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# Performance of Advanced Tomato (*Solanum lycopersicum* L.) Lines for Different Fruit Characters 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 DTO-4 had shown highest average fruit weight and highest polar diameter when compare to other lines and also it had shape index of greater than 1.25 that resembles oval shape. DTO-7 was highest in transverse diameter. Therefore DTO-4 is superior performer as concern to fruit characters in the northern dry zone of Karnataka.

**Keywords** Fruit characters, Advanced lines, Tomato, Performance.

## 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 also (Teta et al. 2005). As reported by Giovannucci (2002), 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, 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 to-

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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 ($kg/cm^2$) | 0.184 | 0.237** | 0.017 | 0.094 | 0.376 | 0.273 |
| 15 | TSS ($^0$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 |

mato 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 fruit characters viz., average fruit weight, polar diameter of fruits, transverse diameter of fruits and shape index of fruits shows superior quality fruits. So this present investigation done to check performance of advanced tomato (*Solanum lycopersicum* L.) lines in northern dry zone of Karnataka.

## 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

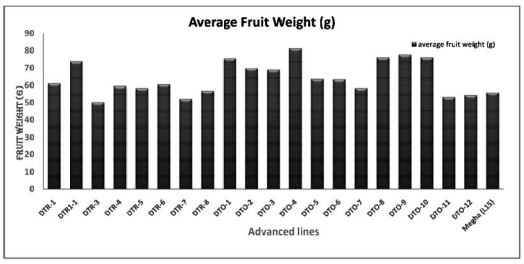


**Fig. 1.** Average fruit weight of different advanced tomato lines.

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 2g/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, DTR1-1, 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. (1972). The average weight of five fruits was recorded and expressed in grams. Polar diameter of five fruits was recorded with the help of vernier calipers and average was calculated and expressed in centimeters. Average transverse diameter of five fruits was calculated with the help of vernier calipers and expressed in centimeters. Ratio of random five fruits polar diameter (cm) and transverse diameter (cm) was taken to calculate shape index.

**Table 2.** Average fruit weight, polar diameter, transverse diameter and shape index of different advanced tomato lines. Significant at 5% probability level.

| Sl. No. | Treatments | Average fruit weight (g) | Polar diameter (cm) | Transverse diameter (cm) | Shape index |
|---|---|---|---|---|---|
| 1 | DTR-1 | 61.15 | 5.00 | 4.68 | 1.03 |
| 2 | DTR$_{-1}$ | 74.00 | 4.76 | 4.40 | 1.02 |
| 3 | DTR-3 | 50.22 | 4.24 | 4.51 | 0.94 |
| 4 | DTR-4 | 59.60 | 4.45 | 4.34 | 1.03 |
| 5 | DTR-5 | 58.40 | 4.58 | 4.49 | 1.01 |
| 6 | DTR-6 | 60.58 | 4.97 | 4.78 | 1.04 |
| 7 | DTR-7 | 52.20 | 4.38 | 4.41 | 0.99 |
| 8 | DTR-8 | 56.80 | 4.71 | 4.63 | 1.07 |
| 9 | DTO-1 | 75.60 | 5.38 | 4.46 | 1.20 |
| 10 | DTO-2 | 69.80 | 5.72 | 4.79 | 1.15 |
| 11 | DTO-3 | 69.00 | 5.60 | 4.73 | 1.18 |
| 12 | DTO-4 | 81.40 | 6.10 | 4.53 | 1.34 |
| 13 | DTO-5 | 63.60 | 5.42 | 4.59 | 1.09 |
| 14 | DTO-6 | 63.42 | 5.40 | 4.69 | 1.14 |
| 15 | DTO-7 | 58.40 | 6.06 | 5.31 | 1.06 |
| 16 | DTO-8 | 76.20 | 5.79 | 4.58 | 1.27 |
| 17 | DTO-9 | 77.80 | 5.84 | 4.54 | 1.28 |
| 18 | DTO-10 | 76.20 | 5.87 | 4.68 | 1.24 |
| 19 | DTO-11 | 53.30 | 5.45 | 4.93 | 1.07 |
| 20 | DTO-12 | 54.40 | 4.95 | 4.39 | 1.10 |
| 21 | Megha (L 15) | 55.80 | 4.43 | 4.41 | 0.96 |
| | F test | * | * | * | * |
| | SEm | 3.2 | 0.031 | 0.06 | 0.067 |
| | CD (0.05) | 9.44 | 0.164 | 0.18 | 0.068 |
| | CV (%) | 7.05 | 1.527 | 1.91 | 2.683 |

## 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 Pradeepkumar et al. (2001) and Fekadu et al. (2003) for the tomato characters studied. For average fruit weight significant difference was observed among the genotypes (Table 2 and Fig. 1). Fruits of DTO-4 had maximum weight (81.40 g) while fruits of Megha weighed 55.8 g similar results also found by Dudi and Sanwal (2004). In addition to this DTO-4 other 8 advanced lines had significantly higher fruit weight than Megha. The minimum aver-

age fruit weight was noticed in DTR-3 (50.22 g). Among the different genotypes significant differences were observed with respect to the polar diameter of fruits (Table 2). The maximum polar diameter of the fruit was recorded in DTO-4 (6.10 cm) followed by DTO-7 (6.06 cm). Most of the advanced lines had significantly more polar diameter than Megha (4.43 cm) (Alam Patwary et al. 2014) also in the same line. The only line which had significantly lower polar diameter (4.24 cm) than standard check, Megha was DTR-3. Even for transverse diameter of fruits genotypes varied significantly among themselves (Table 2). The significantly higher transverse diameter of the fruit was recorded in DTO-7 (5.31 cm) followed by DTO-11 (4.93 cm) when compared to Megha (4.41 cm). Other seven lines were also on par with these superior lines. None of the lines had significantly lowest transverse diameter than Megha similar results also found by Alam Patwary et al. (2014) although DTO-4 had least value (4.34 cm) for this trait. The difference among treatments varied significantly with respect to shape index (Table 2). The shape index was less than 1 for DTR-7 (0.99), Megha (0.96) and DTR-3 (0.94). Thus, the fruits of these lines were flat round or round. Fruits of DTR-5 (1.01), DTR-1 (1.02), DTR-1 (1.03), DTR-4 (1.03) having shape index of 1 are very near to perfect round. The lines having shape index of more than 1.25 (DTO-4, DTO-9 and DTO-8) may be definitely considered as oval shaped similar findings also noted by Regassa et al. (2012).

The present concept of research is to provide a variety which is better in quality in addition to yield. The quality attributes (average fruit weight, polar diameter of fruits, transverse diameter of fruits and shape index) and their improvement, is the need of the hour for processing tomatoes. Among 21 advanced lines, advanced line DTO-4 had shown highest average fruit weight and polar diameter when compare to other lines and also it had shape index of greater than 1.25 that resembles oval shape. DTO-7 was highest in transverse diameter. Therefore DTO-4 is superior performer as concern to fruit characters in the northern dry zone of Karnataka.

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