



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(7): 3119-3122
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www.thepharmajournal.com
Received: 13-05-2022
Accepted: 28-06-2022

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Evaluation of different genotypes for growth, fruit yield and quality parameters of determinate tomato (*Solanum lycopersicum* L.)

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Abstract

The investigation entitled “Evaluation of different genotypes for growth, fruit yield and quality parameters of determinate tomato” was carried out in the field of AICRP on vegetable crops, Horticulture Research cum Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) during *Rabi* season 2021-2022. Evaluation of diverse tomato genotypes for desired horticultural attributes and to identify superior genotypes for additional improvement in yield and yield related traits is indispensable. Hence, fifteen genotypes were field planted in randomized block design replicated thrice. Morphological and floral data were collected. The genotype 2019/TODVAR-5 was superior, showing highest mean performance for fruit yield per plot (q) followed by genotype 2019/TODVAR-4 among different genotypes. For quality traits like TSS, total sugar and reducing sugar content was maximum in genotype 2021/TODVAR-4.

Keywords: Tomato, growth, yield character, genotypes, quality

Introduction

Tomato (*Solanum lycopersicum* L.) belongs to family Solanaceae, originated from Central Africa and South America (Vavilov, 1951) [14]. It is grown as an annual or short lived perennial herbaceous plant sexually propagated by seed. It is also known as protective food both because of its special nutritive value and its wide spread production. The tomato is now grown worldwide for its edible fruits. Phenolics and carotenoids are the main bioactive compounds present in ripened tomatoes. The red colour of a ripe tomato is because of a significant amount of lycopene (Martí *et al.* 2016; Perveen *et al.* 2015) [6, 10].

Tomatoes are commonly consumed fresh but over 80% of tomato consumption comes from processed products such as tomato juice, paste, puree, ketchup and sauce (Takeoka *et al.* 2001) [13]. It indicates the potential health benefits of a diet rich in tomatoes and tomato products (Mayeaux *et al.* 2006) [7].

In India, the tomato is sown in an area of 812 thousand hectares with an ample annual production of 20573 thousand MT (Anonymous, 2020) [2] while in Chhattisgarh the area under tomato cultivation is 64.383 thousand hectares with an annual production of 1151.488 thousand MT, mainly grown in Durg, Bemetara, Jashpur, Raipur and Bilaspur (Anonymous, 2021) [1].

Tomato is well fitted in different cropping systems due to development of high yielding cultivars and its suitability with vivid agro-climatic conditions. In case of Chhattisgarh, tomato has large coverage area and is quite popular among farmers, resulting in consecutive evaluation and selection of cultivar. Variety selection is a dynamic process. The crucial horticultural characteristics related to cultivars include high fruit yield, number of fruits per plant, good shelf life, high TSS, cracking free, biotic and abiotic resistance, etc. Consumer's preference with respect to size, shape and colour of the variety also plays an important role in varietal selection.

Material and Methods

The experiment was laid out at Horticulture Research cum Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) during *Rabi* season 2021-2022. Geographically the farm is situated between 22°33'N and to 21°14'N latitude and 82°6'E to 81°38'E longitude, at a height of 289.56 meters above mean sea level.

The soil was clay loam with good drainage and adequate water holding capacity. Fifteen genotypes were raised in Randomized Block Design (RBD), replicated thrice.

Five competitive and healthy plants from each entry of each replication were randomly selected before flowering and tagged for the purpose of recording observations on various quantitative traits and their mean values were used in the statistical analysis. The genotypes were studied for various yield related traits *viz.*, plant height (cm), number of primary branches, days to first and 50% flowering, days to first harvesting, number of flowers per cluster, number of fruits per cluster, number of fruits per plant, fruit girth and length (cm), fruit weight (g), number of locules, pericarp thickness (mm), TSS ($^{\circ}$ Brix), pH, total sugar content (%), reducing sugar (%), fruit yield per plant (kg) and fruit yield per plot (q). The data of different parameters collected during the period of experiment were subjected to statistical analysis as per method of analysis of variance by Panse and Sukhatme (1978) [8].

Results and Discussion

The analysis of variance depicted that most of the traits studied under the present experiment exhibited significant mean sum of squares due to treatment (genotypes) except for number of primary branches per plant. These confirmed the presence of considerable amount of genetic variability among various tomato genotypes. Similar results with respect to this reported by Patel *et al.* (2015) [9], Kanaujia and Phom (2016) [4], Aralikatti *et al.* (2018) [3] and Sushma *et al.* (2020) [12].

The data of mean performance of tomato genotypes for yield and yield attributing characteristics depicted in Table 1.

For growth and fruit yield parameters

Plant height (cm)

The highest plant height were noticed in genotype 2020/TODVAR-3 (161.90 cm) which was at par with 2021/TODVAR-6 (155.90) while the lowest plant height were observed in 2019/TODVAR-1 (136.33 cm) which was at par with 2021/TODVAR-1 (137.33 cm).

Number of primary branches per plant

Most number of primary branches per plant were observed in genotype 2021/ TODVAR-6 (6.19) which was at par with genotype 2021/TODVAR-3 (6.14) and while the least number of primary branches were found in genotype 2019/ TODVAR-4 (4.17) and 2019/TODVAR-6 (4.17).

Days taken to 1st and 50% flowering

The least days taken to flowering were recorded in genotype 2019/TODVAR-9 (24.33) whereas maximum days taken to first flowering was seen in genotype 2021/TODVAR-3 (33.33) which was at par with genotype 2019/TODVAR-3 (32.67) and the genotypes earliest days taken to 50% flowering were noted in 2019/TODVAR-6 (28.00) while maximum number of days to 50% flowering was seen in plot with genotype namely 2019/TODVAR-3 (39.67) which was at par with 2021/TODVAR-2 (39.33).

Days taken to 1st harvesting

The least days taken to 1st harvesting were recorded for 2021/TODVAR-2 (82.67) which was at par with all genotypes except remaining 2019/TODVAR-3 (90.00), 2021/TODVAR-5 (90.67), 2021/TODVAR-6 (91.33) and

2021/TODVAR-4 (91.33) while the maximum days required for 1st harvesting were seen for genotype 2021/TODVAR-3 (99.00).

For yield parameters

Number of flowers per cluster

The highest number of flowers per cluster were observed in genotype 2021/TODVAR-1 (8.33) which was at par with remaining all genotypes except 2021/TODVAR-5 (6.66), 2019/TODVAR-5 (6.56), 2019/TODVAR-9 (6.50) and 2019/TODVAR-7 (6.34). On the other hand, least number of flower per cluster was noticed in 2021/TODVAR-3 (4.78).

Number of fruits per cluster

The maximum number of fruits per cluster were observed in genotype 2019/TODVAR-6 (6.07) which was at par with 2019/TODVAR-3 (5.70) followed by 2019/TODVAR-4 (5.56) while 2021/TODVAR-2 recorded for bearing least fruits per cluster.

Number of fruits per cluster

Highest number of fruits per plants were noticed in 2021/TODVAR-4 (96.57) which was at par with genotypes 2021/TODVAR-5 (92.81) while at the same time lowest number of fruits per plants was recorded in 2019/TODVAR-3 (24.26) which was at par with 2021/TODVAR-3 (28.20).

Fruit girth (cm)

The maximum fruit girth was noticed for genotype 2019/TODVAR-3 (6.02 cm) which was at par with 2021/TODVAR-1 (5.80 cm) mean while minimum fruit girth were exhibited by genotype 2019/TODVAR-4 (3.94).

Fruit length (cm)

The fruit length was maximum for genotype 2019/TODVAR-7 (6.55 cm) which is at par with 2021/TODVAR-5 (6.05 cm) and minimum fruit length were recorded for genotype 2019/TODVAR-10 (3.38 cm) which was at par with 2019/TODVAR- 9 (4.01 cm).

Fruit weight (g)

The maximum fruit weight were noticed for genotype 2021/TODVAR-3 (113.55 g) which was at par with genotype 2019/TODVAR-3 (113.32 g) followed by 2021/TODVAR-2 (111.89 g) and the lowest fruit weight were recorded for 2019/TODVAR-4 (55.27 g) which was at par with genotype 2019/TODVAR-10 (63.78 g) followed by 2019/TODVAR-9 (69.00 g).

Number of locules per fruit

The maximum number of locules per fruit were observed in genotype 2021/TODVAR-6 (5.78) besides the minimum number of locule were noticed in genotype 2021/TODVAR- 3 (2.6) which was at par with 2019/TODVAR-7 (2.72) followed by 2019/TODVAR-3 (2.73), 2021/TODVAR-5 (2.77) and 2019/TODVAR-9 (2.78).

Pericarp thickness (mm)

The maximum pericarp thickness were observed in genotype 2021/TODVAR-6 (7.65 mm) which was at par with 2021/TODVAR-3 (6.84 mm) however, least pericarp thickness was seen in 2019/TODVAR-6 (3.44 mm).

Fruit yield per plant (kg)

The highest yield per plant were recorded for genotype 2021/TODVAR-5 (4.77 kg) which was at par with 2019/TODVAR-5 (4.32 kg) whereas lowest yield per plant were observed for 2021/TODVAR-3 (1.10 kg) which was at par with 2019/TODVAR-4 (1.36 kg).

Fruit yield per hectare (q)

The maximum fruit yield per plot were exhibited by genotype 2019/TODVAR-5 (791.71q) which was at par with 2021/TODVAR-1 (743.76 q) and the least fruit yield were seen for genotype 2021/TODVAR-4 (198.52 q).

Table 1: Mean Performance of tomato genotypes for yield and its components along with quality parameters

GENOTYPES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
2019/TODVAR-1	136.33	4.50	26.33	31.33	6.89	5.35	32.27	84.33	5.40	4.47	81.62	2.83	5.91	3.2	3.93	4.07	3.86	1.86	560.84
2019/TODVAR-2	122.33	4.70	28.00	34.00	6.78	4.62	41.97	84.33	5.67	4.28	91.70	3.13	5.31	2.67	3.78	2.33	1.52	2.85	574.78
2019/TODVAR-3	120.77	5.00	32.67	39.67	7.34	5.70	24.26	90.00	6.02	4.65	113.32	2.73	6.63	3.2	4.14	2.58	2.40	2.16	691.43
2019/TODVAR-4	121.90	4.17	26.00	31.33	7.67	5.56	32.48	85.00	3.94	3.62	55.27	3.13	5.50	3.07	3.85	3.44	2.86	1.36	635.63
2019/TODVAR-5	126.77	5.42	27.00	31.33	6.56	5.43	64.23	86.67	5.48	4.94	103.93	3.07	6.78	3.23	4.72	3.46	3.21	4.32	791.71
2019/TODVAR-6	126.37	4.17	25.33	28.00	6.89	6.07	50.07	86.33	4.95	4.45	79.53	3.64	3.44	2.8	3.53	2.96	2.56	2.57	584.13
2019/TODVAR-7	118.75	4.83	26.67	32.67	6.34	5.19	47.40	87.67	5.20	6.55	99.23	2.72	6.63	2.9	3.91	3.13	1.57	3.39	564.74
2019/TODVAR-9	137.33	4.56	24.33	29.67	6.50	4.85	34.71	84.33	4.45	4.01	69.00	2.78	5.63	2.8	3.94	2.86	2.56	3.13	358.76
2019/TODVAR-10	137.43	4.33	25.33	30.00	7.78	5.41	78.43	85.00	4.70	3.38	63.78	3.23	5.07	3.1	3.67	3.24	3.09	1.81	405.64
2021/TODVAR-1	137.33	4.82	32.00	38.00	8.33	5.23	65.33	85.33	5.80	5.07	88.23	3.15	5.94	3.17	3.87	3.76	3.39	2.77	743.76
2021/TODVAR-2	129.67	4.67	32.67	39.33	6.89	4.22	50.86	82.67	4.96	5.43	111.89	2.96	6.27	3.27	3.83	4.37	3.80	2.25	333.17
2021/TODVAR-3	161.90	6.14	32.33	38.00	4.78	4.56	28.20	99.00	5.16	5.44	113.55	2.6	6.84	4	4.26	4.14	3.34	1.10	313.20
2021/TODVAR-4	123.89	5.51	33.33	38.67	8.17	4.94	96.57	91.33	5.15	5.07	71.04	3.22	6.6	4.47	3.78	6.58	6.00	1.81	198.52
2021/TODVAR-5	137.93	4.58	31.67	35.67	6.66	5.03	92.81	90.67	5.70	6.05	87.23	2.77	6.08	4.03	3.88	3.79	3.59	4.77	354.21
2021/TODVAR-6	155.90	6.19	31.33	37.33	6.25	5.19	88.10	91.33	5.12	4.77	100.12	5.78	7.66	3.33	3.53	5.69	5.21	3.34	560.34
MEAN	132.99	4.91	29	34.33	6.92	5.16	55.18	87.6	5.18	4.81	88.63	3.18	6.02	3.28	3.91	3.62	3.26	2.16	511.39
C.D.	13.84	1.27	2.95	2.94	1.65	0.84	16.53	5.33	1.00	1.01	15.5	0.75	1.75	0.50	0.28	0.31	0.22	1.11	89.25
SE(m)	4.77	0.44	1.01	1.01	0.57	0.29	5.71	1.84	0.34	0.34	5.35	0.26	0.6	0.17	0.09	0.10	0.07	0.38	30.8
SE(d)	6.75	0.62	1.44	1.43	0.80	0.41	8.07	2.6	0.48	0.49	7.56	0.36	0.85	0.24	0.13	0.15	0.22	0.54	43.57
C.V. (%)	6.21	15.47	6.08	5.13	14.21	9.77	17.91	3.64	11.5	12.49	10.46	14.17	17.39	9.08	4.32	5.23	4.18	25.31	10.43
1.Plant height(cm)	6.No. of fruits/cluster				11.Fruit Weight(g)				16.Total sugar content(%)										
2.No. of primary branches	7.No. of fruits/ plant				12.No. of locule				17.Reducing sugar(%)										
3.Days to 1st flowering	8. Days to 1st harvesting				13.Pericarp thickness(mm)				18.Fruit yield/plant (kg)										
4.Days to 50% flowering	9.Fruit Girth(cm)				14.TSS(°Brix)				19. Fruit yield per hectare(q)										
5.Number of flower per cluster	10.Fruit length(cm)				15.pH														

Quality attributes**TSS (°Brix)**

For quality attributes, high value of TSS was observed for genotype 2021/TODVAR-4 (4.47 °Brix) which is at par with 2021/TODVAR-5 (4.03 °Brix) while the low value for TSS were observed for genotype 2019/TODVAR-2 (2.67 °Brix) which was at par with genotype 2019/TODVAR-6 (2.8 °Brix).

pH

The high pH was exhibited by genotype 2019/TODVAR-5 (4.72) while the lowest pH were noticed for genotype 2019/TODVAR-6 (3.53) and 2021/TODVAR-6 (3.53) which was at par with 2019/TODVAR-10 (3.67).

Total sugar content (%)

The total sugar content were recorded highest in line 2021/TODVAR-4 (6.58%) while lowest total sugar estimate were possessed by genotype 2019/TODVAR-2 (2.33%) which is at par with 2019/TODVAR-3 (2.58%).

Reducing sugar (%)

High degree of reducing sugar were observed in genotype 2021/TODVAR-4 (6.00%) and the lowest value of reducing sugar were observed for genotype 2019/TODVAR-2 (1.52%) which is at par with 2019/TODVAR-7 (1.57%).

Conclusion

In nutshell, based on present investigation it can be concluded that genotype 2019/TODVAR-5 was found to be suitable over

other genotype and can be grown successfully in Chhattisgarh plains. In addition to its yield characteristics, it also showed good vegetative growth and other yield related characteristics. Also, for quality traits viz., TSS, total sugar content and reducing sugar were maximum in genotype 2021/TODVAR-4.

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