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PERFORMANCE OF TOMATO (*Lycopersicon esculentum* Mill.) HYBRIDS WITH RESPECT OF YIELD AND QUALITY TRAITS

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ABSTRACT
Present experiment was carried out at Horticulture Research Station, Gandhi Krishi Vigyana Kendra, University of Agricultural Sciences, Bangalore during *kharif* season of 2008-09 to evaluate 22 hybrids for yield, quality and against pest and diseases tolerance. Yield per plant differed significantly among hybrids which may attributed to significantly higher number of fruits per plant and average fruit weight. The highest fruit yield per plant was recorded in hybrid US 618 (5.94 kg plant^{-1}). With respect to quality, among the hybrids TSI-48 (5.13 °Brix), US 2175 (5.17°Brix), US 1196 (5.03°Brix) and Anup (4.98°Brix) recorded highest TSS with lower acidity of 0.25 per cent, 0.36 per cent, 0.33 per cent and 0.32 per cent respectively. The fruit firmness was highest for Heem Sohna (4.47 kg cm^{-2}). Fruit of hybrid Heem Sohna (25.20 days) had the longest shelf life followed by TSI-48 (22.60 days) From an overall view of results, it can be inferred that the hybrids US 618, Heem Sohna and US 1196 were high yielding and good for fresh marketing. For the purpose of processing hybrids US 1196, T 1224, TSI-48, Anup and Super samurai were found suitable. Hence these hybrids were found better suited for commercial cultivation in Eastern Dry Zone of Karnataka (Zone 5).

KEYWORDS: *kharif* season, *Lycopersicon esculentum,* TSI-48, US 2175, US 1196.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.), belongs to the family Solanaceae, is an extremely popular and widely grown vegetable in the world. It is grown for its edible fruits, which can be consumed either fresh as salads or consumed after cooking or utilized in the preparation of range of processed products like sauce, ketchup, puree, paste, powder, soup and canned whole fruits. Unripe green fruits are used for preparation of pickles and chutney. Tomato tops the list of processed vegetables and is a very good source of lycopene, ascorbic acid and β-carotene, which are considerd as good (Anon, 2004).

Now a days, inspite of the availability of several hybrids, the growers are finding it difficult to go for cultivation of tomatoes, some of the reasons being, their suitability for a particular region, demand more attentive management, ripe at a time that leads to the problem of storage and processing facilities, lack of high and quality yield under open conditions and unstable inheritance of specific traits. To minimize these problems the new tomato hybrids developed should adopt to varied agro-climatic conditions may be a difficult proposition. However India being a wast country with varied agro-climatic regions, different genotypes need to be evolved for specific regions. In general, with ever increasing demand for tomatoes, it has become imperative to develop high yielding hybrids with resistance to biotic and abiotic stresses and suitable to fresh market and processing hybrids for cultivation in different agro-climatic conditions to boost up the tomato production per unit area and per unit time according to the consumers and growers preference.

MATERIALS & METHODS

The experiment was conducted at the Horticulture Research Station, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bangalore (Zone-5), on red sandy loam soil during the *kharif* season of 2008-2009. In this experiment twenty two tomato hybrids have been selected from both public and private sectors (Table 1). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Healthy, uniform 28 days old seedlings were transplanted on 31st August 2007. The distance between plants was 0.75m and the distance between rows was 1.0m. The crop was raised by providing recommended package of practices, (Anon., 2004). Observations were recorded in respect of plant height (cm), days to 50 per cent flowering, number of branches, number of fruits per plant, average fruit weight (g), total yield per plant (kg), estimated fruit yield per hectare (t/ha) on five randomly selected plants in each entry of each replications. The average values were computed as treatment mean under each replication. The data on various observations such as growth, yield and quality parameters were tabulated and subjected to statistical analysis as described by Sunder Raj *et al*., 1972.

TABLE 1: Hybrids of tomato used for evaluation

Sl. No.	Hybrid	Source
1	Arka Shreshta	IIHR, Bangalore
2	Arka Ananya	IIHR, Bangalore
3	Arka Abhijit	IIHR, Bangalore
4	CO TH- 2	TNAU, Coimbatore
5	Surya	TOKITA Seeds Pvt. Ltd.
6	TSI-48	TOKITA Seeds Pvt. Ltd.
7	Super Samaurai	TOKITA Seeds Pvt. Ltd.
8	Bhoomi-04	TOKITA Seeds Pvt. Ltd.
9	T 1224	ZUARI Seeds
10	T 1210	ZUARI Seeds
11	US 2175	US Agri Seeds
12	US 1196	US Agri Seeds
13	US 618	US Agri Seeds
14	Abhinav	Syngenta Seeds Pvt. Ltd.
15	Heem Sohna	Syngenta Seeds Pvt. Ltd.
16	TH -1389	Syngenta Seeds Pvt. Ltd.
17	All Rounder	Syngenta Seeds Pvt. Ltd.
18	Anup	Syngenta Seeds Pvt. Ltd.
19	NS 77	Namdhari Seeds
20	NS 816	Namdhari Seeds
21	NS 585	Namdhari Seeds
22	NP 5024	Nun hems seeds

RESULTS & DISCUSSION

Hybrids differed significantly among themselves for the trait plant height at 30, 60 and 90 days after transplanting (DAT). Maximum plant height at 90 DAT was observed in US 1196 (123.38 cm) followed by NS 816 (120.83 cm), US 618 (118.47 cm), Heem Sohna (116.86 cm) and All Rounder (113.48 cm) and minimum was observed in T 1210 (69.28 cm). Maximum number of branches at 90 DAT was observed in US 1196 (17.86) followed by US 618 (17.33), Heem Sohna (17.11), All Rounder (16.90), US 2175 (16.84) and Anup (15.54) and minimum of 11.50 was observed in COTH 2 (Table 2).

TABLE 2: Plant height and Number of branches per plant on 30, 60 and 90 days after transplanting in tomato hybrids

Sl.No	Hybrids	Plant height (cm)			Number of branches		
		30 DAT	60DAT	90DAT	30 DAT	60DAT	90DAT
1.	Arka Shreshta	42.28	80.96	90.14	7.56	11.37	12.57
2.	Arka Ananya	48.63	82.80	94.67	9.64	11.24	12.86
3.	Arka Abhijit	39.13	79.28	85.10	7.83	11.13	12.15
4.	COTH 2	42.30	60.16	72.95	8.30	10.32	11.50
5.	Surya	41.75	84.26	96.16	10.45	11.37	13.07
6.	TSI-48	38.91	78.57	91.37	7.03	12.03	13.23
7.	Super Samaurai	46.76	88.33	104.16	9.82	12.42	13.64
8.	Bhoomi-04	39.54	82.67	94.68	8.03	11.23	12.62
9.	T1224	40.49	87.36	100.27	9.57	13.16	14.33
10	T1210	35.32	54.19	69.28	9.62	10.84	12.37
11.	US 2175	49.67	92.47	110.70	10.83	15.23	16.84
12.	US 1196	55.30	98.50	123.38	10.44	14.82	17.86
13.	US 618	47.80	95.36	118.47	8.03	14.37	17.33
14.	Abhinav	38.46	80.23	93.15	6.82	12.57	14.20
15.	Heem Sohna	42.64	93.24	116.86	8.94	14.15	17.11
16.	TH 1389	43.33	91.57	105.64	8.43	13.83	14.40
17.	All Rounder	47.28	94.04	113.48	7.57	12.98	16.90
18.	Anup	36.27	72.78	89.37	7.18	14.03	15.54
19.	NS 77	43.60	87.86	102.16	7.57	12.17	13.93
20.	NS 816	52.15	96.74	120.83	10.16	12.66	14.40
21.	NS 585	42.53	85.14	99.27	11.14	13.68	14.83
22.	NP 5024	37.70	73.54	92.64	9.63	12.63	13.92
SEm±		1.073	2.838	2.957	0.286	0.322	0.453
CD(p=0.05)		3.16	8.309	8.658	0.840	0.944	1.327

In the present study, hybrid COTH 2 (24.74 DAT) flowered early followed by Anup (24.93 DAT). Such earliness could be due to its higher capacity to make available the assimilates to the apex during the sensitive phase before initiation (Dielmen and Heuvelink, 1992). US 1196 (31.74 DAT) flowered late (Table 3).

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TABLE 3: Performance of tomato hybrids for different yield parameters

Sl.No	Hybrids	Days to 50% flowering	Number of fruits per plant	Average fruit weight (g)	Average Yield/plant (kg)	Average Yield per/ha (t)
1.	Arka Shreshta	29.24	37.04	77.46	2.83	37.73
2.	Arka Ananya	30.04	51.23	53.38	2.93	39.06
3.	Arka Abhijit	26.63	44.74	63.12	2.70	35.99
4.	COTH 2	24.74	63.63	36.11	2.00	26.66
5.	Surya	29.54	52.32	88.09	4.09	54.53
6.	TSI-48	28.77	55.03	73.77	3.41	45.46
7.	Super Samaurai	29.14	53.04	69.82	3.52	46.93
8.	Bhoomi-04	31.43	58.30	66.21	3.44	45.86
9.	T1224	28.54	73.61	55.95	3.84	51.19
10	T1210	28.13	44.63	65.80	2.67	35.59
11.	US 2175	30.54	54.14	92.73	4.63	61.73
12.	US 1196	31.74	55.43	95.54	4.72	62.93
13.	US 618	29.47	85.34	86.39	5.94	79.19
14.	Abhinav	29.83	52.36	72.33	3.49	46.53
15.	Heem Sohna	29.62	52.64	100.19	4.93	65.73
16.	TH 1389	26.43	60.43	74.98	3.98	53.06
17.	All Rounder	30.82	58.37	78.75	4.24	56.53
18.	Anup	24.93	43.02	69.73	2.64	35.19
19.	NS 77	27.94	34.83	125.83	4.01	53.33
20.	NS 816	28.43	56.14	62.02	3.25	43.33
21.	NS 585	29.32	36.43	97.65	2.92	38.93
22.	NP 5024	28.93	49.62	65.50	2.94	39.19
SEm±		0.667	1.346	1.869	0.092	2.471
CD(p=0.05)		1.951	3.993	5.472	0.270	7.052

TABLE 4: Performance of tomato hybrids for quality parameters

Sl.No	Hybrids	TSS (^{O}Brix)	Titrable acidity (%)	Ascorbic acid (mg/100g)	Firmness (kg/cm^2)	Number of locules	Pericarp thickness (cm)	Shelf life (days)
1.	Arka Shreshta	4.63	0.27	14.74	2.64	4.23	0.49	13.16
2.	Arka Ananya	4.07	0.32	15.73	2.12	3.28	0.47	13.11
3.	Arka Abhijit	3.98	0.42	15.23	1.92	3.43	0.45	12.73
4.	COTH 2	3.04	0.49	19.34	1.74	3.63	0.38	9.98
5.	Surya	2.89	0.41	20.18	1.98	4.01	0.48	12.89
6.	TSI-48	5.13	0.25	16.76	4.16	2.43	0.79	22.60
7.	Super Samaurai	4.82	0.21	16.13	2.35	2.23	0.58	14.52
8.	Bhoomi-04	4.19	0.44	9.62	3.48	2.70	0.65	17.62
9.	T1224	5.21	0.40	14.22	4.12	2.21	0.70	19.30
10	T1210	3.98	0.34	16.40	3.74	3.33	0.68	18.64
11.	US 2175	5.17	0.36	22.85	2.30	2.97	0.61	15.57
12.	US 1196	5.03	0.33	14.16	3.57	3.43	0.74	20.00
13.	US 618	4.74	0.31	16.37	2.81	2.83	0.62	18.45
14.	Abhinav	4.50	0.42	18.56	1.87	2.25	0.43	13.28
15.	Heem Sohna	4.64	0.34	15.66	4.47	2.23	0.83	25.20
16.	TH 1389	5.19	0.41	16.32	2.66	3.30	0.64	17.26
17.	All Rounder	4.45	0.33	11.92	3.62	2.37	0.72	19.70
18.	Anup	4.98	0.32	15.79	2.98	3.23	0.64	18.72
19.	NS 77	4.02	0.35	14.74	1.65	5.23	0.27	8.55
20.	NS 816	3.31	0.34	19.74	1.54	4.03	0.25	7.84
21.	NS 585	3.35	0.30	17.89	2.89	4.13	0.47	12.64
22.	NP 5024	4.28	0.43	18.14	2.71	2.92	0.56	14.22
SEm±		0.124	0.018	0.421	0.070	0.141	0.015	0.421
CD(p=0.05)		0.363	0.053	1.232	0.206	0.414	0.414	1.234

Average fruit weight was highest in NS 77 (125.83 g) followed by Heem Sohna (100.19 g) which had comparatively less number of fruits per plant thus resulting in higher accumulation of assimilates, which may be a reason for higher fruit weight, due to inverse relationship existing between fruit weight and number of fruits per plant as reported by Supe *et al.* (1989). In this study COTH 2 (63.63) and T 1224 (73.61) which borne highest number of fruits, recorded the lowest average fruit weight of 36.11 g and 55.95 g respectively (Table 3). It is also known that fruits with higher fruit diameter exhibit higher individual fruit weight (Torres, 1987). Fruit length differed significantly among the hybrids which ranged between 4.03 cm (Surya) and 6.68 cm (NS 585). Surya, COTH 2 and NS 816 showed shorter fruit length and it was mainly due to their flattened and round nature of fruits (Arvindkumar *et al*., 2003). Yield per plant differed among hybrids which may be attributed to significant variation in number of fruits per plant and average fruit weight. The highest fruit yield per plant was recorded in hybrid US 618 (5.94 kg/plant) (Table 3), which is attributed to comparatively higher number of fruits per plant and relatively higher average fruit weight. This is in agreement with studies conducted by Sathyanarayana and Reddy (1986). Other hybrids Heem Sohna (4.93 kg/plant), US 1196 (4.72 kg/plant), US 2175 (4.63 kg/plant) also gave significantly higher yields due to higher average fruit weight. Tomato ranks first among processed vegetables in the world. High total soluble solids (TSS) and low acidity are the major factors considered for manufacture of processed products. One percent increase in TSS content of fruits results in 20 per cent increase in recovery of processed product (Berry *et al.,* 1988). From the present investigation, TSI-48 (5.13), US 2175 (5.17), US 1196 (5.03) and Anup (4.98) recorded highest TSS with lower acidity of 0.25percent, 0.36percent, 0.33percent, and 0.32percent, respectively (Table 4). This is an agreement with studies conducted by Sucheta Sharma *et al.,* (2004). Ascorbic acid (Vitamin-C) content was significantly high in US 2175 (22.85 mg/100 g) and low in Bhoomi-04 (9.62 mg/100 g) (Table 4). This was agreement with the findings of Jasmine *et al*.(1993) where they found cultivar difference. Where they reported highest Ascorbic acid in Pusa Ruby (23.4 mg/100 g) and lowest in Punjab Chhouhar (14.50 mg/100 g). Hybrid Heem Sohna recorded highest firmness (4.47 kg/cm^2) followed by TSI-48 (4.16 kg/cm^2). These hybrids recorded relatively higher pericarp thickness (Table 4). This is in agreement with the findings of Imakauea *et al.* (1989). Pericarp thickness was highest in Heem Sohna (0.83 cm) followed by TSI-48 (0.79 cm) where as it was lowest for NS 816 (0.25 cm). Similar results were obtained by Randhawa *et al*.(1988) and Joshi *et al.* (1998). Fruit firmness and pericarp thickness are related to the genotype and not to the number of locules. Higher pericarp thickness and firmness also improves shelf life (Nautiyal and Lal, 1983). Pericarp thickness should be more than 6 mm for transportation and canning (Raina *et al.,* 1980). The hybrid NS 77 (5.23) recorded the highest number of locules per fruit, which was followed by Arka Shreshta (4.23) whereas, the lowest number of locules was recorded for T 1224(2.21). Number of locules ranged form 2.21 to 5.23 (Table 4). Fruits with higher number of locules were oblate in shape. This is in conformity with the findings of Kamimura *et al,* (1985) who reported that in oblate fruits locules was significantly higher than those in the elongated fruit group. Padda *et al*. (1971) reported that fruits with higher locules have more juice content. Keeping quality or shelf life of red ripe tomatoes differed significantly among hybrids. The highest shelf life of 25.20 days was recorded in Heem Sohna (Table 4), followed by TSI-48 (22.60) US 1196 (20.00) and All Rounder (19.70). It is mainly due to their high pericarp thickness and firmness. This is agreement with Jitender Kumar (2005). Kanwar (2004) reported that the pear shaped tomato cultivars are preferred over round shaped, because of longer keeping quality and are better suited for canning and processing purposes. Nautiyal and Lal (1983) and Yadav *et al*.(1992) reported that pericarp thickness and firmness are important characters that give ideal storage behaviour of the fruits. From an overall view of results, it can be inferred that the hybrids US 618, Heem Sohna, and US 1196 were high yielding and good for fresh marketing. For the purpose of processing hybrids US 1196, T 1224 TSI-48, Anup and Super Samaurai, were found suitable. Hence, these hybrids can be recommended as better hybrids for commercial cultivation in Eastern Dry Zone of Karnataka in *karif* season.

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