Studies on salt tolerance levels of BINAtomato-3

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Abstract: An experiment was carried out to study the effect of different levels of salinity on the morphological characters, physiological attributes and yield components in BINA tomato-3 mutant variety during the period from December, 2012 to April, 2013 at the horticulture farm of Bangladesh Agricultural University, Mymensingh. The two factor experiment had 4 seedlings treated in salt solutions, containing 0m mol, 25m mol, 50m mol, 75m mol and 100m mol NaC1 and pots soil treated in salt, containing 0%, 0.5% and 1% NaC1. The experiment was conducted in randomized complete block desigh (RCBD) with three replications. The plants were under pot culture at ambient air in Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh. Plant height, number of leaves and number of branches per plant decreased significantly with increasing salinity levels. Leaf area, leaf dry weight, stem dry weight and root dry weight were also significantly decreased with the increasing salt levels. At 100 m mol and 1% salinity level the plants failed to survive. As the salt level increased, flower per plant, fruit per plant and fresh fruit weigh per plant were decreased gradually. The salinity shock was found pronounced at 50 mmol and above level of NaC1 in BINA tomato-3 seedling i.e., the salinity shock up to 25 mmol NaC1 at the seedling stage could be endured by BINA tomato-3 variety. This mutant variety could also endure salinity shocks at pot condition up to 0.5% soil salinity levels. At 1% soil salinity, this mutant variety did not show any tolerances to produce flowers, fruits consequently fresh fruits weight plant^{-1}.
Key words: Salt tolerance, growth, yield and tomato.

Introduction

Tomato (*Lycopersicon esculentum* Mill) is an important popular and nutritious vegetable all over the world. It plays a vital role in providing a substantial quantity of vitamin C and A in human diet. In Bangladesh, the average yield of tomato is 7.42 t ha^{-1} which is very low compared to other tropical countries (Anonymous, 2006). Presence of excess soluble salt in soils is one of the factors that reduces the growth and development of cultivated crops of Bangladesh. The quality and quantity of soluble salt, salt dynamics and soil water regimes during the growing season strongly influence the crop growth. The composition and concentration of soluble salts in saline soil vary markedly in space and time as the soils are continuously subjected to salt accumulation, leaching, precipitation, dissolution, dilution etc. Salts primarily have two types of effect due to increase in osmotic potential of the soil solution in and around the root zone of the crop. The increased salinity in soil eventually limits the supply of assimilates to the growing parts and thus limits yield of the crop. It has been reported that there are few plant capable to develop adaptive mechanism against salinity (Flowers *et al.,* 2007; Dalton *et al*., 2009; Greenway and Munns, 2010 and Al-Rawahy, 2010) by which they successfully survive and propagate under adverse saline conditions. In Bangladesh about 0.833 millions hectares net cultivated land out of 3.03
million hectares of the costal and offshore areas are badly affected by different degrees of salinity (Karim *et al.,*1990).The main saline area of Bangladesh includes the greater districts of Khulna, Patuakhali, Noakhali and Chittagong as well as the islands of Bay of Bengal such as Bhola, Hatiya and Sandwip (Brammen, 2008). In these areas the salinity is developed primarily in dry winter season when concentration of salts in the soil surface are build up rapid evapotranspiration that ultimately causes a drastic reduction in crop yield. Salinity is also developed due to frequent inundations by tidal flood. Reclamation of these saline soils is a difficult and complex process (Soliman and Doos, 2008).

The response to salinity is generally evaluated by using plant growth, ion balance and osmotic adjustment. A number of researchers (Sanchez-Blanco *et al*., 2007; Alarcon *et al*., 1993a;1994b and Mangal *et al.,* 2011) have studied the water relations and the osmotic and elastic adjustment capacity of different tomato genotypes under saline stress and shown that the growth of salt treated tomato plants is often limited by the inability of the root to extract water from the soil and transport it to the shoot. Therefore, the present study has been carried out to study the effect of salinity levels on morphological and growth attributes in tomato; to determine the optimum dose of priming salinity for BINA tomato-3 production and estimation of its critical level of tolerance; and to assess the salt tolerance ability of BINA tomato-3 by treating seedling with salinity.

Materials and Methods

An experiment was carried out to study the effect of different levels of salinity on the morphological characters, physiological attributes and yield components in BINA tomato-3 mutant variety during the period from December, 2012 to April, 2013 at the horticulture farm of Bangladesh Agricultural University, Mymensingh.. The two factor experiment had 4 seedlings treated in salt solutions, containing 0m mol, 25m mol, 50m mol, 75m mol and 100m mol NaC1 and pots soil treated in salt, containing 0%, 0.5% and 1% NaC1. The plants were under pot culture at ambient air in Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh. Twenty days old seedling was treated in salt solution. After 20 days, the salt solution applied to the upper reached of the pots soil containing seedlings and then the seedlings were transplanting main experimental pots. Seeds of BINA tomato -3 a popular variety which has been developed by BINA, was used. The healthy seeds were sown in pots on November 28, 2015 at about 50% field capacity. Tomato seedling was transplanted after 20 days in soil of the pot on 2nd January 2001 at morning. In each pot 3 seedlings were transplanted. Two plants were uprooted from the pot after 30 days. The soil of the pot around the base of the plant was loosened with the help of a khurpi. Intercultural operation was done as and when necessary. Data on yield and yield contributing characters were recorded and the difference between the treatment means was judged by Least Significant Test (LSD).

Results and Discussion

Salinity affects the plant growth and metabolism activities. The adverse effect of salinity may be minimized by developing tolerant varieties, well managed cultural practices etc. In the present work the effect of salinity on tomato seedlings growth and yield were investigated. Results are described under the following heads.

Effect of soil treatment: The height of the plants, number of branch per plant, no. of leaf per plant, no of flower and fruit per plant were measured at an interval of 14 days from 35 DAT to 63 DAT and leaf area71 DAT as well as dry weight of leaf per plant, dry weight of stem per plant, dry weight of root per plant, number of fruit, fresh weight of fruit per plant from 75 DAT. Effect of salt application in soil was also found to be significant on all the mentioned parameters. The highest plant height (68.03 cm), number of branch per plant(10.97),no. of leaf per plant (55.67), no. of flower and fruit (22.13 and 14.80) per plant (Table 1), leaf area (769.68 cm^2),dry weight of leaf per plant (5.42 gm), dry weight of stem (11.00 gm) per plant, dry weight of root per plant (0.92 gm), fresh weight of fruit per plant (205.27 gm) (Table 2) were always recorded in no salt treated soil at every growth stage and yield contributing characters. Where as the lowest values were found on all the mentioned parameters in salt treated soil @ 1.0 m mol NaCl. Regarding number of flowers and fruits, the effect were like that an increase in the level of soil salinity, were more decrease in the number of flowers and fruits. Karim *et al.,*(1990) noted that reduction in yield and yield contributing characters due to salinity.

Table 1. Effect of elevated soil salinity on growth characters of BINA tomato-3 at different growth stages

Salinity(%)	Plant height (cm)			Number of branch plant^{-1}			Number of Leaf plant^{-1}			Number of flower plant^{-1}			Number of fruit plant^{-1}		
	35DAT	49DAT	63DAT	35DAT	49DAT	63DAT	35DAT	49DAT	63DAT	35DAT	49DAT	63DAT	35DAT	49DAT	63DAT
00	40.58 a	59.97 a	68.03 a	3.13 a	8.07 a	10.97 a	2343 a	34.23 a	55.67 a	1.33 a	14.50 a	22.13 a	2.00 a	8.97 a	14.80 a
0.5	25.81 b	45.27 b	51.67b	1.23 b	2.80 b	3.40 b	12.57 b	18.10 b	31.97 b	0.60 b	4.83 b	10.17 b	0.87 b	2.33 b	2.87 b
1.0	8.77 c	8.37 c	12.73c	0.00 c	0.40 c	0.40 c	6.30 c	8.07 c	9.27 c	0.00 c	0.77 c	1.00 c	0.00 c	0.20 c	0.27 c
Sign.Level	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Effect of seedlings salinity on growth and yield components of BINA tomato-3															
Control	31.2a	49.1a	60.5a	2.3a	5.7a	7.2a	19.2a	23.6a	40.0a	0.81a	9.1a	14.6a	1.8a	6.2a	8.8a
25	26.3c	47.2b	57.2b	2.0b	4.8b	5.9b	16.2b	25.4b	35.8b	0.91b	8.2b	13.8b	1.0b	4.2b	6.7b
50	25.1b	37.5c	45.3c	1.7c	4.0c	5.6c	15.0c	18.6c	33.4c	0..82c	6.2c	13.4c	0.9c	3.6c	5.9c
75	22.1d	30.2d	35.6d	0.5d	3.8d	4.2d	11.2d	16.3d	32.2d	0.93d	5.8d	8.3d	0.7d	3.2d	4.6d
100	18.2e	31.5e	39.3e	0.6e	1.5e	2.9e	9.3e	13.8e	25.4e	0.95e	3.5e	9.2e	0.6e	2.6e	4.8e
Sig. Level	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CV%	7.82	11.68	8.48	26.58	17.15	14.85	10.54	14.34	11.29	14.50	10.48	6.44	28.09	24.62	9.00

Common letter (s) within the column do not differ significantly at 1% level by DMRT

Table 2. Effect of elevated soil salinity on yield components of BINA tomato-3

Seeding salinity levels (m mol)	Leaf area Plant^{-1} (cm^2) 71 DAT	Leaf dry wt. plant^{-1} (gm) 75 DAT	Stem day wt. plant^{-1} (gm) 75 DAT	Root day wt. plant^{-1} (gm) 75 DAT	Fruit fresh wt. plant^{-1} (gm) 75 DAT	Level of salinity plant^{-1} soil (mS/cm)
00	769.68 a	5.42 a	11.00 a	0.92 a	205.27 a	2.39 c
0.5	481.37 b	3.14 b	5.70 b	0.52 b	112.37 b	10.35 b
1.0	112.43 c	0.55 c	0.96 c	0.06 c	47.75 c	24.91 a
Level of Sign.	0.01	0.01	0.01	0.01	0.01	0.01
CV%	6.39	21.04	17.09	30.10	12.16	8.02

Common letter (s) within the column do not differ significantly at 1% level by DMRT

Table 3. Seedling treatment in different salinity levels on yield components of BINA tomato-3

Seedling salinity levels (m mol)	Leaf area Plant^{-1} (cm^2) 71 DAT	Leaf dry weight plant^{-1} (gm) 75 DAT	Stem day weight plant^{-1} (gm) 75 DAT	Root day weight plant^{-1} (gm) 75 DAT	Fruit fresh weight plant^{-1} (gm) 75 DAT	Level of salinity plant^{-1} soil (mS/cm)
00	765.92 a	3.76 a	6.92 a	0.62 a	221.81 a	11.73 c
25	724.35 b	3.61 a	7.35 a	0.48 ab	175.88 b	11.95 bc
50	397.45 c	2.78 b	6.67 a	0.62 a	109.58 c	12.31 bc
75	198.97 d	2.10 c	4.88 b	0.47 b	52.46 d	12.80 b
100	185.77 d	2.91 d	3.62 c	0.33 c	49.36 d	13.94 a
Level of Sign.	0.01	NS	NS	0.01	0.01	0.01
CV%	6.39	21.04	17.09	30.10	12.16	8.03

Common letter (s) within the column do not differ significantly at 1% level by DMRT

Effect of seedlings treatment: Effect of salt application on seedlings was also found to be significant on all the mentioned parameters. The height of the plants, number of branch per plant, no. of leaf per plant, no of flower and fruit per plant were measured at an interval of 14 days from 35 DAT to 63 DAT and leaf area at 71 DAT as well as dry weight of leaf per plant, dry weight of stem per plant, dry weight of root per plant, fresh weight of fruit per plant from 75 DAT. The highest plant height (68.03 cm),number of branch per plant(10.97), no. of leaf per plant (55.67) no. of flower and fruit (14.6 and 8.8) per plant (Table 1), leaf area (769.68 cm^2),dry weight of leaf per plant (5.42 gm),dry weight of stem (11.00 gm) per plant, dry weight of root per plant (0.92 gm),number of fruit (14.80), fresh weight of fruit per plant (205.27 gm) (Table 3) were always recorded in no salt treated soil at every growth stage as well as lowest values were also found on all the mentioned parameters in 100 mmol NaC1 seedlings treatment. A trend in gradual decrease in all the mentioned parameters were also found with increasing levels of salt application. However, all the parameters were not affected by 25 mmol of salinity treatment. But a drastic reduction was observed in the salt treatments of 75 and 100 mmol NaC1. A trend in gradual decrease in fruit number was found with increasing salt applications with the exception that at 63 DAT most equal number of fruit plant^{-1} but less that the lower salinity level (50 mmol NaC1) was obtained by both 75 and 100 mmol NaC1. A trend in gradual decrease in fruit fresh weight was found with increasing salt applications from 25 to 100 mmol NaC1 (Table 3). In tomato, the value of yield and yield contributing characters decreases were found with increasing salinity (Flowers *et al.,* 2007 and Dalton *et al*., 2009)

Interaction effect on plant height: Interaction effect of seedling treatment with soil treatment on plant height number of branch per plant, no. of leaf per plant, no of flower and fruit per plant, dry weight of leaf per plant, dry weight of stem per plant, dry weight of root per plant, number of fruit, fresh weight of fruit per plant are presented in Table 3. In all cases the highest values were observed in no salt treated plant and values were gradually decreased with the increase of salt concentration both in soil and seedling treatment. Exceptionally there was a slight increase in plant height during the whole growth period (35 to 63 DAT) by the plants treated with 25 mmol at seedling stage as unpaired to no salt treated plants. The effect of salinity injury at seedling stage beyond the level of 50 mmol NaC1 was so prominent that the plants could not survive after 35 DAT (Table 4).

Table 4. Mean interaction effects of seedling salinity and elevated soil salinity on growth and yield components of BINA tomato-3

Seedling salinity levels (m mol)	Soil salinity (%)	Plant height (cm)			Number of branch $plant^{-1}$			Number of Leaf $plant^{-1}$			Number of flower $plant^{-1}$			Number of fruit $plant^{-1}$		
		35 DAT	49 DAT	63 DAT	35 DAT	49 DAT	63 DAT	35 DAT	49 DAT	63 DAT	35 DAT	49 DAT	63 DAT	35 DAT	49 DAT	63 DAT
00	00	44.92a	66.84a	74.17ab	5.50a	9.83b	12.83ab	37.50a	39.83b	60.50ab	1.83a	21.67a	29.00a	3.50a	11.50a	17.50b
	0.5	33.80c	59.17b	70.83bc	1.50cd	6.50c	7.83d	11.00de	19.67de	32.00cde	0.00c	5.50f	11.83e	1.50cd	5.50d	6.33e
	1.0	1.33h	14.00ef	31.33g	0.00e	1.00ef	1.00gh	6.83g	12.17f	26.50e	0.00c	2.00h	0.00j	0.00g	1.00efg	1.33g
25	00	45.75a	71.00a	76.83a	5.33a	10.00b	12.17b	26.50d	54.67a	56.83b	1.00b	18.67b	23.33b	2.17b	9.32b	15.33b
	0.5	32.1cd	47.33c	53.67d	1.00d	2.50d	3.67f	17.00c	18.00d	28.50de	1.00b	7.00e	15.00d	1.17de	2.33e	3.67f
	1.0	10.17hi	21.17e	32.33fg	0.00e	1.00ef	1.00gh	6.00g	12.00g	19.83f	0.00c	1.83h	3.67h	0.00g	0.00g	0.00h
50	00	43.75a	59.00b	66.00c	2.67b	11.17a	13.83a	25.67b	18.33cd	64.83a	1.83a	15.50c	19.83c	1.67c	8.67bc	14.67b
	0.5	24.67e	49.33c	5367d	1.67c	1.33e	2.67f	13.33d	22.50c	31.00cde	0.00c	4.00g	12.83e	1.00ef	1.83ef	3.00f
	1.0	9.50hi	0.00g	0.00h	0.00e	0.00f	0.00h	7.50fg	13.17ef	0.00g	0.00c	0.00i	1.33i	0.00g	0.00g	0.00h
75	00	39.00b	45.17c	56.67d	1.00d	9.33b	9.50c	15.83c	40.33b	61.83ab	1.00b	12.17d	19.50c	1.67c	8.17bc	13.83
	0.5	22.00f	37.50d	42.17e	1.00d	2.50d	1.50g	12.00d	17.67d	33.00cd	1.00b	4.17g	5.00g	0.00g	1.33efg	0.00h
	1.0	6.33j	6.67fg	0.00h	0.00e	0.00f	0.00h	5.17g	0.00g	0.00g	0.00c	0.00i	0.00j	0.00g	0.00g	0.00h
100	00	29.50g	57.83d	66.50c	1.17cd	0.00f	6.50e	11.67de	18.00d	34.33cd	1.00b	4.50fg	19.00c	1.00ef	7.17c	12.67
	0.5	16.50g	33.00d	38.00ef	1.00d	1.67e	1.33g	9.50ef	15.67def	35.33c	1.00b	3.50g	6.17f	0.67f	0.67fg	1.33g
	1.0	7.50ij	0.00g	0.00h	0.00e	0.00f	0.00h	6.00g	0.00g	0.00g	0.00c	0.00i	0.00j	0.00g	0.00g	0.00h
level of sign.		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CV%		6.81	12.78	8.48	26.58	17.15	14.85	10.54	14.34	11.29	14.50	10.48	6.44	28.09	24.62	9.00

Contd.

Seedling salinity levels (m mol)	Soil salinity (%)	Leaf area $plant^{-1}$ (cm^2)	Leaf day weight $plant^{-1}$ (gm)	Stem day weight $plant^{-1}$ (gm)	Root day weight $plant^{-1}$ (gm)	Fruit fresh weight $plant^{-1}$ (gm)	Level of salinity $plant^{-1}$ soil (mS/cm)
		71 DAT	75 DAT	75 DAT	75 DAT	75 DAT	
00	00	1220.79 a	5.94 a	10.36 b	0.95 b	313.55 a	1.87 e
	0.5	773.45 b	3.87 b	8.05 c	0.64 cd	216.55 c	9.41 d
	1.0	303.53 ef	1.48 d	2.37 e	0.26 ef	135.33 d	23.90 b
25	00	1191.27 a	5.96 a	11.85 b	0.87 bc	300.44 a	1.91 e
	0.5	723.15 c	3.61 bc	7.77 c	0.51 d	123.77 de	9.85 d
	1.0	258.64 f	1.26 b	2.44 e	0.07 fg	103.42 ef	24.11 b
50	00	810.05 b	2.67 a	15.28 a	1.31 a	245.03 b	2.04 e
	0.5	382.29 d	2.68 c	4.72 d	0.55 d	83.71 fg	9.95 b
	1.0	0.00 g	0.00 e	0.00 f	0.00 g	0.00 h	24.95 ab
75	00	326.31 e	3.37 bc	1.33 b	0.90 b	86.04 ft	2.73 e
	0.5	270.60 f	2.94 bc	4.31 d	0.52 d	71.34 g	10.30 b
	1.0	0.01 g	0.00 e	0.00 f	0.00 g	0.00 h	25.38 ab
100	00	299.97 ef	6.15 a	7.18 c	0.59 d	81.30 ft	3.38 e
	0.5	257.34 f	2.60 c	3.67 de	0.40 de	66.48 g	12.23 c
	1.0	0.00g	0.00 e	0.00 f	0.00 g	0.00 h	26.20 a
Level of Significance		0.01	0.01	0.01	0.01	0.01	0.01
CV%		6.39	21.04	17.09	30.10	12.16	8.03

The highest Branch number was observed in no salt treated plant. Branch number per plant was gradually decreased with the increase of salt concentration both in soil and seedling treatment. The seedling treated with no salt (control) could not produce any branch till 35 DAT at 1% soil salinity but they could produce only one branch (least) at 49 DAT and 63 DAT. The seedling treated with 25 mmol NaC1 also produced only one branch $plant^{-1}$ at 49 and 63 DAT. The seedling treated with 50 mmol NaC1 and above could not be able to develop branch at 1% soil salinity. Leaf number was generally decreased with the increase of salt concentration both in soil and seedling treatment. The injury shock of salinity treatment of 50 mmol NaC1 at seedling stage was so great that the leaves become completely disappeared at 1% soil salinity at 63 DAT. In case of 75 mmol and 100 mmol seedling treatment, similar kind of disappearance of leaves occurred earlier at 1% soil salinity (49 DAT) (Table 4).

Flower number was gradually decreased with the increase of salt concentration both in soil and seedling treatment. The seedling received no salt treatment resulted in no flower development on 35 DAT at both 0.5% and 1% soil salinity but there was found a positive effect of seedling treatment with salinity on antigenic development of plants. The seedling treated with 25, 75 and 100 mmol NaC1 enhanced flowering and at 35 DAT in 0.5% soil salinity. At 1% soil salinity, the salinity limit was found toxic and they could not e able to produce any flowers. Fruit number was gradually decreased with the increase of salt concentration both in soil and seedling treatment. The seedlings having no salinity treatment on seedling condition resulted better fruitings $plant^{-1}$ at all level of salinity than the saline treat seedlings. The saline treated seedlings what ever by 25, 50, 75 or 100 mmol showed no fruitings ability at 1% soil salinity levels (Table 4).

Plant leaf area was gradually decreased with the increase of salt concentration both in seedling and soil treatment.

The interaction effect was that the control seedlings and the seedling treated with 25 mmol NaC1 behaved almost equally to the different soil salinity levels i.e., both type of seedling after transplantation in the post reduced statistically alike leaf area with increasing intensity of the soil salinity up to 1% soil salinity levels. The 50 mmol NaC1 treated seedlings reduced much less area at both control and saline soil condition as compared to control and 25 mmol NaC1 treated seedlings. The injury effect on seedling by 75 and above mmol NaC1 was found so great the they could produce least leaf area (299.97-326.31 cm^2) at control and (257.34-270.60 cm^2) at 0.5% soil salinity level(Table 4). There was not found any leaf area development at 1% level soil salinity by both higher saline treated seedlings (75 and 100 mmol NaC1).

Leaf dry weight was generally decreased with the increase of salt concentration both in seedling and soil treatment. The highest leaf dry weight was 1220.79 gm for seedling control treatment. The lowest leaf dry weight was 257.34 gm at 100 mmol NaC1 and at 0.5 soil salinity level. Stem dry weight was generally decreased with the increase of salt concentration both in seedling and soil treatment. The 50 mmol NaC1 treated seedlings reduced much less stem dry weight at both control and saline soil condition as compared to control and 25 mmol NaC1 treated seedling. The highest root dry weight was gradually decreased with increased of salt concentration both in seedling and soil treatment.

Plant height, number of leaves and number of branches per plant decreased significantly with increasing salinity levels. Leaf area, leaf dry weight, stem dry weight and root dry weight were also significantly decreased with the increasing salt levels. At 100 m mol and 1% salinity level the plants failed to survive. As the salt level increased, flower per plant, fruit per plant and fresh fruit weigh per plant were decreased gradually. The salinity shock was found pronounced at 50 mmol and above level of NaC1 in BINA tomato-3 Seedling i.e., the salinity shock up to 25 mmol NaC1 at the seedling stage could be endured by BINA tomato-3 variety. This mutant variety could also endure salinity shocks at pot condition up to 0.5% soil salinity levels. At 1% soil salinity, this mutant variety did not show any tolerances to produce flowers, fruits consequently fresh fruits weight $plant^{-1}$.Salinity stress had inhibitory effect on seedling growth as well as on the rate of depletion of leaf, root and stem dry matter at the yield growth condition. The fresh fruit weight per plant illustrated were a significantly negative effect of salinity shock to seedlings on BINA tomato-3 but could eddure the shock up to 50 mmol NaCl treatment.This mutant variety also resulted the endurance of soil salinity level up to 0.5%.This tomato mutant variety circumstances BINA tomato -3 did not show its only under pot culture condition.

The salinity injury in both seedling stage and field condition in BINA tomato-3 was found prominent. This mutant variety could tolerate 25 mmol NaCl at seedlings stage and 0.05% soil salinity levels under field condition. At 1% soil salinity, this mutant variety did not show any tolerances to produce flowers, fruits, and consequently fresh fruits weight per plant. The lowest level of salinity per pot was recorded in no salt treated soil. But the highest level of salinity per pot soil was observed in salt treated soil @1%.From the overall observations it may be concluded that the BINA tomato -3 ,mutant variety showed well performances in saline conditions. So it may be a salinity tolerant variety.

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