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IDENTIFICATION OF TOMATO GENOTYPES FOR SALT TOLERANCE

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ABSTRACT

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A pot experiment was carried out to study the salt tolerance of eight tomato genotypes *viz*., J-5, Binatomato-5, BARI tomato-7, CLN-2026, CLN-2366, CLN-2413, CLN-2418 and CLN-2443 at Bangladesh Institute of Nuclear Agriculture during October 2006 to January 2007. Three levels of salinity *viz*., control, 6 and 10 dS/m were imposed at pre-flowering stage of tomato genotypes. Plant height, primary branches, flower cluster, fruit cluster, number of fruits and total fruit yield/plant, individual fruit weight, amino acid content in leaves gradually decreased while total sugar and reducing sugar content in leaves increased with the increase in salinity levels. BARI tomato-7, CLN-2026, CLN-2413, CLN-2418, CLN-2366 and CLN-2443 had shown better performance with salinity and identified to be better tolerant.

Key words: *salt tolerance, morphological, biochemical and yield attributes, tomato genotypes*

INTRODUCTION

Salinity is one of the major environmental stresses affecting plant growth and development (Ashraf and Wahed, 1993). The salinity damage manifests most prominently in the dry season when concentration of salts at the soil surface is caused by evaporation that ultimately causes a drastic reduction in crop yield. Agricultural land use in saline areas is very poor, which is much lower than the countries average cropping intensity (166 percent). For these reasons, plant response to salinity is one of the most widely researched subjects in plant physiology. The response to salinity is generally evaluated by using plant growth, ion balance and osmotic adjustment. A number of researchers (Sancheg-blanco *et al*. 1991; Alarcon *et al*. 1993) have studied the water relation and osmotic adjustment of different tomato genotypes under saline stress and showed that the growth of salt treated tomato plants is often limited by the inability of the root to extract water from soil and transport to shoot. Salinity affects plant growth by decreasing the rate of water uptake due to osmotic effect, through ion-specific toxic effects caused by ion antagonism (Levitt 1980). Agronomical practices like irrigation, drainage, mulching etc. are expensive involvement. So, the poor farmer cannot bear this expense. Scientific studies may be made to find out alternative means for salt tolerant varieties of tomato. So the research work was undertaken to assess the effect of salinity on different morpho-physiological attributes of tomato genotypes and to identify salt tolerant genotypes.

MATERIALS AND METHODS

A pot experiment was carried out under three levels of salinity *viz*, control, 6 and 10 dS/m with eight tomato genotypes *viz*., J-5, Binatomato-5, BARI tomato-7, CLN-2026, CLN-2366, CLN-2413, CLN-2418 and CLN-2443 at the pot yard of Bangladesh Institute of Nuclear Agriculture, during October 2006 to January 2007. A total of 72 PVC pots were prepared with 8 kg of soils. Seeds were sown on 5 September, 2006 and 29-day old seedlings were transplanted in the experimental pots in the afternoon of 3 October, 2006. The experiment was laid out in a randomized complete block design with three replications. Urea, TSP and MP of 1.066, 0.933 and 0.722 kg respectively were applied @ urea 400 kg/ha, TSP 350 kg/ha and MP 300 kg/ha and cowdung 12 ton/ha in each pot. Half the doses of urea, full dose of TSP and MP were mixed with the soil. Rest of urea was applied in the soils with two splits at branching and early flowering stages. Uniform care and intercultural operation were done. Salinity was created by adding different amount of NaCl in the soil following Michael (1978) and Ponnamperuma (1984). Chlorophyll content in leaves was determined by SPAD meter. Total sugar, reducing sugar and amino acids in leaves were estimated following Dubois *et al*. (1956), Somogyi (1952) and Yapinlee and Takahashi (1966). Observations were made on the morphological, biochemical and yield attributes of tomato plant. All collected data were statistically analyzed and the means were compared with Duncan's Multiple Range Test at 5% level of significance.

RESULTS AND DISCUSSION

Plant height and number of primary branches/plant decreased with both the salinity of 6 and 10 dS/m whereas number of flower cluster and fruit cluster/plant decreased with only 10 dS/m (Table 1). The genotype CLN-2366 produced the highest number of flower cluster and fruit cluster/plant under the salinity treatments. Interaction effect of salinity levels and tomato genotypes on plant height and number of primary branches/plant was significant (Table 2). Plant height and number f primary branches/plant were maximum in BARI tomato-7 in control. The results are in conformity with the results of Javed *et al*. (2002) who observed decreased plant height in tomato under salinity stress.

Number of fruits/plant and individual fruit weight decreased with only 10 dS/m whereas total fruit yield/plant decreased with both the salinity levels (Table 3). The genotypes BARI tomato-7, CLN-2026, CLN-2366, CLN-2413 and CLN-2443 produced higher fruit yield compared to other genotypes. Interaction effect of salinity levels and tomato genotypes on individual fruit weight was significant (Table 4). BARI tomato-7 and CLN-2413 showed maximum individual fruit weights in control. Decreased number of fruits and fruit weight with increasing salinity were reported by Singh *et al*. (1988) and Cho and Chung (1997), respectively.

Chlorophyll content in leaves (SPAD reading) was not significantly decreased with salinity levels, however, variation was found with 6 and 10 dS/m (Table 5). Total sugar and reducing sugar content in leaves increased and amino acid content decreased with both the salinity levels compared to control. Cuartero and Fernandez-Munoz (1999) showed that salinity enhanced tomato fruits taste by increasing total sugars. Interaction effect of salinity levels and tomato genotypes on chlorophyll, total sugar, reducing sugar and amino acid content in leaves was significant (Table-6).

Table 1. Morphological attributes of tomato genotypes under different salinity levels

Treatment	Plant height (cm)	No. of primary branches/plant	No. of flower cluster/plant	No. of fruit cluster/plant
Salinity levels (dS/m)				
Control	97a	5.3a	19.5a	12.1a
6	88b	4.1b	18.5a	11.0a
10	80c	3.5b	14.4b	7.7b
Genotypes				
J-15	79c	5.6ab	14.1c	7.1d
Binatomato-5	92b	4.0bc	14.1c	7.7cd
BARI tomato-7	104a	6.1a	16.4bc	10.6bc
CLN-2026	91b	2.8c	16.0bc	9.4cd
CLN-2366	83bc	5.7ab	25.4 a	15.5a
CLN-2413	84bc	4.7abc	17.8bc	9.7cd
CLN-2418	90b	3.4c	21.1ab	12.7ab
CLN-2443	83bc	2.6c	14.0c	9.5cd

Values having common letter(s) in a column do not differ significantly at 5% level by DMRT

Table 2. Interaction effects of salinity levels and tomato genotypes on morphological attributes

Genotypes × Salinity	Plant height (cm)	No. of primary branches/plant	No. of flower cluster/plant	No. of fruit cluster/plant
J-5 × Control	93bcd	7.0abc	14.6	9.6
J-5× 6 dS/m	72fg	5.6bcd	14.6	7.0
J-5 × 10 dS/m	72fg	7.3b-e	13.0	4.6
Binatomato-5 × Control	102ab	4.3 b-e	18.6	10.0
Binatomato-5 × 6 dS/m	92bcd	4.3 b-e	16.3	8.3
Binatomato-5 × 10 dS/m	83b-g	3.3de	7.3	5.0
BARI tomato-7 × Control	114a	9.0a	20.0	13.0
BARI tomato-7 × 6 dS/m	102ab	4.0cde	11.6	8.3
BARI tomato-7 × 10 dS/m	97abc	5.3b-e	17.6	10.6
CLN-2026× Control	92bcd	4.0cde	20.3	11.3
CLN-2026 ×6 dS/m	91b-f	2.6de	15.6	10.3
CLN-2026 × 10 dS/m	91b-f	2.0e	12.0	6.6
CLN-2366 × Control	100ab	7.6ab	35.5	20.0
CLN-2366 ×6 dS/m	79c-g	5.3b-e	25.0	15.3
CLN-2366 × 10 dS/m	71g	4.3 b-e	16.0	11.3
CLN-2413 × Control	91b-e	4.3 b-e	18.0	9.3
CLN-2413 × 6 dS/m	89b-g	4.3 b-e	20.6	12.0
CLN-2413 ×10 dS/m	71g	4.3 b-e	15.0	8.0
CLN-2418 × Control	98abc	4.0cde	16.0	13.0
CLN-2413 × 6 dS/m	93bcd	3.6cde	27.3	16.3
CLN-2413 ×10 dS/m	79c-g	2.6de	20.0	9.0
CLN-2443 × Control	88b-g	2.6de	13.6	11.0
CLN-2443 × 6 dS/m	87b-g	3.3de	16.6	10.6
CLN-2443 ×10 dS/m	75d-g	2.0e	16.6	7.0

Values having common letter(s) in a column do not differ significantly at 5% level by DMRT

Table 3. Yield and yield attributes of tomato genotypes under different salinity levels

Treatment	No. of fruits/ plant	Total fruit yield/ plant	Individual fruit weight (g)
Salinity levels (dS/m)			
Control	15.2a	762a	50.5a
6	13.0a	556b	45.3a
10	4.5b	175c	16.8b
Genotypes			
J-15	3.0c	237c	30.8bc
Binatomato-5	10.2ab	359bc	30.7bc
BARI tomato-7	9.3ab	585ab	53.3b
CLN-2026	14.8a	1728a	44.2abc
CLN-2366	11.4a	456abc	26.5c
CLN-2413	12.1a	637ab	47.5bc
CLN-2418	10.3ab	412bc	27.6c
CLN-2443	14.2a	570ab	39.5abc

Values having common letter(s) in a column do not differ significantly at 5% level by DMRT

Table 4. Ineraction effects of salinity levels and tomato genotypes on yield attributes

Genotypes × Salinity	No. of fruits/ plant	Total fruit yield/ plant	Individual fruit weight (g)
J-5 × Control	9.0	396	41.0a-d
J-5× 6 dS/m	5.3	286	36.4a-e
J-5 × 10 dS/m	0.6	30	15.0def
Binatomato-5 × Control	17.3	660	37.4a-e
Binatomato-5 × 6 dS/m	13.0	413	51.1abc
Binatomato-5 × 10 dS/m	0.3	3	3.6ef
BARI tomato-7 × Control	9.0	618	68.7a
BARI tomato-7 × 6 dS/m	10.3	696	62.8ab
BARI tomato-7 × 10 dS/m	8.6	440	28.3b-f
CLN-2026× Control	16.0	884	55.6abc
CLN-2026 ×6 dS/m	14.0	759	52.3abc
CLN-2026 × 10 dS/m	14.6	541	24.8e-f
CLN-2366 × Control	20.3	875	42.0a-d
CLN-2366 ×6 dS/m	14.0	494	37.6a-e
CLN-2366 × 10 dS/m	0.0	0	0.0f
CLN-2413 × Control	19.3	1542	64.9a
CLN-2413 × 6 dS/m	13.6	578	48.4a-d
CLN-2413 ×10 dS/m	3.3	90	29.2b-f
CLN-2418 × Control	16.0	736	48.4a-d
CLN-2413 × 6 dS/m	15.0	501	34.3a-e
CLN-2413 ×10 dS/m	0.0	0	0.0f
CLN-2443 × Control	15.0	586	46.0a-d
CLN-2443 × 6 dS/m	19.3	726	39.0a-d
CLN-2443 ×10 dS/m	8.3	299	33.6a-f

Values having common letter(s) in a column do not differ significantly at 5% level by DMRT

Table 5. Biochemical attributes of tomato genotypes under different salinity levels

Treatment	SPAD reading chlorophyll content in leaves	Total sugar contents in leaves (mg/gfw)	Reducing sugar contents in leaves (mg/gfw)	Amino acid contents in leaves (mg/gfw)
Salinity levels (dS/m)	45.2ab	129b	15.7c	17.6a
Control	46.6a	138a	18.7b	14.4b
6	43.2b	141a	21.1a	12.6c
10				
Genotypes				
J-15	38.7c	147a	18.4bc	12.3c
Binatomato-5	38.2c	134bcd	21.2a	13.8bc
BARI tomato-7	49.0a	131cd	19.1b	16.3ab
CLN-2026	47.1ab	117e	15.5d	14.3bc
CLN-2366	43.5b	142abc	19.8ab	14.7bc
CLN-2413	48.7a	144ab	19.4ab	14.9bc
CLN-2418	46.6ab	128de	18.2bc	18.7a
CLN-2443	48.1ab	144ab	16.4cd	13.8bc

Values having common letter(s) in a column do not differ significantly at 5% level by DMRT

Table 6. Interaction effects of salinity levels and tomato genotypes on biochemical attributes

Genotypes × Salinity	SPAD reading chlorophyll content in leaves	Total sugar contents in leaves (mg/gfw)	Reducing sugar contents in leaves (mg/gfw)	Amino acid contents in leaves (mg/gfw)
J-5 × Control	35.8ef	133b-f	14.9ghi	13.6c-f
J-5× 6 dS/m	43.1a-e	162a	18.4c-g	12.1efg
J-5 × 10 dS/m	37.2def	147abc	21.8a-d	11.2g
Binatomato-5 × Control	44.9a-e	131b-f	18.1a-h	16.4b-g
Binatomato-5 × 6 dS/m	40.5b-e	135b-f	22.2ab	13.1c-g
Binatomato-5 × 10 dS/m	29.2f	136b-f	23.2a	12.0efg
BARI tomato-7 × Control	51.3a	123 b-f	16.7f-i	21.5ab
BARI tomato-7 × 6 dS/m	48.7abc	127 b-f	19.0b-f	15.3c-g
BARI tomato-7 × 10 dS/m	47.2abc	142a-d	21.5a-d	12.2efg
CLN-2026× Control	46.7abc	113c	13.0i	17.3a-e
CLN-2026 ×6 dS/m	45.2a-d	118def	15.9f-i	13.2c-g
CLN-2026 × 10 dS/m	49.6ab	120def	17.7e-h	12.4efg
CLN-2366 × Control	48.4abc	135b-f	17.7e-h	17.1a-f
CLN-2366 ×6 dS/m	42.2a-e	143a-d	19.6a-f	14.3c-g
CLN-2366 × 10 dS/m	40.0cde	148ab	21.9abc	12.6d-g
CLN-2413 × Control	47.1abc	139a-e	16.6f-i	18.1a-d
CLN-2413 × 6 dS/m	50.9a	147abc	19.4b-f	15.0c-g
CLN-2413 ×10 dS/m	48.2abc	147ab	22.2abc	11.6fg
CLN-2418 × Control	43.5abc	112f	14.6hi	22.1a
CLN-2413 × 6 dS/m	51.1a	132b-f	18.6b-g	18.4abc
CLN-2413 ×10 dS/m	45.3a-d	140a-e	21.4a-e	15.6c-g
CLN-2443 × Control	44.2a-e	142a-d	14.0i	14.9c-g
CLN-2443 × 6 dS/m	51.3a	144a-d	16.5f-i	13.5c-g
CLN-2443 ×10 dS/m	48.8abc	146abc	18.9b-f	12.8d-g

Values having common letter(s) in a column do not differ significantly at 5% level by DMRT

CONCLUSION

Salinity of 6 and 10 dS/m imposed at pre-flowering stage of tomato genotypes decreased plant height, primary branches, flower cluster, fruit cluster, number of fruits and total fruit yield/plant, individual fruit weight and amino acid content in leaves and increased total sugar and reducing sugar content in leaves. BARI tomato-7, CLN-2026, CLN-2418, CLN-2366 and CLN-2443 had shown better performance with salinity and identified to be better tolerant.

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