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Performance of Tomato (*Solanum lycopersicon*) Hybrids for Different Horticultural Traits under High Altitude Cold Desert of Leh-Ladakh

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Abstract

A study was undertaken during 2005 in Field Research Laboratory at Leh sector of Ladakh region during April to September (summer season) to evaluate the performance of 16 (F_1 S) of tomato for yield, yield contributing and quality traits. The results revealed that carliness (26.00 days) in hybrid Hawii × 7611-4 and BT18 × 7611-8 (26.5 days), while each hybrid BT18 × 7611-6 and BT18 × 7611-7 took (32.33 days) for days to 50% flowering. It varied from 26.00 to 33.00 days. Marketable yield varied from 827.67 to 1,277.70 g. Average fruit varied from 36.75 g (Hawii × 7611-3) to 68.91 g (BT18 × 7611-2). Days to first harvest varied from 63.33 g (BT18 × 7611-8) to 68.00 (7721 × Hawaii-3). It also revealed that hybrids BT18 × 7611-8 (1390.69 g), Hawii 7611-4 (1385.56 g) and Hawii × 7611-5 (1376.56 g) exhibited higher yield/plant along with higher marketable yield/ plant. On the basis of quality parameters (total soluble solids and pericarp thickness), hybrids BT18 × 7611-7 and Hawii × 7611-1 were screened. These desirable heterotic combinations can further be exploited for commercial cultivation or can be used in various breeding programs.

Key words : Tomato, *Solanum lycopersicon,* Yield, Quality.

Tomato (*Solanum lycopersicon* formerly *Lycopersicon esculentum* Mill), a member of family Solanaceae is one of the most popular and widely grown vegetables in India. Its demand in Ladakh sector is high for the domestic consumption. But local materials grown by the farmers are of poor quality along with low yielding. Being a highly perishable vegetable and being not well connected by roads during winters and is available in winters in plains, transportation to this place is a major problem. Air transport is expensive to the tune of Rs 45/kg. The cropping season in this area is limited, i.e. during April to September with wide fluctuation in the diurnal temperature leading to poor growth, yield and quality. Therefore, there is an immediate need to develop high yielding hybrids which are well suited for cultivation to high altitude areas. Since there are no appropriate reports available on the suitability of hybrids for this region. Hence, the present study was carried out to evaluate the performance of 16 hybrids of tomato.

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Methods

The present investigation was undertaken at the experimental farm of Field Research Laboratory (FRL) Leh-Ladakh of Defence Research and Development Organization (DRDO) from April to September, 2005 for summer season crop. The investigation was carried out on 16 F_1 S of tomato. Seedlings were raised in the polythene covered trenches of appropriate size, mainly 38 × 38 × 33 cm^3 during April, 2005. The seedlings of 16 F_1 S were transplanted in randomized block design with three replications on 20 May, 2005. Each entry was accommodated in four rows (28 plants) spaced 75 cm apart with an intra-row spacing of 45 cm. Besides the application of farm yard manure (FYM) at 20 t/ha, the chemical fertilizers were applied based on the recommended package of practices (100 kg N, 75 kg P_2O_5 and 50 kg K_2O/ha). One third dose of N and full doses of P_2O_5 and K_2O were applied at the time of field preparations. Remaining two-third dose

Table 1. Performance of different tomato hybrids for morphological and yield traits.

Hybrids 1	Gross yield/plant (g) 2	Marketable yield/plant (g) 3	Days to 50% flowering 4	Days to Ist harvest 5	Locules/ fruit 6	Plant height (cm) 7	Duration of fruit harvest (days) 8	Total fruits/ plant 9	Marke-table fruits/ plant 10	Average fruit weight 11
BT-18×7611-1	995.16	827.17	31.67	67.00	4.20	95.97	42.33	16.67	13.33	62.10
BT-18×7611-2	1137.98	942.98	30.67	67.00	4.63	69.03	32.00	17.23	13.46	68.91
BT-18×7611-4	1298.42	1086.57	29.00	65.00	4.35	69.77	37.00	24.52	21.35	51.13
BT-18×7611-5	1246.15	1063.21	33.00	66.33	4.20	98.08	38.33	27.86	23.91	44.90
BT-18×7611-6	1230.58	1035.00	32.33	63.67	4.10	101.73	39.00	28.44	23.29	44.60
BT-18×7611-7	1201.52	1050.46	32.33	66.67	4.92	98.03	40.33	23.81	19.66	57.04
BT-18×7611-8	1390.69	1262.80	26.50	63.33	3.17	107.03	40.33	35.87	32.35	39.30
Hawii×7611-1	1376.56	1213.28	27.33	65.33	3.19	100.63	40.00	36.41	31.75	38.10
Hawii×7611-2	1349.55	1277.29	29.33	64.67	3.10	108.67	40.33	35.34	33.82	37.88
Hawii×7611-3	1306.31	1195.20	26.67	66.00	3.23	97.00	40.00	36.87	32.52	36.75
Hawii×7611-4	1385.56	1185.75	26.00	63.67	3.46	112.40	40.33	36.78	31.50	37.53
Hawii×7611-5	1264.35	1114.20	28.67	63.67	3.26	88.70	39.00	27.32	22.49	45.17
Hawii×7611-6	1353.55	1122.21	30.67	64.00	3.66	92.23	39.67	35.38	28.36	39.57
7721×Hawii-1	1334.04	1095.15	27.33	64.00	3.24	106.67	40.67	31.71	25.55	43.38
7721×Hawii-3	1123.13	1023.23	27.33	68.00	3.86	130.70	40.33	28.12	25.45	40.26
BRH-2 × Sun 7611	1039.35	898.60	26.67	65.00	3.76	88.22	40.67	24.91	20.19	44.50
SE ±	37.26	42.04	1.27	0.92	0.03	2.6	0.66	1.25	1.3	2.21
CV (%)	5.12	6.78	7.40	2.44	1.43	4.61	2.92	7.46	9.03	8.23
CD 5%	107.51	121.128	3.59	2.65	0.08	7.51	1.92	3.61	3.75	6.39
Range	995.16-1390.69	827.67-1277.70	26.00-33.00	63.33-68.00	3.10-4.92	69.03-130.70	32.00-42.33	16.67-36.87	13.33-33.82	36.75-68.91

of N was top dressed in equal amounts after 30 and 45 days of transplanting. The remaining intercultural operations were carried out in accordance with the recommended package of practices. Observation on the characters viz., plant survival (%), days to 50 per cent flowering, days to first harvest, gross yield/plant (g), total fruits/plant, marketable yield/plant (g), marketable fruits/plant, average fruit weight (g), fruit diameter (polar and equatorial), pericarp thickness (mm), locules/fruit, plant height (cm), duration of fruit harvest and total soluble solids (%) were recorded. For the characters viz., polar diameter and equatorial diameter, pericarp thickness, locules/fruit and total soluble solids, a random sample of 15 fruits per entry per replication was drawn from third/fourth picking. The data were statistically analyzed following methods given by Panse and Sukhatme (1).

Results and Discussion

The results revealed that tomato hybrids differed significantly for all the traits (Table 1). Days to 50% flowering exhibited significant differences among the different hybrids but BT18 × 7611-7 and BT18 × 7611-6 took maximum time (32.33 days, each) to emerge, while Hawii × 7611-7 took minimum (26.00 days). Plant height varied significantly and the tallest plants were observed in hybrid 7721 × Hawii-3 (130.70 cm) hybrid. The smallest plants were observed in hybrid BT18 × 7611-2 (69.03). Days to first harvest also showed significant variation, tomatoes were ready for picking after 63.33 days of sowing in BT18 × 7611-8 which were at par with Hawii × 7611-4, Hawii × 7611-5 revealed first harvest in 63.67 days. Similarly duration of tomato picking i.e. between first and last extended for 42.33 days in BT18 × 7611-1. Hybrid 7721 × Hawii-3 took maximum time for first picking (68.00) days and was at par with BT-18 × 7611-1 and BT18 × 7611-1, while only 32 days in BT18 × 7611-8. The variation in days to flowering and fruit per tomato picking may be attributed to the variation in heat units and degree-days required by the hybrids. The genotypic differences in relative pod and seed growth might also be responsible for variation in days to picking as also reported by Sharma (2). Hybrid Hawaii × 7611-3 gave maximum number of fruits per plant (36.87) which were

Table 2. Performance of different tomato hybrids for quality traits.

Hybrids	Plant survival (%)	Polar diameter (cm)	Equatorial diameter (cm)	Pericarp thickness (mm)	Total soluble solids (%)
BT-18 × 7611-1	90.23 (9.54)	3.70	4.66	7.60	6.07
BT-18 ×7611-2	85.14 (9.27)	4.55	4.84	7.25	6.14
BT-18 × 7611-4	92.57 (9.67)	3.64	3.74	7.46	6.20
BT-18 × 7611-5	88.00 (9.43)	4.17	3.66	7.67	4.57
BT-18 × 7611-6	83.66 (9.19)	4.31	3.85	7.29	5.20
BT-18 × 7611-7	86.90	4.30	3.85	8.74	6.13
BT-18 × 7611-8	86.43	3.82	3.74	7.25	6.21
Hawii × 7611-1	83.90	3.25	3.32	8.71	6.17
Hawii × 7611-2	82.86	3.24	3.44	7.15	6.00
Hawii × 7611-3	86.67	4.80	4.57	7.82	4.93
Hawii × 7611-4	76.90	4.75	4.82	6.79	4.23
Hawii × 7611-5	85.47	4.65	5.02	7.66	6.00
Hawii × 7611-6	83.09	4.51	3.72	7.69	5.00
7721 × Hawii-1	90.61	5.02	4.70	7.76	5.53
7721 × Hawii-3	85.21	5.06	3.61	7.94	4.57
BRH-2 × Sun 7611	89.42	4.89	4.76	7.65	5.93
SE ±	–	0.04	0.08	0.05	0.03
CV (%)	2.65	1.70	3.32	1.25	0.94
CD 5%	–	0.12	0.22	0.16	0.08
Range	76.90-92.57	3.24-5.06	3.32-5.02	6.79-8.74	4.23-6.21

at par with Hawii × 7611-4 and Hawii × 7611-1, while cross combination BT18 × 7611-2 (16.67) too revealed minimum number of fruits per plant.

Cross combination Hawii × 7611-2 (33.82) gave maximum marketable fruits per plant which were at par with Hawii × 7611-3 (32.55). Minimum number of marketable fruits per plant was observed in BT-18 × 7611-1 was at par with hybrid BT18 × 7611-2. Maximum average fruit weight was observed in hybrid BT18 × 7611-2 (68.91 g), while minimum in Hawii × 7611-3 (36.75 g) which were at par with Hawii × 7611-4 and Hawii × 7611-2. Hybrid BT-18 × 7611-8 exhibited maximum gross yield per plant which were at par with cross combinations Hawii × 7611-1, Hawii × 7611-2 and Hawii × 7611-4, while minimum gross yield per plant was exhibited by hybrid Hawii × 7611-1. Cross combination BT18 × 7611-7 (4.92) observed maximum locules / fruit followed by BT18 × 7611-2 (4.63) and BT18 × 7611-4, while minimum by hybrid Hawii × 7611-2 (3.10). Duration of fruit harvest varied from 32.00 to 42.33 days. Minimum fruit harvest was showed by hybrid BT18 × 7611-2 (32.00 days), while maximum by BT18 × 7611-2 (42.33 days). Total fruits/plant was maximum in hybrids Hawii × 7611-3 (36.78), Hawii × 7611-1 (36.41) and BT18 × 7611-8 (35.87). These hybrids also revealed high mean value for traits like gross yield/plant, marketable yield/plant marketable fruit/plant and average fruit weight. These findings are in accordance with the findings of earlier workers (3, 4). Minimum marketable fruits/plant was exhibited by cross combination BT18 × 7611-1 (16.87). High mean value for traits like marketable yield/plant, plant height, duration of fruit harvest, and moderate mean value for average fruit weight was indicated by cross Hawii × 7611-2. Similar results were also reported Kumar and Lal (4) and Sidhu and Singh (5).

The results revealed significant differences in polar diameter with maximum in 7721 × Hawii-3 (5.06) and was at par with Hawii × 7611-5 (5.02) but significantly superior over rest of hybrids (Table 2). The minimum polar diameter was observed in Hawii × 7611-2 (3.24) which was at par with Hawii × 7611-1 (3.25). Maximum equatorial diameter was observed in hybrid Hawii × 7611-5 (5.02) which was at par with BT18 × 7611-2 (4.84), BT18 × 7611-6 (3.89) and BT18 × 7611-7 (3.85).Minimum equatorial diameter was observed in Hawii × 7611-1 (3.32) which was at par with Hawii × 7611-2 (3.44). Pericarp thickness also revealed significant differences among the hybrids. Maximum pericarp thickness was revealed by hybrid BT18 × 7611-7

(8.74) which were at par with Hawii × 7611-1 (8.71) and 7721 × Hawii-3 (7.94). Minimum was showed by hybrid Hawii × 7611-4 (6.79). Plant survival varied from 76.90 to 92.57%. Maximum plant survival was observed in hybrid BT18 ×7611-4 (92.57) which were at par with BT18 × 7611-1 (90.23%) and 7721 × Hawii-1 (90.61%), while minimum was observed in Hawii × 7611-4 (76.90%). Maximum total soluble solids was observed in BT18 × 7611-8 (6.27%) which were at par with Hawii × 7611-1 (6.17%), BT18 × 7611-2 (6.14%), BT18 × 7611-4 (6.20) and BT18 × 7611-1 (6.07%), while minimum in Hawii × 7611-4 (4.23%) which was at par with Hawii × 7611-3 (4.13%). These results were also in conformity with the findings of earlier workers (6—9).

Therefore, based on present study hybrids BT18 × 7611-8 (1390.69 g), Hawii × 7611-4 (1385.56 g) and Hawii × 7611-5 (1376.56 g) exhibited earliness along with higher yield/plant and higher marketable yield/plant. With regard to quality, these hybrids did not show desirable high mean value for all the qualitative traits. For improving quality traits of tomato viz., total soluble solids and pericarp thickness, most promising hybrids screened were BT18 × 7611-7 and Hawii × 7611-1. These desirable heterotic combinations can further be exploited for commercial cultivation or can be used in various breeding programs.

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