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Evaluation of F_1 hybrids and their parents for growth, yield and quality in cherry tomato (*Solanum lycopersicum* var. *cerasiforme*)

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ABSTRACT

The present study was carried out to estimate the performance of F_1 hybrids and their parents for various yield and yield-attributing traits in cherry tomato, at Division of Vegetable Crops, Indian Institute of Horticultural Research (IIHR), Bengaluru, during the year 2010-11. Among the seven parents used, three parents, namely, IIHR-2866 (yielding 3.03kg/plant), IIHR-2864 (2.87kg/plant) and IIHR-2865 (2.73kg/plant) were found to be high-yielding. Among the 21 F_1 hybrids evaluated, three hybrids, namely, IIHR-2754 x IIHR-2860 (4.27kg/plant), followed by IIHR-2754 x IIHR-2865 (3.97kg/plant) and IIHR-2864 x IIHR-2865 (3.40kg/plant) recorded higher yield than the Check varieties, whereas, three hybrids, viz, IIHR-2754 x IIHR-2865 (54.38t/ha), succeeded by IIHR-2863 x IIHR-2866 (46.46t/ha) and IIHR-2858 x IIHR-2866 (44.79t/ha), recorded higher estimated yield per hectare than the Check varieties. Hybrid IIHR-2754 x IIHR-2860 was found promising for most of the traits studied. The best performing parents can be used for breeding further while, the hybrids can be exploited commercially.

Key words: Cherry tomato, high yield, hybrids, parents, breeding

INTRODUCTION

Cherry tomato (*Solanum lycopersicum* var. *Cerasiforme)* is a botanical variety of the cultivated tomato. It is thought to be the ancestor of all the cultivated tomatoes. It is marketed at a premium price compared to the regular tomatoes. Cherry tomatoes are widely cultivated in Central America and are distributed in California, Korea, Germany, Mexico and Florida. It is a warm-season crop, reasonably tolerant to heat and drought, and grows under a wide range of soil and climatic conditions (Anon, 2009a). Cherry tomato is grown for its edible fruits which are ideal for making processed products like sauce, soup, ketchup, puree, curry, paste, powder, *rasam* and sandwich. These also have good nutritional and antioxidant properties. The size of cherry tomatoes ranges from thumb-tip to the size of a golf ball, and, can range from being spherical to slightly oblong in shape (Anon, 2009b). Hybrid vigour in cherry tomato has not been exploited fully. Little attention has been paid by plant researchers on the performance for yield and yield-components in the hybrids of cherry tomato. Therefore, the present study was undertaken to evaluate the best-performing parents and their F_1 hybrids in cherry tomato.

MATERIAL AND METHODS

The present study was undertaken at Division of Vegetable Crops, ICAR-Indian Institute of Horticultural Research (IIHR), Hesarghatta, Bengaluru. The experimental field is located at an altitude of 890 meters above MSL, at $13^{0}38'$ N latitude and 78^{0}E longitude. The parents and the hybrids were evaluated during July 2011 - May 2012. The experimental material consisted of seven parents, viz, IIHR-2754 (P_1), IIHR-2858 (P_2), IIHR-2860 (P_3), IIHR-2863 (P_4), IIHR-2864 (P_5), IIHR-2865 (P_6) and IIHR-2866 (P_7), three Check varieties, viz, IIHR-2871 (C_1), IIHR-2876 (C_2) and Arka Ashish (C_3), and 21 F_1 hybrids developed through half-diallele mating design, during *Kharif* 2011. Spacing between plants was 60cm, while, between rows it was 45cm.

All the twenty one hybrids, along with their corresponding parents, were evaluated in Randomized Block Design in three replications, during the summer of 2012. Observations on five randomly-selected plants were recorded for various yield-attributing traits to estimate performance of the parents and hybrids.

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RESULTS AND DISCUSSION

Per se performance of parental lines, check varieties and hybrids (Table 1) and the three best-performing parents, and hybrids, for various growth, yield and quality parameters are presented in Table 2.

Genotypes differed significantly in plant height which ranged from 98cm (P_2) to 140cm (P_6) among parents (Table 1), from 57.67cm (C_3) to 131.33cm (C_1) among Check varieties, and from 89cm (P_2 xP_4) to 165.67cm (P_1 x P_6) among hybrids (Table 1). Number of primary branches per plant ranged from 3 (P_2 and P_3) to 3.67 (P_1 and P_5) among parents, from 3 (C_2) to 4.33 (C_3) among check varieties, and from 3 (P_1 x P_7) to 3.67 (P_1 x P_2) among hybrids (Table 1). Number of secondary branches ranged from 8 (P_5) to 11 (P_1) among parents, from 6 (C_2) to 9 (C_1) among check varieties, and from 6 (P_5 x P_6) to 11.33 (P_1 x P_5) among hybrids (Table 1). A higher number of branches may have resulted in production of more number of leaves and greater size of the leaf. Total number of leaves on a plant could perhaps decide the efficiency of photosynthesis, thereby resulting in better growth and yield. These results are in confirmity with Deepa and Thakur (2008) and Arun *et al* (2004).

A significant difference was seen in the number of inflorescences per plant, ranging from 35 (P_3) to 48 (P_1) among parents, from 25 (C_3) to 35.33 (C_1) among Check varieties, and from 37 (P_3 x P_5) to 63.33 (P_2 x P_3) among hybrids (Table 1). Parents used in the experiment differed

Table 1. Mean performance of parents, F_1 hybrids and Check varieties for growth, yield and quality traits in cherry tomato

Sl. No.	Parent/ F1 hybrid / Check variety	Plant height (cm)	No. of primary branches	No. of secondary branches	No. of inflore-scences	Average fruit weight (g)	No. of fruits/ kg	No. of fruits/ cluster	No. of fruits/ plant	Yield/ plant (kg)	Yield/ ha (t)	No. of locules/ fruit	Fruit firmness (kg/mm2)	Pericarp thickness (mm)
	Parent													
1	P1	130.67	3.67	11.00	48.00	10.36	96.67	10.33	498.67	2.20	21.46	2.33	4.40	2.20
2	P2	98.00	3.00	9.00	38.67	14.11	71.00	9.67	374.33	2.50	24.79	3.00	5.00	2.43
3	P3	115.67	3.00	9.33	35.00	14.66	68.33	9.33	326.33	2.20	27.92	2.33	4.20	3.87
4	P4	109.00	3.00	8.67	36.00	12.46	80.33	8.67	312.67	2.57	20.83	2.67	4.53	2.43
5	P5	131.00	3.67	8.00	38.33	31.05	32.33	7.00	269.33	2.87	33.33	2.33	7.20	4.80
6	P6	140.00	3.33	12.67	38.33	13.77	72.67	8.33	318.33	2.73	29.79	3.67	5.00	2.23
7	P7	127.67	3.33	9.67	38.00	13.41	74.67	8.33	316.00	3.03	30	2.33	4.57	4.03
F1 hybrid														
1	P_1 X P_2	117.33	3.67	9.33	44.33	12.83	78.00	9.33	416.67	3.20	38.96	2.67	4.60	2.40
2	P_1 X P_3	144.67	3.67	10.33	44.67	19.15	52.33	8.00	357.33	4.27	26.46	2.67	3.33	3.10
3	P_1 X P_4	154.00	3.67	8.67	56.33	16.68	60.00	7.33	414.67	2.70	32.92	2.00	8.20	3.13
4	P_1 X P_5	140.00	3.33	11.33	38.00	15.90	63.00	6.67	253.33	3.07	44.38	2.67	7.00	4.00
5	P_1 X P_6	165.67	3.33	9.33	42.33	16.59	60.33	8.33	352.00	3.97	40.63	2.67	6.00	3.20
6	P_1 X P_7	139.33	3.00	9.67	46.67	13.98	71.67	8.33	391.67	3.33	54.38	2.33	4.40	3.13
7	P_2 X P_3	115.67	3.00	9.33	63.33	15.41	65.00	9.00	570.00	3.27	32.5	2.00	5.00	3.17
8	P_2 X P_4	89.00	3.00	8.33	38.67	15.56	64.33	8.33	323.33	2.50	35.83	2.33	5.20	4.00
9	P_2 X P_5	149.33	3.33	7.67	40.33	20.02	50.00	6.33	256.00	3.37	39.17	2.00	7.20	6.00
10	P_2 X P_6	144.33	3.00	8.33	44.67	16.68	60.00	8.33	371.00	2.60	32.5	2.33	6.80	4.07
11	P_2 X P_7	149.00	3.00	8.00	42.67	18.10	55.33	8.33	357.33	3.03	44.79	2.33	7.17	4.20
12	P_3 X P_4	105.00	3.00	9.33	42.67	18.44	54.33	8.33	355.33	2.57	35.83	2.33	7.27	3.13
13	P_3 X P_5	141.67	3.67	7.67	37.00	23.68	42.33	6.00	222.00	3.03	42.71	2.33	9.53	5.00
14	P_3 X P_6	142.33	3.67	11.00	39.33	17.98	55.67	7.33	288.00	3.30	43.75	2.67	6.00	3.20
15	P_3 X P_7	152.00	3.00	8.67	38.00	15.32	65.33	7.00	266.67	2.93	36.25	2.33	7.80	4.10
16	P_4 X P_5	156.00	3.00	9.67	50.33	19.76	50.67	6.33	318.67	3.13	37.29	2.00	6.13	3.97
17	P_4 X P_6	148.67	3.00	7.67	45.00	16.68	60.00	8.00	360.00	3.20	36.88	2.67	4.80	3.20
18	P_4 X P_7	144.00	3.00	6.67	44.00	16.43	61.00	8.33	366.00	3.00	46.46	2.33	7.97	3.93
19	P_5 X P_6	127.67	3.00	6.00	40.33	15.24	65.67	6.67	268.33	3.40	38.33	3.00	5.97	4.07
20	P_5 X P7	131.67	3.00	7.33	42.33	18.10	55.33	7.67	325.33	3.07	36.04	2.67	6.20	4.20
21	P_6 X P_7	140.33	3.00	10.00	38.33	14.79	67.67	8.33	319.33	2.90	39.38	3.33	8.00	3.20
Check														
1	C1	131.33	3.67	9.00	35.33	17.68	56.67	8.00	282.66	2.10	23.12	2.00	5.80	3.00
2	C2	118.00	3.00	6.00	34.33	16.69	60.00	7.33	252.00	1.93	33.54	2.33	5.80	2.80
3	C3	57.67	4.33	6.33	25.00	91.41	11.00	4.67	117.67	3.10	21.46	3.33	8.20	7.40

Table 2. Three best-performing parents (Lines and Check varieties) and hybrids in cherry tomato for growth, yield and quality traits

Trait	Parent (Lines and Check variety)			F_1 Hybrid		
	I	II	III	I	II	III
Plant height (cm)	P_6 (140)	C_1(131.33)	P_5(131.00)	P_1 x P_6 (165.67)	P_4 x P_5 (156.00)	P_1 x P_4 (154.00)
No. of primary branches	C_3(4.33)	P_1,P_5 and C_1(3.67)	P_2, P_3 and p_4 (3.00)	P_1 xP_2 (3.67)	P_1 x P_5 (3.33)	P_1 X P_7 (3.00)
No. of secondary branches	P_6(12.67)	P_1 (11.00)	P_7 (9.67)	P_1 x P_5 (11.33)	P_3 x P_6 (11.00)	P_3 x P_6 (10.33)
No. of inflorescences	P_1 (48)	P_2(38.67)	P_5 and P_6(38.33)	P_2 x P_3 (63.33)	P_1 xP_4(56.33)	P_4 x P_5 (50.33)
Average fruit weight (g)	C_3 (91.41)	P_5 (31.05)	C_1 (17.68)	P_3 x P_5 (23.68)	P_2 x P_5 (20.02)	P_4 x P_5 (19.76)
No. of fruits/ kg	P_1 (96.67)	P_4 (80.33)	P_7(74.67)	P_1 x P_2 (78.00)	P_1 x P_7 (71.67)	P_5 x P_6 (65.67)
No. of fruits/ cluster	P_1 (10.33)	P_2 (9.67)	P_3 (9.33)	P_1 x P_2 (9.33)	P_2 x P_3 (9.00)	P_1 xP_6 (8.33)
No. of fruits/ plant	P_1 (498.67)	P_2 (374.33)	P_3 (326.33)	P_2 x P_3 (570)	P_1 x P_2 (416.67)	P_1 x P_4 (414.67)
Yield/ plant (kg)	C_3 (3.10)	P_7 (3.03)	P_5 (2.87)	P_1 x P_3 (4.27)	P_1 x P_6 (3.97)	P_5 x P_6 (3.40)
Yield/ ha (t)	C_2 (33.54)	P_5 (33.33)	P_7 (30.00)	P_1 x P_7 (54.38)	P_4 x P_7 (46.46)	P_2 x P_7 (44.79)
No. of locules/ fruit	P_6 (3.67)	C_3 (3.33)	P_2 (3.00)	P_6 x P_7 (3.33)	P_5 xP_6 (3.00)	P_1 xP_2 and P_1 x P_3 (2.67)
Fruit firmness (kg/mm2)	C_3 (8.20)	P_5 (7.20)	C_1 and C_2 (5.80)	P_3 x P_5 (9.53)	P_1 x P_4 (8.20)	P_6 x P_7 (8.00)
Pericarp thickness (mm)	C_3 (7.40)	P_5 (4.80)	P7 (4.03)	P_2 xP_5 (6.00)	P_3 x P_5 (5.00)	P_2 xP_7, P_5 x P_7 (4.20)

significantly among themselves for average fruit-weight which ranged from 10.33g (P_1) to 31.05g (P_5). Fruit weight ranged from 16.69g (C_2) to 91.41g (C_3) among Check varieties, and from 12.83g (P_1 x P_2) to 23.68 (P_3 x P_5) among hybrids (Table 1). Average fruit weight contributed directly towards fruit yield per plant. This is in agreement with the findings of Deepa and Thakur (2008) and Shivakumar (2000).

The genotypes under study differed significantly among themselves for number of fruits per kg which ranged from 32.33 (P_5) to 96.67 (P_1) among parents, from 11 (C_3) to 60 (C_2) among Check varieties, and from 42.33 (P_3 x P_5) to 70 (P_1 x P_2) among hybrids (Table 1). Number of fruits per cluster ranged from 7 (P_5) to 10.33 (P_1) among parents, from 4.67 (C_3) to 8 (C_1) among Check varieties, and from 6.33 (P_2 x P_5 and P_4 x P_5) to 9.33 (P_1 x P_2) among hybrids (Table 1). The genotypes differed significantly among themselves for number of fruits per plant which ranged from 269.33 (P_5) to 498.67 (P_1) among parents, from 117.67 (C_3) to 282.66 (C_1) among Check varieties, and from 222 (P_3 x P_5) to 570 (P_2 x P_3) among hybrids (Table 1). Increased fruit-set observed may be due to a higher rate of anther dehiscence and better pollen viability. Similar results were reported earlier by Shivanand (2008). Any deviation in results with the findings of others could be attributed to differences in genotypes under study, environmental conditions and stage of fruit harvest.

As for yield per plant, genotypes differed significantly, ranging from 2.20kg (P_1 and P_3) to 3.03kg (P_7) among parents, from 1.93kg (C_2) to 3.10kg (C_3) among Check varieties, and from 2.50kg (P_2 x P_4) to 4.27kg (P_1 x P_3) among hybrids (Table 1). Genotypes differed significantly among themselves for estimated yield which ranged from 20.83 tonnes per hectare (P_4) to 33.33 tonnes per hectare (P_5) among parents, from 21.46 tonnes per hectare (C_3) to 33.54 tonnes per hectare (C_1) among Check varieties, and from 26.46 tonnes per hectare (P_1 x P_3) to 54.38 tonnes per hectare (P_1 x P_7) among hybrids (Table 1). Hybrid P_1 x P_7 showed highest yield per plant and estimated yield per hectare. These results are in consonance with findings of Madalageri and Dharmatti (1991).

Genotypes differed significantly among themselves in number of locules per fruit which ranged from 2.33 (P_1, P_3, P_5 and P_7) to 3.67 (P_6) among parents, from 2(C_1) to 3.33(C_3) among Check varieties, and from 2.00 (P_1 x P_4, P_2 x P_3, P_2 x P_5 and P_4 x P_5) to 3.33 (P_6 x P_7) among hybrids (Table 1). Variation in fruit firmness depends upon stage of harvest, and at mature stage this ranged from 4.20 kg/mm^2 (P_3) to 7.20 kg/mm^2 (P_5) among parents, from 5.8kg/mm^2

(C_1 and C_2) to 8.20kg/mm^2 (C_3) among Check varieties, and from 3.33kg/mm^2 (P_1 x P_3) to 9.53 kg/mm^2 (P_3 x P_5) among hybrids (Table 1). Thus, hybrid P_3 x P_5 may be best suited for long-distance transport and for processing. Genotypes differed significantly among themselves for pericarp thickness (mm) which ranged from 2.20mm (P_1) to 4.80mm (P_5) among parents, from 2.80mm (C_2) to 7.40mm (C_3) among Check varieties, and from 2.40mm to (P_1 x P_2) to 6.00 (P_2 x P_5) among hybrids (Table 1). These results are similar to the findings of Thakur *et al* (2005), Hazarika and Phookan (2005) and Shivakumar (2000). Fruit firmness and pericarp thickness are important fruit-quality parameters. The three best overall performing parents (Lines and Check varieties) and hybrids are presented in Table 2 for different traits studied in cherry tomato.

In this study, parents IIHR-2866, IIHR-2864 and IIHR-2865 performed well for various traits under study. As such, these could be exploited further in various breeding programmes. Promising hybrids, IIHR-2754 x IIHR-2866 (P_1 x P_7) and IIHR-2754 x IIHR-2860 (P_1 x P_3), can be subjected further to selection for isolating desirable genotypes in cherry tomato.

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