

EVALUATION OF ELITE TOMATO CULTIVARS UNDER THE AGRO-CLIMATIC CONDITIONS OF DERA ISMAIL KHAN

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An experiment was conducted to evaluate the performance of 11 tomato cultivars under the agro-climatic conditions of Dera Ismail Khan. The trail was laid out in Randomized Complete Block Design (RBCD) with three replications. Data were collected on different parameters including days to flowering, days to fruiting, stem diameter, fruits per plant, fruit weight, fruits per cluster, fruit length, fruit diameter, yield per plot (kg) and yield per hectare (tons). The results indicated that tomato cv. Vegnesh and Nandi took the minimum days to flowering and fruiting. Maximum stem diameter was reported in Vegnesh. Maximum number of fruits per cluster and fruit length was obtained in cv. Jyothi and Vegnesh. Maximum number of fruit per plant, weight of fruits per plant, fruit diameter, yield per plot (Kg) and yield per hectare (tons) was recorded in cv. 131 and Vegnesh. It was recommended that tomato cvs. Vegnesh, 131 and Jyothi performed well under the agro-climatic conditions of Dera Ismail Khan.

Keywords: *Lycopersicon esculentum*, cultivars, fruit weight, fruit length, fruit yield.

INTRODUCTION

The tomato (*Lycopersicon esculentum*) belongs to Solanaceae or nightshade family. The cultivated tomato is relatively recent addition to the world's important food crops, with the past century it has become one of the most popular and widely consumed vegetable crop (Tigchelaar, 1986). It is one of the most common and popular vegetable, used in Pakistan. Although there has been a progressive increase in its production and area under cultivation in Pakistan (Anonymous, 2006), but its production in Pakistan is far more low as compared to the other countries. There are many factors responsible for its low production including lack of technical knowledge, weed infestation, non-availability of high yielding and insect and disease resistant cultivars, non-availability of timely nutrients etc. Amongst the other important factors, non-availability of high yielding cultivars is one of the main constrains. Our farmers are still using the old traditional cultivars, but to enhance tomato production and farmer's income, they have to import some other high yielding tomato cultivars. Petrakis and Fanourakis (1980) reported that the cultivars Red Balloon, Westland bird, Primmet and MM-Milo 70 followed by Money Maker, Sonato, Hollandbrid, Stacos, MM-Nova and Moase showed a tendency to give higher yields. Mazkoo (1994) found that Tobol and Chef PS cultivars had the highest yield and marketable fruits and can be selected as the best cultivars. Chaudary *et al.* (1999) evaluated Roma, Chico III and Tanja as the most promising tomato cultivars producing yield of

30.1, 27.9 and 27.0 t/ha, respectively. Deouk *et al.* (2000) observed that at harvest, fruit set, fruit fresh weight and fruit yield per plant were the highest in cv. Arafat and the lowest in cv. Super Strain-B. Tomato cv. Chico yielded the highest number of fruits/plant (52.50), fruit size was maximum in Tanja (6.90 cm), whereas Roma and Mar-globe produced the highest yield (9218.75 and 9140.75 kg/ha, respectively (Rahman *et al.*, 2000). Hussain *et al.* (2001) reported that cultivar Tanja produced maximum fruit weight per plant (1.55kg) and gave the highest yield of 41.45 t/ha, followed by Chico and Sorrento which exhibited average yields of 40.32 and 39.13 t/ha, respectively. Hussain *et al.* (2002) reported significant differences for time required to flowering, fruit ripening, yield/plant and yield ha⁻¹ for different tomato cultivars. They also observed that cvs. Marmande TMV and Marmande out yielded other cultivars with 64.29 and 62.99 t ha⁻¹, respectively. Tomato cvs. Parana and Turquesa matured earlier taking 95.25 and 98.75 days, respectively. The cultivar Turquesa with maximum fruit weight plant⁻¹ exhibited the highest yield of 20.45 kg m⁻², respectively (Khokar *et al.*, 2002). Hossain *et al.* (2004) reported that tomato variety BARI 7 produced the highest yield (57.02 t/ha) and BARI 5 produced the lowest yield (51.38 t/ha). Neeraja *et al.* (2004) evaluated seven promising tomato cultivars and found that DT-39 was the earliest to flower (53.5 days), HYT-1 recorded the highest fruit yield of 41.05 t/ha which was at par with that of Selection-7 (35.31 t/ha) and RHRT-33-1 recorded the longest shelf life (15 days), followed by RHRT-6-1(14 days). Hamid *et al.* (2005)

reported that maximum plant height and size of fruit was observed in variety Raickoi Naclazdenie, where as maximum number of flower clusters and fruits per plant were observed in 'Paths'. Ceberckoi Ckorocpelai and Patris gave maximum fruit weight of 4.96 and 4.85kg/plant. They also recommended Patris and Ceberckoi Ckorocpelai as tomato commercial varieties due to high production. Solis *et al.* (2006) studied significant variations among the tomato cultivars in terms of fruit number per plant, weight and yield, with cultivars Mariela, Amalia and INIFAT-28 recording the highest values for the parameters measured. Zahoor *et al.* (2006) evaluated three tomato lines along with a local cultivar in Swat, Pakistan. The survival percentage of the different lines was non- significant. The maximum days to flowering (58.33) were recorded in TT 0202 and the minimum in TT 0302 (51.33), TT 0302 took the minimum days (90.33) to ripening from transplanting, while TT0202 took the maximum days (102.00). Number of flowers per cluster were the highest in TT0202 (5.83) and TT0102 (5.54), and the lowest in Swat local (4.25). The maximum fruit set per cluster (71.62%) was recorded in Swat local, while the minimum (32.12%) fruit set was recorded in TT0202. Plant height was maximum (81.67 and 77.33 cm) in TT0302 and Swat local, respectively, while it was minimum (71.75 cm) in TT0202. Number of fruits/kg was high (24.331) in Swat local and low (13.33) in TT0302. The highest yield (24.17 t/ha) was recorded in TT0302 and the lowest (12.50t/ha) in Swat local, TT0302 is recommended for high yield. Tomato performance has also been different under rain fed and irrigated conditions (Agele *et al.*, 2011). Keeping in view the importance of tomato the present research project was undertaken to evaluate some tomato cultivars for their yield potential under the agro-climatic conditions of Dera Ismail Khan.

MATERIAL AND METHODS

The research work was conducted at Agriculture Research Institute Ratta Kulachi, Dera Ismail Khan (situated at 31.8167°N and 70.9167°E) during the Kharif season, 2007. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications in plots of 6 m² size under open field conditions. The mean monthly temperature and rainfall is mention in Table 1. The eleven exotic tomato varieties including Jyothi, TM-532.et, 131, Sorya-66, Mrutyam-Jaya-2, Magnit, Naina, Nandi, Vegnesh, Jayam and Nema-1200 were tested for their morphological and agronomical characteristics. Nursery bed was prepared by mixing farmyard manure at the rate of 20t/ha in soil one month prior to sowing. Seedlings of same age and size were transplanted on beds with row x row distance 1 m and plant x plant distance 30 cm. Fertilizer was applied at the rate of 80kg/ha P₂O₅, 40kg/ha K and 100kg/ha N; the full doze of potash and phosphorus and half dose of nitrogen was applied

at transplanting, whereas the second half dose was applied after one month of transplanting. Irrigation was applied immediately after transplanting.

Table 1. Meteorological parameters recorded during the trial period at Dera Ismail Khan

Months	Monthly mean temperature (°C)		Monthly Rainfall (mm)
	Minimum	Maximum	
May 2007	23	41	5.0
June 2007	27	41	41.5
July 2007	27	39	100.0
August 2007	27	39	3.0
September 2007	24	32	52.0

The parameters which were studied during the course of study were days taken to flowering, days taken to fruit set, number of leaves/plant, stem diameter (cm), number of fruits/plant, fruit weight per plant (kg), fruit length (cm), fruit diameter (cm), number of seeds/10 fruits, yield per plot (kg) and yield per hectare (tons) and it was calculated by using the following formula:

$$\text{Yield per ha.} = \frac{\text{Yield per plot (kg)} \times 10,000}{6 \times 1000}$$

The data of all the above mentioned parameters were individually subjected to the analysis of variance techniques (Steel *et al.*, 1997). Subsequently, the significant means were separated by the Least Significant Difference test by using the MSTATC computer program.

RESULTS AND DISCUSSION

Days taken to flowering: The data showed that maximum days to flowering (58.33) were recorded in cv. 131, closely followed by Mrutyum and TM-532-et with 55.67 and 53.67 days to flower, respectively (Table 2). All these three cultivars were statistically non-significant to each other. Significantly similar results were recorded in Naina, Nema-1200, Magnit and Sorya-66 by taking 50.67, 50.33, 45.00 and 44.33 days to flowering, respectively. The least days to flowering (37) were recorded in Nandi followed by Vegnesh with 39 days. Earlier flowering is considered as positive character of a variety as it would bear flowers and fruits much earlier. The results showed that Nandi and Vegnesh flowered earlier than the rest of the cultivars. Neeraja (2004) reported that DT-39 was the earliest to flower and took 53.5 days to flower. Also similar results had been reported by Zahoor (2006) stating that the cv.TT0302 took (51.33) days to flower.

Days taken to fruiting: The data pertaining the days taken to fruiting is shown Table 2. The results depicted that maximum days taken to fruiting were taken by Nema-1200, Mrutyum and Naina with 26.67, 26.33 and 26.00 days, respectively. All these three cultivars were statistically at par

Table 2. Performance of different tomato cultivars under agro-climatic conditions of Dera Ismail Khan

Cultivars	Days taken to flowering	Days to fruiting	Stem diameter (mm)	Fruits per plant	Fruit weight per plant	Fruits per cluster
Jyothi	43.33 bcd	18.67 abc	12.38 bc	21.0 c	2.00 c	4.4 a
TM-532-et	53.67 abc	20.33 abc	10.81 cd	27.6 b	2.51 b	3.8 b
131	58.33 a	16.67 bc	12.46 bc	39.1 a	3.55 a	2.8 d
Sorya-66	44.33 a-d	23.67 ab	14.05 ab	28.6 b	2.60 b	3.0 c
Mrutyum-Jaya-2	55.67 ab	26.33 a	10.97 cd	19.5 c	1.77 c	3.0 c
Magnit	45.00 a-d	19.67 abc	11.67 bcd	20.5 c	1.86 c	3.0 c
Naina	50.67 a	26.00 a	11.96 bc	09.3 d	0.84 d	2.6 d
Nandi	37.00 d	14.00 c	11.07 cd	24.5 b	2.22 b	3.0 c
Vegnesh	39.33 cd	14.67 c	14.95 a	40.5 a	3.68 a	4.2 a
Jayam	42.33 bcd	23.67 ab	10.51 cd	23.1 c	2.10 b	3.2 c
Nema-1200	50.33 a-d	26.67 a	09.11 d	03.5 e	0.31 d	3.8 b
LSD Value	13.00	7.742	2.34	4.5	0.5	0.4

Means followed by different letter shows significant result at 5% level of significance

with each other. Statistically similar results for days to fruiting were observed in Jayam, Sorya-66, TM-532-et, Magnit and Jyothi by taking 23.67, 23.67, 20.33, 19.67 and 18.67 days to fruiting, respectively. Least days to fruiting were found in Nandi and Vegnesh by taking 14.00 and 14.67 days to fruiting, respectively. These results showed once again that Nandi and Vegnesh are the earlier flowering and fruiting cultivars amongst all the other cultivars. Our results are further confirmed by the previous findings of Khokar *et al.* (2002) and Chaudary *et al.* (1999) who also observed time variations in fruit setting in various tomato cultivars. Similarly, Zahoor (2006) reported that cv. TT0302 took minimum days (90.33) to ripening from transplanting. Hussain *et al.* (2002) also reported that tomato cultivar Polefemo took maximum days (27.3) to fruit setting, while cv. Giasone took the least (17) days to fruit set.

Stem diameter (mm): The data regarding stem diameter showed statistically alike stem diameter (14.95 and 14.05 mm) in Vegnesh and Sorya-66, respectively (Table 2). Similar results were also observed in cultivars including 131, Jyothi, Naina and Magnit which produced 12.46, 12.38, 11.96, 11.67 mm stem diameter, respectively. Intermediate results were also observed in Nandi, Mrutyum, TM-532-et, and Jayam with 11.07, 10.97, 10.81 and 10.51 mm stem diameter, respectively. The least diameter (9.11 mm) was recorded in cultivar Nema-1200.

Fruits per plant: Statistically at par result was recorded in Vegnesh and 131 with 40.5 and 39.1 fruits per plant (Table 2). Similarly, Sorya-66, TM-532-et and Nandi produced at par results producing 28.6, 27.6 and 24.5 fruits per plant, respectively. Minimum fruits per plant (3.5) were recorded in Nema-1200, followed by Naina with 9.3 fruits. Our results get support from the previous findings of Solis *et al.* (2006) who also stated that significant variations were recorded for number of fruits per plant in different tomato cultivars. Similarly, Hamid *et al.* (2005) also reported that Tomato cv. Paths produced maximum fruit per plant.

Khokar *et al.* (2002) also reported that tomato cv. Borna produced the maximum number of fruits (52.75) while Parana produced minimum number of fruits per plant (25.75). Similar results were obtained by Rahman *et al.* (2000) who reported maximum number of fruits/plant in tomato cv. Chico and Roma with 52.50 and 47.25 fruits.

Fruit weight per plant (Kg): Maximum fruit weight per plant (3.68 kg) was recorded in Vegnesh followed by 131 which produced 3.55 kg of fruits per plant and both the cultivars were statistically at par with each other. Statistically similar results were also recorded in Sorya-66, TM-532-et, Nandi and Jayam with 2.60, 2.51, 2.22 and 2.10 kg fruits per plant, respectively (Table 2). The lowest yield per plant was recorded in Naina and Nema-1200 which yielded 0.84 and 0.31 kg of fruits per plant, respectively.

Fruits per cluster: The data showed that maximum number of fruits per cluster (4.4) was recorded in cv. Jyothi, closely followed by Vegnesh with 4.2 fruits per cluster and both the cultivars were statistically at par with each other (Table 2). Significantly similar results were obtained by TM-532-et and Nema-1200 with 3.8 fruits per cluster. Other cultivars including Jayam, Magnit, Mrutyum-Jaya-2 and Sorya-66 gave almost alike values (3.2, 3.0, 3.0 and 3.0) for fruits per cluster. Cultivars Naina and 131 produced only 2.8 and 2.6 fruits per cluster, respectively. Similarly, Zahoor *et al.* (2006) also observed maximum fruit set per cluster (71.62%) in Swat local. Our results also get support from the previous findings of Hussain *et al.* (2001) who also reported that tomato cvs. BARI-5 and BARI-4 produced the maximum 4.04 and 3.94 fruits/cluster.

Fruit length (cm): The fruit length of different tomato cultivars ranged from 5.41 to 3.58 cm (Table 3). Maximum fruit length was recorded in Jyothi with 5.41 cm which was closely followed by Nandi and Vegnesh with 5.10 and 4.98 cm long fruits, respectively. All these cultivars were statistically at par with each other. Statistically similar results were recorded for TM-532-et, Naina, Mrutyum,

Sorya-66, and Magnit with 4.87, 4.86, 4.78, 4.71 and 4.55 cm long fruits, respectively. The smallest fruit length (3.58 cm) was observed in cv.131. These results are supported by Hussain *et al.* (2001) who observed maximum fruit length (5.97) in tomato cv. BARI-8. Similarly, Rahman *et al.* (2000) also reported variation in tomato fruit length as cv. Tanja produced 6.90 cm long fruit.

Fruit diameter (cm): The significant maximum fruit diameter (4.83 cm) was observed in Jayam and 131 closely followed by Nandi, Vegnesh and Mrutyum which attained 4.76, 4.70 and 4.65 cm fruit diameter, respectively (Table 3). All these cultivars were statistically alike with each other. Intermediate results were reported in Naina, Jyothi and TM 532-et by producing 4.54, 4.52 and 4.06 cm fruit diameter, respectively. Once again the Nandi and Vegnesh showed maximum fruit width which is a positive character from commercial point of view. Similar results were reported by Hussain *et al.* (2001) who reported that tomato fruit diameter ranged from 4.27 to 6.50 cm, in which BARI-7 produced maximum fruit diameter (6.50). Similarly, Rahman *et al.* (2000) observed maximum fruit diameter in tomato cvs. FM-9 and EVA with 5.58 and 5.65 cm diameter, respectively where as local tomato cultivars produced fruit diameter of 2.03 cm.

Table 3. Seeds per fruit, yield per plot (kg) and yield ton per hectare of different Tomato cultivars.

Cultivars	Seeds per fruit	Yield/plot (kg)	Yield t/ha
Jyothi	60.47 bc	11.40 cd	52.00 g
TM-532-et	63.77 bc	14.30 b	65.30 d
131	102.90 a	20.20 a	92.40 b
Sorya-66	44.17 cde	14.80 b	67.70 c
Mrutyum-Jaya-2	45.97 cd	10.60 d	46.20 i
Magnit	58.20 bc	10.70 d	49.50 h
Naina	16.53 f	5.800 e	22.00 j
Nandi	59.53 bc	13.30 bc	58.00 e
Vegnesh	24.83 ef	22.10 a	95.90 a
Jayam	69.70 b	12.10 cd	54.80 f
Nema-1200	25.67 def	2.400 f	8.100 k
LSD Value	19.50	1.932	1.979

Means followed by different letter shows significant result at 5% level of significance

Seeds per ten fruits: The data revealed that maximum seed number was recorded in 131 with 102.9 seeds, followed by Jayam with 69.70 seeds (Table 3). Statistically similar results were found in TM-532-et, Jyothi, Nandi, Magnit with 6.77, 60.47, 59.53 and 58.20 seeds per ten fruits, respectively. Mrutyum-Jay-2 and Sorya -66 produced 45.97 and 44.17 seeds, respectively and were statistically at par with each other. The low number of seeds was found in Vegnesh and Naina with 24.83 and 16.53 seeds, respectively. The low number of seeds in fruits is an

appealing character from consumer point of view, so these cultivars can be recommended as low seed holders. Similar results were described by Suwwan and Baker (1986) who also reported variations in seed number in different nine tomato hybrids and three tomato cultivars.

Yield per plot (kg): The data depicted the highest yield (22.10 kg/plot) in Vegnesh followed by cv. 131 with total yield of 20.2 kg/plot and both the cultivars were statistically at par (Table 3). Statistically similar results were observed in Sorya-66, TM-532-et, and Nandi, which produced 14.80, 14.30 and 13.30 kg/plot, respectively. Jyothi and Jayam also produced statistically similar results, as they yielded 12.10 and 11.40 kg fruit per plot. The lowest yield was recorded in Nema-1200, as it produced yield of 2.4 kg/plot. Similar results were quoted by Rahman *et al.* (2000) who stated that different tomato cultivars behaved significantly different with each other regarding yield kg/plot.

Yield per hectare (ton): The highly significant data revealed that maximum yield was recorded in Vegnesh and 131 with 36.850 and 33.660 t/ha, respectively (Table 3). Sorya-66 and TM-532-et had produced statistically similar results by giving 24.67 and 23.83 t/ha of yield, respectively. Other cultivars including Nandi, Jayam, Jyothi, Magnit and Mrutyum-Jaya-2 yielded 22.17, 20.16, 17.83 and 17.67 t/ha fruits, respectively. The minimum yield was recorded in Nema-1200 and Naina with 4.00 and 9.67 t/ha fruits, respectively. Similarly, Hussain *et al.* (2001) reported that tomato cultivar Tanja produced the maximum average yield (41.45 t/ha) and all the cultivars were statistically different to each other. The results also got support from the previous findings of Hussain *et al.* (2002) who also found significant difference in fruit yield t/ha amongst different tomato cultivars. They also reported that cv. Marmande TMV and Marmande out yielded other cultivars with 64.29 and 62.99 t/ha, respectively. Similar results were also quoted by a number of researchers including Khokar *et al.* (2002) and Chaudhry *et al.* (1999) who also reported yield differences in various tomato cultivars.

Conclusions: It can be concluded from the results that most of the cultivars showed good performance; however, Vegnesh, 131 and Sorya-66 performed well under agro climatic conditions of D.I. Khan.

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