

## Vegetative Performance of Advanced Tomato (*Solanum lycopersicum* L.) Lines in Northern Dry Zone of Karnataka

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**Abstract** Twenty tomato advanced lines, with a check variety (Megha), were evaluated during *kharij*, 2014 to study the vegetative 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-3 showed highest plant height, stem thickness, number of primary branches and secondary branches at all the stages studied viz., 40DAP, 90 DAP and final harvest respectively when compare to the check variety Megha, where as DTO-4 had lower plant height and number of secondary branches. Least stem thickness and number of primary branches found by the line DTO-12. Therefore

DTR-3 is superior performer as concern to vegetative growth in the northern dry zone of Karnataka.

**Keywords** Vegetative, Plant height, Primary branches, Advanced lines, Tomato.

### Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important, popular and extensively used vegetable as fresh fruit [1] 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 in WH Foods [2], 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 ben-

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**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**	0.011	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 <sup>2</sup> )	0.184	0.237**	0.017	0.094	0.376	0.273
15	TSS (°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

efits. Lycopene prevents skin disease induced by UV-light [3]. Lycopene protects from various cancers and cardiovascular disease [4] also. As reported by Giovannucci [5], high 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, sundried 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 [6]. 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 vegetative growth of the plant. The plants which shows optimum vegetative growths viz., plant height, stem thickness, primary branches and secondary branches, gives highest yield and superior quality fruits. So this present investigation done to check vegetative performance of advanced tomato (*Solanum*

*lycopersicum* L.) lines in northern dry zone of Karnataka.

### Materials and Methods

A field experiment was conducted during *khariif*, 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 coco-peat 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, DTR 1-1, 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 replications 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. [7]. Plant height was taken at 45, 90 days after planting (DAP) and also at the time of final picking, and expressed in centimeters. Average stem thickness was taken with the help of vernier calipers at 45, 90 DAP and at the time of final picking and ex-

pressed in centimeters. Total number of primary branches per plant were counted at 45, 90 DAP and also at final picking. Total number of secondary branches per plant arising from primary were counted at 45, 90 DAP and also at final picking.

### 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 earlier [8, 9] for the tomato characters studied.

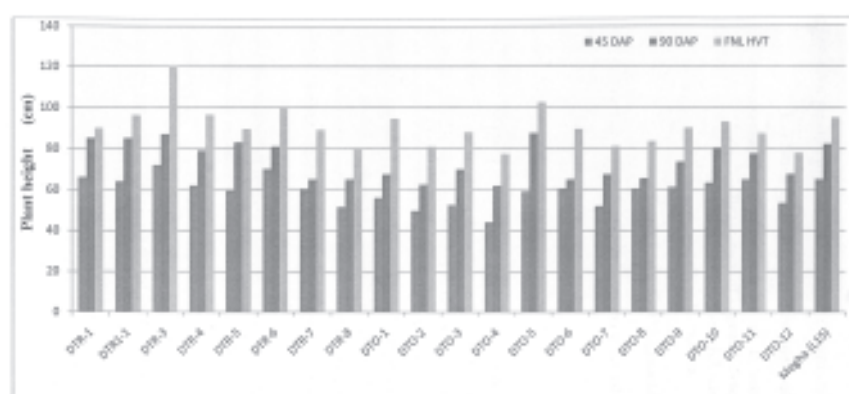
Within the genotypes highest plant height (Table 2 and Fig. 1) was observed in DTR-3 both at 45 DAP (72 cm) as well as at final harvest (120 cm) except at 90 DAP, whereas DTO-4 had recorded the significantly lowest plant height at all the stages of growth studied. However, at final harvest only DTR-3 was found significantly superior over Megha, the check. Among the twenty one genotypes evaluated, significant difference was found with respect to stem thickness (Table 2). Even for stem thickness the genotype DTR-3 was found significantly superior over check at both stages 45 DAP (1.26 cm) and final harvest (2.14 cm) of growth. Significantly least stem thickness was recorded in DTO-12 at all the stages of growth. At final harvest, only two genotypes (DTR-3 and DTR-4) were found to record better thickness than Megha and rest (18 genotypes) were of lower stem thickness. Significant differences were observed among the genotypes with respect to number of primary branches per plant (Table 2). The maximum number of primary branches per plant were observed in DTR-3 at all the growth stages (10.00, 11.5 and 11.8 at 45 DAP, 90 DAP and at final harvest, respectively). The second best line to record more branches at final harvest was DTO-6 (11.6 cm). Least number of branches at 45 DAP (3.9) and both at 90 DAP and at harvest were noticed in DTO-12. The difference among lines was significant with respect to number of secondary branches per plant (Table 2) also. Secondary branches per plant were more at early stage in DTR-1 but at later stages DTR-3 registered the significantly highest branches (32.0 and 38.6 at 90 DAP and at final harvest, respectively). DTR-1, DTR-4, DTR-5, DTO-7, DTO-

**Table 2.** Plant height , stem thickness, primary branches and secondary branches of different advanced tomato lines at 45 DAP, 90 DAP and at final harvest.

Sl. No.	Treatments	Plant height (cm)			Stem thickness (cm)			Primary branches			Secondary branches		
		45 DAP	90 DAP	Final harvest	45 DAP	90 DAP	Final harvest	45 DAP	90 DAP	Final harvest	45 DAP	90 DAP	Final harvest
1	DTR-1	66.1	85.0	89.8	1.02	1.50	1.70	6.8	9.7	9.9	12.0	20.0	32.0
2	DTR	64.0	85.0	96.2	1.10	1.60	1.86	7.6	10.2	10.6	8.4	14.0	24.0
3	DTR-3 <sup>1-1</sup>	72.0	87.0	120.0	1.26	1.85	2.14	10.0	11.5	11.8	11.4	32.0	38.6
4	DTR-4	62.1	79.0	96.5	1.04	1.85	1.95	7.5	10.6	10.6	9.6	18.0	28.4
5	DTR-5	59.7	83.0	89.5	0.94	1.30	1.69	5.8	9.7	9.9	9.7	18.0	29.6
6	DTR-6	70.1	81.0	99.5	1.12	1.60	1.74	6.4	10.5	10.7	7.6	15.0	24.6
7	DTR-7	60.5	65.0	89.0	0.83	1.30	1.54	5.4	9.8	10.0	8.2	19.0	25.1
8	DTR-8	51.7	65.0	80.0	0.72	1.25	1.45	6.4	10.2	10.6	7.4	15.0	20.6
9	DTO-1	56.0	67.5	94.5	0.88	1.55	1.66	6.0	10.1	10.5	7.1	15.0	20.6
10	DTO-2	49.6	62.5	81.0	0.78	1.45	1.65	5.5	10.4	10.8	8.6	18.0	25.7
11	DTO-3	52.6	70.0	88.0	0.89	1.50	1.75	5.7	10.5	10.7	8.8	18.0	26.4
12	DTO-4	44.1	62.0	77.3	0.89	1.30	1.58	4.0	8.2	8.5	6.8	13.0	16.4
13	DTO-5	59.2	87.5	102.5	0.95	1.57	1.70	5.0	10.7	10.9	8.5	17.0	22.2
14	DTO-6	60.7	65.0	89.5	0.97	1.45	1.66	7.1	11.4	11.6	7.8	14.0	22.4
15	DTO-7	52.1	67.5	81.0	0.85	1.40	1.57	5.4	9.4	9.6	10.8	23.0	29.6
16	DTO-8	60.6	65.5	83.5	0.91	1.20	1.51	5.4	9.6	9.8	8.7	17.5	23.9
17	DTO-9	61.3	73.5	90.0	0.92	1.30	1.52	4.8	10.0	10.4	10.5	13.0	20.5
18	DTO-10	63.4	80.0	93.0	0.92	1.35	1.51	5.7	10.1	10.2	10.9	22.0	30.7
19	DTO-11	64.9	77.5	87.3	1.02	1.40	1.48	5.9	8.6	8.8	9.2	21.0	31.4
20	DTO-12	53.4	67.5	77.7	0.66	1.10	1.40	3.9	8.2	8.5	11.2	20.0	32.4
21	Megha (L15)	64.9	82.0	95.0	1.07	1.65	1.87	8.4	11.2	11.4	9.6	17.0	23.6
	<i>F</i> test	*	*	*	*	*	*	*	*	*	*	*	*
	SEm	4.43	4.31	5.901	0.059	0.077	0.074	0.284	0.518	0.50	0.628	0.918	1.41
	CD (0.05)	13.07	12.18	17.40	0.123	0.240	0.232	0.836	1.527	1.41	1.864	2.705	4.18
	CV (%)	10.53	7.87	9.224	6.493	7.870	6.907	6.550	7.318	6.610	9.727	7.173	7.68

10, DTO-11 and DTO-12 recorded significantly higher number of secondary branches than the check.

Check variety Megha had 9.6, 17 and 23.6 number of secondary branches per plant at 45 DAP, 90 DAP

**Fig. 1.** Plant height of different advanced tomato lines at 45 DAP, 90 DAP and final harvest stage.

and at harvest, respectively. Both, at early (6.8) and at harvest (16.4) DTO-4 had the significantly lowest number of secondary branches per plant.

Finally the investigation revealed that the advanced line DTR-3 showed highest plant height, stem thickness, number of primary branches and secondary branches at all the stages studied viz., 40DAP, 90 DAP and final harvest stage respectively when compare to the check variety Megha, Where as DTO-4 had lower plant height and number of secondary branches. Least stem thickness and number of primary branches found by the line DTO-12. Therefore DTR-3 is superior performer as concern to vegetative growth in the northern dry zone of Karnataka.

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