

Evaluation of different tomato (*Lycopersicon esculentum* Mill.) lines for drought tolerance

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ABSTRACT

A trial to evaluate drought tolerance lines in tomato revealed that maximum plant height (98 cm), more number of primary branches (9), more number of flowering clusters (31.81), maximum number of fruits per plant (54.01), highest total yield per plant (2.499 kg), minimum RWC (45.09 %) and maximum WSD (54.91 %), minimum chlorophyll content (1.01 mg/g), minimum soil moisture (24.31 %), maximum root length (49.03 cm) was recorded in Selection-14. Hence, selection-14 is superior than remaining selections and checks in respect of drought tolerance and yield also. This variety is suitable under rainfed conditions.

Key words : Drought, Determinate, Indeterminate, Lines, Tomato

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is the most important vegetable grown world wide under field and controlled condition. It is adaptable to wide range of growing condition. In India it is grown over almost all parts of the country. Under Maharashtra condition, particularly Marathwada the main season of tomato cultivation is *Rabi*. Now a days tomatoes are seen in the market throughout the year due to cultivation under controlled climatic condition. Cultivated tomatoes is said to be native of tropical America.

From tropical America it spread to other parts of the world in 16th century and became popular in India within the last six decades. Tomato plants are herbaceous annual and sexually propagated. Growth habit both determinate and indeterminate and branching pattern is sympodial. Tomato fruits can be utilized in many ways. It is cooked as vegetable alone or mixed with potato and brinjal. It is popular in fresh form as Salad and also in the processed form as juice, puree ketchups, pickles and many other products. Tomato requires frequent irrigation but in certain areas where derth of irrigation water occurs and under such condition drought tolerant varieties are the best alternatives. Therefore, the present investigation was carried out to evaluate drought tolerant lines in tomato.

MATERIALS AND METHODS

A field trial was carried out at Research Farm of Department of Horticulture, Marathwada Agricultural University, Parbhani. The experiment was laid out in Randomized Block Design with nine treatments and three replications. Thirty days old healthy seedlings were transplanted on one side of ridge at spacing of 60 cm x

60 cm. The fertilizers nitrogen, phosphorus and potash were applied @ 100:50:50 kg/ha in the form of urea, single super phosphate and muriate of potash, respectively. Nitrogen was applied in two doses. Half of nitrogen and full dose of P₂O₅ and K₂O were applied one day before transplanting. Remaining half dose of nitrogen was applied one month after transplanting. The treatment details are as follows.

Sr. No.	Symbols	Treatments
1.	T ₁	Selection-1
2.	T ₂	Selection-4
3.	T ₃	Selection-5
4.	T ₄	Selection-7
5.	T ₅	Selesction-12
6.	T ₆	Selection-13
7.	T ₇	Selection-14
8.	T ₈	Devgiri (check)
9.	T ₉	Pusa Ruby (check)

RESULTS AND DISCUSSION

Data presented in Table 1 revealed that significantly maximum height (98 cm) was produced by Selection-14 than rest of all selections and varieties, however, it was at par with Selection-13, Selection-7 and check Devgiri. At 105 DAT, Selection-14 produced significantly more number of primary branches per plant (9) than check Devgiri and Pusa Ruby. Prasad and Singh (1990) observed that the variety Pusa Ruby produced more number of primary branches per plant (14.80), whereas, Punjab Chhuhara produced significantly less number of primary branches (11.61).

Satyanarayan and Reddy (1986) reported more number of primary branches in variety Sioux (23.8)

followed by Pusa Ruby (19.90).

It was noticed that Selection-14 produced significantly more number of flowering clusters per plant (31.81) than check Devgiri, Pusa Ruby and rest of all selections, however, it was at par with Selection-13. The results observed in the present findings are in agreement with the results obtained by Rana and Kalloo (1989). They reported the highest number of flowering clusters per plant in drought tolerant varieties of tomato (Selection-28, Rin and EC 130042) as compared to less tolerant lines (KS 43, KS 54, KS 35 and Selection-5).

Among the various treatments, T₇ (Selection-14) produced maximum number of fruits per plant (54.01) followed by Selection-4. Minimum number of fruits per plant was observed in check Devgiri (32.3) followed by Pusa Ruby (52.02). The differences in number of fruits per plant are obvious since the genetic make up of the selections is different. The yield of plant is directly related with height and number of primary branches. In the present investigation, significantly more height and primary branches were observed in Selection-14. Therefore, Selection-14 recorded highest yield. Prasad and Singh (1990) reported highest number of fruits per plant in Punjab Chuhara followed by H.S. 101.

The observations recorded in respect of total yield per plant clearly indicated (Table 1) that Selection-14 produced significantly highest total yield per plant (2.499 kg) followed by Selection-4 (2.356 kg) and Pusa Ruby (2.253 kg). The significantly lowest total yield per plant was recorded in Selection-5 (1.616) followed by Selection-12 (1.756). Yield differences in various selections are obvious on account of differences in parents used in developing these selections. Babu (1980) observed yield differences in the accession LE 573, LE 763 and PKM 1 under moisture stress condition are in agreement with the present findings.

Selection-14 showed minimum RWC (45.09 %) and maximum WSD (54.91 %) which was at par with Selection-13, whereas the highest RWC and lowest WSD was found in Selection-12 (69.24 and 30.76 %). The decrease in RWC may be due to lower moisture availability in soil. Lower RWC is the indication for drought tolerance capacity of the selection. Thakur (1991) studied effect of water stress on RWC in tomato and found that RWC declined with increased stress duration. He reported minimum RWC in Yeshwant A2 (44 %).

Data recorded in respect of chlorophyll content in the leaves revealed that minimum chlorophyll content was found in Selection-14 (1.01 mg/g) which was lower than check Devgiri, Pusa Ruby and significantly remaining all selections, however, it was at par with Selection-13.

Table 1 : Evaluation of tomato lines for drought tolerance

Sr. No.	Treatments	Plant height (cm) at 10 ⁵ DAT	Number of primary branches at 10 ⁵ DAT	Number of flowering cluster per plant	Number of fruits per plant	Total yield per plant (kg)	RWC (%)	WSD (%)	Chlorophyll content (mg/g)	Soil moisture (%)	Root length (cm)
1.	T ₁ -Selection-1	79.10	7.98	24.24	43.67	1.899	56.28	43.75	1.15	37.66	37.01
2.	T ₂ -Selection-4	82.43	8.10	23.96	53.65	2.356	63.63	36.37	1.25	35.92	35.42
3.	T ₃ -Selection-5	85.50	7.51	22.55	35.30	1.616	64.28	35.72	1.19	39.32	40.05
4.	T ₄ -Selection-7	89.51	7.85	28.78	52.00	1.963	66.03	33.97	1.28	42.45	39.61
5.	T ₅ -Selection-12	77.33	7.60	18.70	50.00	1.756	69.24	30.76	1.38	53.33	36.80
6.	T ₆ -Selection-13	97.16	8.95	30.85	48.65	1.862	50.02	49.98	1.07	25.03	45.98
7.	T ₇ -Selection-14	98.00	9.00	31.81	54.01	2.499	45.09	54.91	1.01	24.31	45.03
8.	T ₈ -Devgiri (c)	90.50	8.79	25.45	32.31	1.812	54.99	45.01	1.14	35.13	41.06
9.	T ₉ -Pusa Ruby(c)	94.30	8.90	24.74	52.02	2.253	58.35	41.65	1.29	44.92	38.12
	S.E. ±	0.58	0.10	1.74	2.02	0.081	1.39	0.959	0.025	3.63	2.13
	C.D. (P=0.05)	1.76	0.30	5.22	6.07	0.244	4.16	2.87	0.076	10.89	6.38

WSD = Water saturation deficit

RWC = Relative water content

(c) = Check

DAT = Days after transplanting

Maximum amount of chlorophyll content was found in Selection-12 (1.38 mg/g). Decrease in the chlorophyll content may be due to enzymatic activities affected by moisture stress. Anchanam (1984) reported the stress tolerance superiority of tomato cv. LE 573 than cvs. CO 1, CO 2 by recording the lowest chlorophyll content in cv. LE 573.

It was found that significantly minimum soil moisture was noticed by Selection-14 (24.31 %) and was at par with Selection-13, check Devgiri and was significantly lower than check Pusa Ruby and rest of all selections. Highest per cent of available soil moisture was noticed in Selection-12 (53.33 %). Minimum availability of soil moisture indicates maximum capacity of Selection-14 of utilizing available soil moisture around root zone. This proves the capacity of variety to face better for drought / moisture stress condition.

Rao and Padama (1991) reported that the variety Marutham and Arkavikas recorded the highest yield at low soil moisture, indicating that they are stress tolerance.

From Table 1 it is clear that Selection-14 produced significantly maximum root length (49.03 cm) followed by Selection-13 (45.98 cm) and check Devgiri (41.06 cm), whereas minimum length of root was found in Selection-4 (35.42 cm). Maximum root length in Selection-14 indicated that the variety had maximum capacity to uptake water from deeper soil layer. This proves drought resistant character of the variety.

This is in accordance with the findings of Rana and Kalloo (1989) who reported the maximum root length in the drought tolerant tomato lines viz., Selection-28, Rin, *L. cheesmanii* and EC 130042 as compared to drought susceptible lines (KS 43, KS 54 and KS 35).

Jain *et al.* (1995) studied twelve different irrigation treatments on a summer tomato cultivar Pant Vihar and observed that the plant receiving the lowest number of irrigations, developed vigour and maximum root length.

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