



PER SE PERFORMANCE OF DUAL PURPOSE TOMATO GENOTYPES FOR GROWTH, YIELD AND QUALITY ATTRIBUTES

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Abstract

This experiment was conducted to evaluate the comparative performance of forty tomato genotypes at Vegetable Research Station, Hyderabad during 2013-14 following Randomized Block Design with three replications. Significant differences were observed for all the traits studied indicating the substantial amount of variation. However, potential of these genotypes is needed to be further tested under the different climatic conditions of Telangana to elicit substantial conclusions.

Key words : Tomato, *Per se* performance, yield and quality.

Introduction

Tomato (*Solanum lycopersicum* L., $2n = 24$) is widely grown vegetable in the world from temperate to tropical climate. Cultivated forms are originated from *Lycopersicum esculentum* var. *cerasiforme*. Tomato is incredibly versatile fruit; it contains one of the most powerful anti-oxidant compounds called lycopene which have effective anti-cancer properties (Islam *et al.*, 2010). Tomato also flushes out free radicals, protect against inflammation, heart diseases and prevent DNA damage in human body. It is also used for preparation of natural beauty cosmetics (Mahajan *et al.*, 2010). In India, tomato is grown in an area of 0.882 million hectares with annual production of 18.74 million tonnes and productivity of 21.2 tonnes/ha. Tomato fruits with high total soluble solids, pH less than 4.5, high ascorbic acid, lycopene and total acidity content are preferred for processing purpose (Bose *et al.*, 2002). Therefore, present study has taken up to find out genotypes which serves dual purposes.

Materials and Methods

The experiment was laid out in Randomized Completely Block Design with three replications at the Vegetable Research Station, SKLTSHU, Rajendranagar, Hyderabad during *Kharif* 2013-14. Forty genotypes of tomato including six varieties, which were selfed earlier were raised in a nursery bed and were transplanted at the age of 3 weeks with a spacing of 45 cm × 60 cm.

Necessary prophylactic measures were taken to raise a good crop following a recommended package of practices. Analysis of variance was done based on RBD as suggested by Panse and Sukhatme (1985) for each of the characters separately. The data obtained were analysed using SPSS package.

Results and Discussion

Analysis of variance revealed significant difference among all the traits studied. From the table 1 it is evident that plant height of genotypes varied from 50.37 to 182.47 cm with a total mean of 98.04 cm. Among the genotypes, EC-520078 (182.47 cm) recorded maximum while minimum plant height (50.47 cm) was observed in EC-608262. Two genotypes EC-520078 and EC-611888 recorded significantly higher plant height (182.47 cm and 149.31 cm) compared to check superior check Marutham (134.66 cm). Kallo *et al.* (1998), Manoj and Ragav (1998) and Fayaz *et al.* (2007) also reported differences in plant height among cultivars/hybrids of tomato put under evaluation and screening trials.

The mean values for number of primary branches per plant varied from 3.77 to 8.24 with a grand mean of 5.45 (table 1). Genotype EC-705506 (3.77) recorded less number whereas highest number was recorded in Arka Meghali (8.24). Four genotypes exhibited significantly higher number of primary branches per plant than grand mean. These results are in close conformity with the findings of Sharma and Rastogi (1993) and Fayaz *et al.*

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(2007), who reported significant variation among the cultivars of tomato for the number of primary branches per plant.

It is clear from the table 1 that mean values for number of days taken to 50 per cent flowering varied from 27.33 to 52.67 days with a general mean of 42.56 days. The genotype, EC-520078 took least number of days (27.33 days) while Arka Saurabh was found to be late (62.67 days). Two genotypes EC-523851 and EC-520078 taken significantly lesser number of days to 50 per cent flowering compared to superior check Arka Meghali (34.33 days).

Number of flowers per cluster data in the table 1 indicate significant variation among the genotypes, which varied from 3.74 (EC-570029) to 8.40 (520078) with overall mean of 5.31. Only genotype EC-520078 recorded significantly more number of flowers per cluster than superior check Punjab Chhuhara. Range for number of fruits per cluster was in between 2.24 (EC-570029) to 7.22 (EC-520078) with an average of 3.82. Single genotype, EC-520078 was found to be significantly superior to best check Punjab Chhuhara.

Like other growth and yield attributes fruit length varied from 1.74 cm (EC- 520078) to 6.42 cm (EC-608272) with an overall mean of 4.81 cm. Fourteen genotypes recorded higher fruit length compared to check Arka Saurabh (4.63 cm). The character fruit width exhibited a range of 0.74 cm (EC- 520078) to 6.50 cm (EC-205117) with a grand mean of 4.30 cm. Only four genotypes were statistically exceeding fruit width than superior check Arka Saurabh.

Data presented in table 1 revealed that average fruit weight of forty tomato genotypes evaluated ranged from 1.43 g (EC-520078) to 111.53 g (EC-620428) with a total mean of 53.49 g. Two genotypes recorded significantly higher fruit weight over best check Arka Meghali (76.89 g).

Days to first fruit harvest varied from 44.66 (EC-520078) to 91.33 (EC-619982) days with a grand mean of 77.32 days. Only two were superior to check, Pusa Ruby. Whereas days to last fruit harvest varied from 108.33 (EC-610662) to 141.67 days (EC-605701) with a total mean of 125.66 days. Only one genotype taken significantly higher number of days for last fruit harvest compared to check Punjab Chhuhara.

Fruit yield per plant of tomato genotypes evaluated varied from 1.04 kg (EC-608458) to 2.06 kg (EC-620407) with an average of 1.48 kg. Three genotypes (EC-608415, EC-620407 and EC-620428) recorded significantly higher fruit yield than best check Arka Abha. Jaha and Krishi (2001) reported 4.03 kg fresh fruit yield per plant in cultivar

Naveen while Mishra and Lal (1998) and Fayaz *et al.* (2007) reported that variety Pusa Ruby gave the maximum fruit yield per plant (2.7 kg) among the 39 tomato cultivars.

Pericarp thickness of tomato germplasm studied varied from 0.88 mm (EC- 520078) to 5.54 mm (EC-620419) with a grand mean of 4.20 mm. Fourteen genotypes were found to be significantly superior to grand mean, whereas none of them were significantly superior to best check Punjab Chhuhara.

Range of fruit pH among the tomato genotypes evaluated was in between 4.11 (EC- 620407) to 5.46 (EC-608272) with overall mean of 4.89. Three genotypes were superior to best check. Total soluble solids varied from 3.59 (EC-611888) to 6.29°Brix (EC-520078) with mean of 4.57°Brix. Four genotypes were superior compared to best check.

Range for titrable acidity among the tomato genotypes varied from 0.28% (EC-608455) to 0.60% (Arka Meghali) with grand mean of 0.38%. Seven genotypes were found to be significantly superior compared to grand mean while none of the genotype were found to be superior compared to best check. Ascorbic acid content of tomato genotypes evaluated varied from 14.63 (EC-605701) to 28.47 mg/100g (EC-620360) with a mean value of 19.90 mg/100g. Eleven genotypes were found to be significantly superior to grand mean, while none of the genotypes were significantly superior to best check Punjab Chhuhara.

Range of total sugars varied from 2.01 (EC-520078) to 4.31% (EC-620557) with mean of 3.30%. As many as sixteen genotypes (EC-608304, EC-608334, EC-608360, EC-608398, EC-608407, EC-608415, EC-608455, EC-608458, EC-620407, EC-620557, EC-620360, EC-241148, EC-611885, EC-611888, EC-619982 and Punjab Chhuhara) were significantly superior compared to grand mean and eight genotypes (EC-608304, EC-608334, EC-608407, EC-611885, EC-619982, EC-608415, EC-608455 and EC-608557) compared to best check. The range of reducing sugars in forty genotypes evaluated varied from 1.63 (EC-520078) to 3.86% (EC-620557) with a grand mean of 2.80%. Seventeen genotypes (EC-608304, EC-608334, EC-608360, EC-608398, EC-608407, EC-608415, EC-608455, EC-608458, EC-620407, EC-620557, EC-620428, EC-620360, EC-241148, EC-611885, EC-611888, EC-619982 and Punjab Chhuhara) were found to be significantly superior to grand mean and four (EC-608304, EC-608415, EC-620557 and EC-619982) genotypes to that of superior check.

Lycopene content of fruits varied from 3.91 (EC-241148) to 9.07 mg/100g (EC-520078) with a grand mean

Table 1 : Per se performance of dual purpose tomato genotypes for various characters.

Genotype	Plant height (cm)	No. of primary branches per plant	Days to 50 per cent flowering	Number of flowers per cluster	Number of fruits per cluster	Fruit length (cm)	Fruit width (cm)	Average fruit weight (g)	Days to first fruit harvest	Days to last fruit harvest	Fruit yield per plant (kg)	Pericarp thickness (mm)	Fruit pH	Total soluble solids (°Brix)	Titration acidity (%)	Ascorbic acid content (mg/100g)	Total sugars (%)	Reducing sugars (%)	Lycopene content (mg/100g)
EC-570029	59.77	4.77	39.67	3.74	2.24	4.76	3.76	51.44	76.33	136.33	1.40	2.95	5.25	5.70	0.30	15.03	3.05	2.52	5.07
EC-605701	52.08	5.76	43.33	4.52	3.15	5.04	4.57	77.98	86.67	141.33	1.57	3.65	5.32	4.63	0.35	14.63	2.95	2.47	4.83
EC-605703	67.30	5.11	38.67	3.83	2.51	5.41	5.13	55.65	74.33	129.33	1.24	3.94	4.88	4.19	0.41	17.93	2.83	2.44	4.47
EC-605711	73.28	4.88	44.67	4.80	3.09	5.85	4.82	61.04	82.33	136.67	1.31	5.08	4.29	5.68	0.37	17.33	3.01	2.39	6.33
EC-608243	75.25	5.88	40.67	4.53	3.04	5.15	4.68	43.78	79.33	123.00	1.47	4.93	5.14	4.95	0.30	16.10	2.97	2.44	5.93
EC-608262	50.37	5.30	45.00	3.81	2.75	5.60	4.06	65.02	77.33	126.67	1.30	4.33	4.38	4.01	0.38	17.53	3.20	2.41	4.80
EC-608272	50.44	5.64	44.33	4.95	3.49	6.42	4.49	33.93	82.00	120.33	1.32	4.73	5.46	5.63	0.39	18.97	3.29	2.80	6.70
EC-608304	97.22	5.71	47.67	5.17	4.53	6.25	4.41	61.89	82.33	139.67	1.51	4.52	5.22	4.67	0.28	18.93	3.96	3.51	4.57
EC-608331	90.08	6.00	40.00	5.20	3.70	5.23	4.61	59.32	80.00	141.67	1.68	5.04	5.10	3.71	0.49	21.10	2.77	2.46	4.70
EC-608334	83.89	4.90	40.33	5.73	4.13	5.59	4.58	53.07	78.00	117.33	1.31	5.42	4.90	3.74	0.31	21.33	3.74	3.24	7.53
EC-608360	89.92	5.25	37.33	5.27	3.70	5.52	4.01	44.11	75.33	124.00	1.47	4.65	4.99	4.28	0.29	18.10	3.61	3.05	5.33
EC-608398	52.41	5.34	37.67	5.65	3.68	5.57	4.43	58.54	74.67	116.00	1.43	4.49	4.96	3.93	0.34	18.33	3.61	2.93	6.27
EC-608407	97.39	4.98	39.50	5.09	3.37	4.74	3.88	57.58	75.00	110.33	1.65	3.82	4.40	3.99	0.49	25.83	3.76	3.03	6.80
EC-608415	91.02	4.86	46.67	5.99	3.67	3.85	5.54	80.25	79.00	126.67	2.05	4.37	5.14	4.83	0.40	18.83	3.96	3.70	7.00
EC-608436	116.98	4.01	40.00	5.93	5.31	5.45	4.18	31.10	74.33	124.00	1.33	3.24	5.16	4.13	0.36	17.20	2.57	2.24	5.93
EC-608455	125.96	4.25	43.33	5.31	3.25	5.30	3.88	24.71	71.67	114.00	1.30	4.84	5.34	4.45	0.28	16.27	3.72	3.37	5.20
EC-608458	72.01	4.87	36.00	5.06	3.57	4.61	3.83	36.13	75.67	123.67	1.04	4.36	4.47	4.16	0.40	17.83	3.66	3.10	4.43
EC-610662	115.91	4.94	33.33	4.66	3.56	5.24	5.76	91.08	74.00	108.33	1.28	3.07	4.55	5.04	0.35	16.83	3.02	2.65	5.07
EC-620407	104.54	5.26	33.33	4.97	3.14	5.67	6.02	78.82	71.00	117.67	2.06	5.20	4.11	4.26	0.42	17.13	3.61	3.34	6.47
EC-620557	144.26	5.86	42.33	5.85	4.76	5.91	4.55	65.40	83.67	132.67	1.52	4.98	5.37	5.15	0.36	16.97	4.31	3.86	8.63
EC-620428	106.38	5.57	47.47	5.11	3.96	4.98	4.91	111.53	82.33	127.33	2.04	3.93	4.12	5.09	0.38	24.37	3.36	2.95	7.90
EC-620456	86.82	5.39	41.73	5.48	3.91	4.66	4.30	53.06	82.00	122.33	1.25	5.09	5.04	4.85	0.34	16.70	3.18	2.44	5.10
EC-620419	130.91	6.42	38.33	4.89	3.45	3.60	3.42	38.52	86.33	128.00	1.17	5.54	5.39	5.20	0.42	18.40	3.16	2.65	6.67
EC-620360	109.55	5.18	51.47	5.01	3.06	5.23	4.64	70.28	84.00	133.00	1.99	4.42	4.13	4.32	0.49	28.47	3.63	2.99	7.47
EC-523851	133.84	4.92	30.67	6.47	5.16	2.16	0.96	3.21	46.00	118.67	1.24	1.08	5.28	4.98	0.38	26.73	2.02	1.63	7.17
EC-520078	182.47	5.84	27.33	8.40	7.22	1.74	0.74	1.43	44.67	131.00	1.12	0.88	5.24	6.29	0.39	27.17	2.01	1.63	9.07
EC-241148	58.36	5.73	43.33	5.68	4.24	4.52	4.49	42.04	85.67	127.33	1.37	4.49	4.42	4.34	0.35	18.86	3.54	2.94	3.91

Table 2 continued....

Table 1 contd...

Acc. no.	Genotype	Plant height (cm)	No. of primary branches per plant	Days to 50 per cent flowering	Number of flowers per cluster	Number of fruits per cluster	Fruit length (cm)	Fruit width (cm)	Average fruit weight (g)	Days to first fruit harvest	Days to last fruit harvest	Fruit yield per plant (kg)	Pericarp thickness (mm)	Fruit pH	Total soluble solids (°Brix)	Titration acidity (%)	Ascorbic acid content (mg/100 g)	Total sugars (%)	Reducing sugars (%)	Lycopene content (mg/100g)
RCHT - 28	EC - 205117	67.40	5.20	37.33	4.84	3.62	5.17	6.50	46.67	75.67	108.67	1.71	3.11	4.66	4.99	0.29	16.97	2.77	2.39	5.54
RCHT - 29	EC - 611885	116.79	4.78	44.33	5.14	4.21	4.56	4.17	55.39	81.00	126.67	1.34	4.87	4.92	3.68	0.37	15.54	3.77	3.14	4.96
RCHT - 30	EC - 611888	149.31	5.00	46.67	5.64	3.93	4.52	4.23	63.29	85.00	133.00	1.51	4.63	4.95	3.59	0.41	18.73	3.62	3.08	5.85
RCHT - 31	EC - 611883	145.76	5.96	39.33	5.95	4.99	3.30	3.67	26.41	76.67	117.67	1.20	4.72	4.89	4.73	0.30	16.97	3.14	2.50	5.63
RCHT - 32	EC - 611884	131.90	5.11	50.00	6.08	4.98	5.89	4.27	74.38	90.00	137.33	1.61	4.51	5.26	3.90	0.36	15.84	3.07	2.43	5.81
RCHT - 33	EC - 619982	92.49	5.29	57.00	6.59	4.62	5.69	3.09	60.90	91.33	140.67	1.97	4.17	4.47	4.81	0.38	25.69	4.17	3.83	8.71
RCHT - 34	EC - 705506	60.50	3.77	44.33	5.02	3.30	5.69	4.73	42.47	84.33	128.33	1.55	4.29	5.43	4.53	0.28	15.58	3.15	2.55	4.77
RCHT - 35	Arka Saurabh	89.43	5.61	52.67	4.29	2.71	4.63	5.02	41.97	86.67	126.67	1.31	4.35	4.55	4.33	0.41	24.23	3.60	2.86	5.21
RCHT - 36	Arka Meghali	104.81	8.24	34.33	4.79	2.73	3.89	4.87	76.89	74.00	116.00	1.24	4.97	4.46	4.32	0.60	18.39	2.98	2.71	6.27
RCHT - 37	Arka Abha	97.51	5.87	51.00	5.51	3.69	3.54	3.79	51.11	78.00	118.33	1.76	4.54	4.59	4.38	0.48	26.14	3.25	2.50	5.85
RCHT - 38	Punjab Chuhara	96.43	7.77	43.33	7.45	5.91	4.60	3.71	59.25	80.33	134.33	1.45	5.06	4.44	4.19	0.40	28.00	3.64	3.31	6.84
RCHT - 39	Pusa Ruby	116.06	7.05	32.67	5.07	3.39	2.78	4.58	52.75	58.67	122.00	1.74	2.93	5.22	5.10	0.44	26.26	2.74	2.44	6.13
RCHT - 40	Marutham.	134.66	5.92	35.33	5.08	2.97	4.12	4.87	36.99	67.33	119.33	1.71	2.73	4.61	4.23	0.46	24.67	3.04	2.68	5.57
	Mean	98.04	5.45	42.56	5.31	3.82	4.81	4.30	53.48	77.32	125.66	1.48	4.20	4.89	4.57	0.38	19.90	3.29	2.80	6.01
	C.V	6.07	8.15	2.58	7.90	8.95	5.84	4.27	6.40	2.06	2.19	8.53	5.49	2.82	3.54	4.21	3.95	2.93	1.98	4.16
	S.E.m±	3.44	0.26	0.63	0.24	0.20	0.16	0.11	1.98	0.92	1.59	0.07	0.13	0.08	0.09	0.01	0.45	0.06	0.03	0.14
	C.D 5%	9.67	0.72	1.78	0.68	0.56	0.46	0.30	5.57	2.59	4.48	0.21	0.37	0.22	0.26	0.03	1.28	0.16	0.09	0.41
	C.D 1%	12.83	0.96	2.36	0.91	0.74	0.61	0.40	7.38	3.44	5.94	0.27	0.50	0.30	0.35	0.03	1.69	0.21	0.12	0.54

Table 2 : Promising genotypes suitable for different purposes.

Genotype	Category	Fruit yield per plant	Quality parameters							
			Pericarp thickness (mm)	Total soluble solids ($^{\circ}$ Brix)	Fruit pH	Titration acidity (%)	Ascorbic acid content (mg/100g)	Total sugars (%)	Reducing sugars (%)	Lycopene content (mg/100g)
EC-608415	Processing type	2.05	4.37	4.83	5.14	0.40	18.83	3.96	3.70	7.00
EC-620360	Processing type	1.99	4.42	4.32	4.13	0.49	28.47	3.63	2.99	7.47
EC-620407	Dual type	2.06	5.20	4.26	4.11	0.42	17.13	3.61	3.34	6.47
EC-620428	Culinary type	2.04	3.93	5.09	4.12	0.38	24.37	3.36	2.95	8.71

of 6.01 mg/100g. As many as thirteen genotypes were found significant compared to grand mean and six genotypes to that of best check.

Conclusion

From the table 2, it can be inferred that out of forty genotypes, EC-620428 with significant fruit yield per plant (2.04 kg), pericarp thickness (3.93), total soluble solids (5.09 $^{\circ}$ Brix), fruit pH (4.12), titration acidity (0.38%), ascorbic acid content (24.37 mg/100g), total sugars (3.36%), reducing sugars (2.95%) and lycopene content (7.90 mg/100g) is suitable for culinary purpose and EC-620407 with significant fruit yield per plant (2.06 kg) pericarp thickness (5.20 mm), total soluble solids (4.26 $^{\circ}$ Brix), fruit pH (4.11), titration acidity (0.42%), ascorbic acid content (17.13 mg/100g), total sugars (3.61%), reducing sugars (3.34%) and lycopene content (6.47 mg/100g) is suitable for dual purpose. EC-608415 with significant fruit yield per plant (2.05 kg) pericarp thickness (4.37mm), total soluble solids (4.83 $^{\circ}$ Brix), fruit pH (5.14), titration acidity (0.40%), ascorbic acid content (18.83 mg/100g), total sugars (3.96%), reducing sugars (3.70%) and lycopene content (7.00 mg/100g) is suitable for processing purpose and EC-620360 with fruit yield per plant (1.99 kg), pericarp thickness (4.42 mm), total soluble solids (4.32 $^{\circ}$ Brix), fruit pH (4.13), titration acidity (0.49%), ascorbic acid content (28.47 mg/100g), total sugars (3.63%), reducing sugars (2.99%) and lycopene content (7.40 mg/100g) is suitable for processing purpose.

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