपयोग 2:1:1 के अनुपात में किया गया। बैंगन के कुल 102 प्रभेदों की बुआई दो समूहों में प्लग ट्रे में की गयी। प्रत्येक प्लग ट्रे में 28 पौधे लगाये गये। प्लग ट्रे के एक समूह में सामान्य पानी डाला गया और अंकुर की 2 पत्ती की अवस्था (बुआई के 10-12 दिनों के उपरान्त) प्राप्त करने के उपरान्त लवणता तनाव की स्थिति में अंकुर जीवित रहने का मूल्यांकन करने के लिए लवणयुक्त पानी का प्रयोग किया गया जबकि प्लग ट्रे के दूसरे समूह में लवणता तनाव की स्थिति में अंकुरण प्रतिशत का मूल्यांकन करने के लिए बुआई के तुरन्त बाद लवणयुक्त पानी दिया गया। शोध से स्पष्ट हुआ कि नर्सरी और रूपात्मक छंटनी परीक्षणों के आधार पर लवणतापन के लिए 19 प्रभेदों को सहिष्णु के रूप में, 39 में अर्ध-सहिष्णु के रूप में और 44 को अति संवेदनशील के रूप में वर्गीकृत किया गया। बैंगन के 19 सहिष्णु प्रभेदों में से प्रभेद-एस.एल.-8-पी.बी.-1-3-1-4 (छोटा लम्बा), के.बी.एस.आर.-343-1 (छोटा गोल) और बी.एल.-215 (लम्बा) की भविष्य में पंजाब के लवण प्रभावित क्षेत्रों में उगाने के लिए सिफारिश की जा सकती है।