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Performance of Advanced Tomato (*Solanum lycopersicum* L.) Lines for Different Yield Traits in Northern Dry Zone of Karnataka

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Abstract Twenty tomato advanced lines, with a check variety (Megha), were evaluated during *kharif*, 2014 in the Northern Dry Zone (Zone 3) of Karnataka to study the yield performance of advanced tomato lines in northern dry zone of Karnataka. The analysis of variance indicated significantly higher amount of variability among the genotypes for all the 17 characters studied. The advanced line DTR-7 had shown highest number of flowers per cluster. DTR-3 was earliest to first flowering and 50% flowering and highest number of fruits per cluster. Therefore DTR-3 is superior performer as concern to yield in the northern dry zone of Karnataka.

Keywords Yield traits, Yield, Advanced lines, Tomato.

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Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important, popular and extensively used vegetable as fresh fruit (Toor and Savage 2005) which belongs to the family Solanaceae. It is widely grown all over the world (mainly tropics and subtropics). Tomato is the world's largest grown vegetable crop after potato and onion. It is universally treated as protective food. Tomato forms an essential part of human diet. It is an important source of vitamin A and C as well as minerals and carotenoids. Among the carotenoids, lycopene is a powerful antioxidant which is synthesized in tomato. As reported by WH Foods (2013), lycopene has many human health benefits as it reduces the risks of nervous system problems, heart disease, cancer and obesity. It is reported by many researchers that lycopene has potential human health benefits. Lycopene prevents skin disease induced by UV-light (Aust et al. 2003). Lycopene protects from various cancers and cardiovascular disease (Teta et al. 2005) also. As reported by Giovannucci (2002), high

Table 1. Analysis of variance for different characters of advanced tomato lines. *Significant at 5% probability level, **Significant at 1% probability level.

Sl. No.	Characters	Replication	Genotypes	Error	SEm ±	CD @ 1%	CD @ 5%
1	Plant height (cm)	5.94	190.55*	68.20	5.901	–	17.40
2	No. of primary branches	1.52	1.62**	0.46	0.50	1.93	1.41
3	Stem thickness (cm)	0.019	0.065**	1.011	0.074	0.323	0.232
4	Days to first flowering	50.38	25.83*	11.83	2.43	–	7.19
5	Days to 50% flowering	841.52	62.51**	14.32	2.67	10.56	7.89
6	No. of flowers per cluster	3.72	1.92**	0.32	0.404	1.62	1.187
7	No. of fruits per cluster	0.27	0.96**	0.059	0.16	0.694	0.507
8	Per cent fruit set	193.80	62.84**	16.45	2.86	11.54	8.46
9	No. of fruits per plant	197.16	276.05**	10.36	2.22	8.963	6.57
10	Average fruit weight (g)	80.95	184.06**	20.49	3.2	12.87	9.44
11	Shape index	0.004	0.023**	0.0009	0.067	0.086	0.068
12	Dry matter content (%)	9.81	29.37**	1.06	0.72	2.93	2.15
13	Pericarp thickness (mm)	0.002	0.014**	0.0003	0.038	0.054	0.031
14	Fruit firmness (kg/cm^2)	0.184	0.237**	0.017	0.094	0.376	0.273
15	TSS (^{o} Brix)	0.073	0.251**	0.005	0.06	0.21	0.16
16	Shelf life	237.19	121.75**	1.26	0.268	3.19	2.347
17	Fruit yield per plant (g)	3010	5617**	5238	161.8	651.1	477.4

tomato or lycopene consumption reduces the risk of prostate cancer. Tomato (*Solanum lycopersicum* L.) is one of the important crops used as a fresh vegetable as well as in a variety of processed products such as ketchup, sauce, juice, puree, pasta sauce, salsa, tomato-based powders, sun-dried tomatoes, curries and ready-to-eat products. On a global scale, more than 163 million tonnes (MT) of tomatoes were produced in 2014, or about 15% of total global vegetable production. In 2012, tomato production had a net value of US$59 billion, the eighth most valuable agricultural product worldwide, Global fresh tomatoes exports totaled US$8.4 billion in 2015. Global tomato production has increased by nearly 40% since 2002. FAO statistics show that the increase has been distributed evenly across the top 10 producing countries. While China is the leading producer with a share of 31%, India has consistently produced more tomatoes than third-ranked USA since 2008 with global share of 11% of production (Anonymous 2014). Thus, tomatoes are an important crop for both the farmer and the consumer in India. Amongst vegetable crops, tomato ranks third in priority after potato and onion in India as reflected in the tonnage produced. With an estimated production of 19.4 MT, India ranks second behind China in tomato production as well as in the area planted to the crop. Trends in tomato production in India show a strong expansion of production since 2010 largely due to an expansion in the area under cultivation in view of increasing market demand and a differential higher rate of return for farmers as compared with other crops. Karnataka is the second largest tomato producing state after Andhra Pradesh and accounts for 11.4% of total production. The State produced 2.07 MT of tomatoes from a cultivated area of about 61,000 ha. Karnataka's tomato productivity average is estimated at 34 tonnes/ha, the highest achieved amongst leading Indian tomato producing states. Kolar district produces some 28% of total state tomato production while Belgaum, Haveri and Mandya districts each have a share of between 8–10%. Irrigation remains a critical bottleneck for growers in several districts. Access to markets has also encouraged growers to cluster around the central and southern districts. Though quality of the fruit is important for consumption it is mainly influenced by different traits. The plants which shows good yield attributed characters viz., days to first flowering, days to 50% flowering, number of flowers per cluster, number of fruits per cluster gives highest yield and superior quality fruits. So this present investigation done to check performance of advanced tomato (*Solanum lycopersicum* L.) lines in northern dry zone of Karnataka.

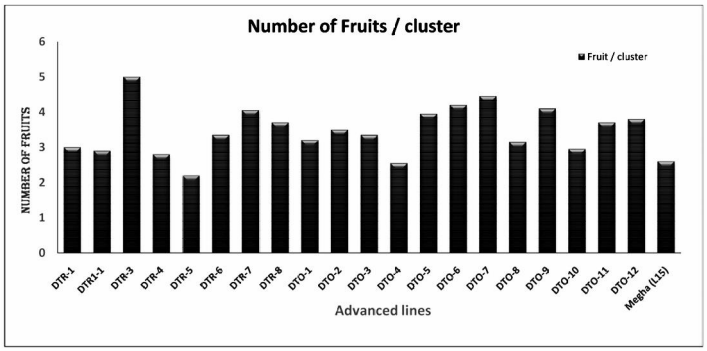

Fig. 1. Number of fruits per cluster of different advanced tomato lines.

Materials and Methods

A field experiment was conducted during *kharif*, 2014 at Regional Horticultural Research and Extension Center (RHREC), University of Horticultural Sciences, Bagalkot, situated in the Northern Dry Zone (Zone 3) of Karnataka. It is located at 75° 42´ East longitude and 16° 10´ North latitude at an altitude of 542 m above Mean Sea Level (MSL). The total rainfall of 249.5 mm was received in 17 rainy days during crop growth period from August to December 2014. Mean maximum and minimum relative humidity were 78.79 and 60.87%, respectively. The mean maximum temperature was 31.25°C and the mean minimum temperature was 19.75°C. The soil of the experimental area was sandy loam having good physical and chemical properties. Tomato seeds were sown in pro-trays filled with cocopeat growing media. Recommended cultural practices and plant protection measures (drenching with Dithane M-45 2 g/l two times) were carried out to raise healthy seedlings. Five plants were tagged at random in each replication and observations were recorded on growth parameters. Treatments of the experiment involved advanced lines (The pre-released genotypes have been developed by the plant breeder for use in modern scientific plant breeding and are under pipeline to release to farmers). Such 20 advanced lines of tomato viz., DTR-1, DTRI-1, DTR-3, DTR-4, DTR-5, DTR-6, DTR-7, DTR-8, DTO-1, DTO-2, DTO-3, DTO-4, DTO-5, DTO-6, DTO-7, DTO-8, DTO-9, DTO-10, DTO-11, DTO-12 from Horticultural Research Station, Haveri (Devihossur) with Megha, a variety released by UAS, Dharwad as check constituted 21 treatments for the present investigation. Randomized complete block design was adopted with two replication with 20 plants in each replication. The experimental data collected were statistically analyzed using Fisher's method of Analysis of variance as outlined by Sundararaj et al. (1972). Number of days taken from transplanting to first flower initiation and 50% flowering was recorded for all the genotypes. Two clusters per plant were taken at random for five tagged plants and number of flowers in each cluster were counted at full bloom. Then, the average number of flowers per cluster was calculated (the clusters selected were tagged for counting the fruits). From the tagged clusters total number of fruits set per cluster were counted and the average number of fruits per cluster was worked out.

Results and Discussion

Result from analysis of variance showed highly significant difference among the genotypes ($p < 0.0001$) for the characters evaluated (Table 1). Similar findings were reported by Pradeep kumar et al. (2001) and Fekadu et al. (2003) for the tomato characters studied. Genotypes included for the precent study differed significantly with respect to days for first flowering. DTR-3 was found to be the earliest (32 days) followed by DTO-9 (33 days) similar to results of Yvonne et al.

Table 2. Days to first flowering, days to 50% flowering, number of flowers per cluster and number of fruits per cluster of different advanced tomato lines. *Significant at 5% probability level.

Sl. No.	Treatments	Days to first flowering	Days to 50% flowering	Flower/ cluster	Fruit/ cluster
1	DTR-1	38.5	43.0	6.05	3.00
2	DTR $_{1-1}$	38.5	43.0	5.10	2.90
3	DTR-3	32.0	41.5	7.45	5.00
4	DTR-4	40.0	42.0	5.05	2.80
5	DTR-5	39.5	43.0	5.85	2.20
6	DTR-6	39.5	42.0	6.80	3.35
7	DTR-7	42.0	51.5	8.00	4.05
8	DTR-8	42.0	54.0	7.30	3.70
9	DTO-1	39.5	55.0	5.45	3.20
10	DTO-2	39.5	53.0	6.15	3.50
11	DTO-3	41.5	54.0	6.50	3.35
12	DTO-4	50.0	56.0	6.10	2.55
13	DTO-5	39.5	52.5	7.80	3.95
14	DTO-6	39.5	42.5	7.80	4.20
15	DTO-7	45.0	51.5	7.62	4.45
16	DTO-8	39.5	51.5	6.15	3.15
17	DTO-9	33.0	42.5	7.75	4.10
18	DTO-10	39.5	41.5	6.75	2.95
19	DTO-11	38.5	42.0	7.25	3.70
20	DTO-12	39.5	44.5	7.65	3.80
21	Megha (L 15)	38.5	42.0	5.25	2.60
	F test	*	*	*	*
	SEm	243	2.67	0.404	0.16
	CD (0.05)	7.19	7.89	1.187	0.507
	CV (%)	8.67	8.04	8.558	7.048

(2013). DTO-4 was the only genotype to flower significantly late (50 days) over Megha, and all the rest were on par. In the present study involving 21 genotypes, wide variation and significant differences were found with regard to days for 50% flowering after transplanting. DTR-3 was found to be the earliest in 41.5 days followed by DTO-`10 (41.5 days) and Megha (42.0 days). The earlier findings Alam et al. (2014) are in line with the present findings. In DTR-4, DTR-6 and DTO-11 also days for 50% flowering was 42.0 days. DTO-4 took maximum number of days (56.0 days). Number of flowers per cluster varied significantly among genotypes. The maximum number of flowers per cluster was recorded in DTR-7 (8.00), followed by DTO-5 (7.8) and DTO-6 (7.8) which were significantly superior over the check which had 5.25 flowers per cluster. However, other lines like DTO-9, DTO-12, DTO-7, DTR-3, DTR-8, DTO-11, DTR-6 and DTO-10 were also on par with the DTR-7. The minimum number of flowers per cluster (5.05) was in DTR-4. The only two genotypes having lesser flowers per cluster than the standard check were DTR1–1 (5.1) and DTR-4 (5.05). The results of Singh et al. (2014) are in agreement with the obtained results.

The difference among the genotypes with respect to number of fruits per cluster was significant. Maximum number of fruits per cluster (5.00) was recorded in DTR-3 followed by DTO-7 (4.45) the results were in accordance with earlier reports of Deepa and Thakur (2008). Megha had 2.6 fruits per cluster. Four genotypes were on par with Megha viz., DTR-1, DTO-10, DTRI-1 and DTR-4, whereas 14 advanced lines were observed significantly superior over the check. The least number of fruits per clusters were in DTR-5 (2.2) and DTO-4 (2.55) which were on par with Megha, the check. Hence with all these results, the advanced line DTR-3 was found to be superior in yield attributed characters viz., days to first flowering, days to 50% flowering and the most important character is highest number of fruits per cluster which contributed to highest yield.

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