Evaluation of the performance of parental lines and their F_1 hybrids for yield and attributing traits in tomato (*Solanum lycopersicum* L.).

Abstract

The present investigation was carried out to obtain information based on *per se* performances of parents and their combinations for genetic improvement in tomatoes. Ten promising genotypes were crossed in a dialler manner (excluding reciprocals). Half diallel set of 45 F_1's in tomato was evaluated in Randomized Complete Block Design (RBD) with three replications for eighteen yield and yield attributing traits during *Rabi* 2020-21 (Y_1) and 2021-22 (Y_2) at the Main Experimental Station (MES), Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar,Kumarganj, Ayodhya (U.P.) India. The study evident that highly significant differences were observed for most of the traits under study. Based on *per se* performance, parent P 3 (3.27 kg) exhibited the highest yield per plant followed by P6 (3.20 kg). The *per se* performance of crosses *i.e.* P3XP4 (3.33kg), followed by P2 x P9 (2.17 kg) produced significantly higher yield per plant than the general mean. These hybrids may be exploited as a new variety after selection and subjected to multi-locational trials for their release as cultivation on a commercial scale.

***Keywords*:** evaluated, traits, hybrid, commercial.

1. INTRODUCTION

Tomato (*Solanum lycopersicum* L., 2n=24) belonging to family Solanaceae is one of the most important vegetables, widely grown worldwide for supplying the fresh market and processing. Tomato is grown worldwide for its edible fruits, with antioxidants benefit. The crop is native to Central and South America. Tomato is considered a healthy food because of its nutritional awareness among people. In recent years, researchers are interested and focused on the identification of bioactive components in food that affects health, and may also reduce the risk of some diseases. The high nutritional value and potential health benefits of tomato have drawn an increased interest towards tomato-based products among consumers. Hence major emphasis is being given to improve the quality of produce along with higher production. Due to carotenoids, lycopene and β-carotene, tomato has high nutritional value. The development of high yielding varieties requires detailed knowledge of the genetic variability present in the germplasm of the crop, the association among yield components, input requirements and culture practices.

The development of new tomato cultivars has intended to improve productivity, quality and adaptation to different production conditions. Sometimes, this is difficult to achieve due to reduced availability of genetic resources. It is an herbaceous, annual to perennial, and sexually propagated plant, mostly grown as annual plant. The plants have taproot system and two types of growth habit, determinate and indeterminate. In determinate types, plants are dwarf, where growth is restricted with the appearance of terminal flower, while in indeterminate plants, growth is continued and there is less initiation of flower and fruits on the stem, the lateral buds always exist to continue vegetative growth. The tomato flower is normally perfect; there are four to eight flowers in each compound inflorescence. There is a light protective anther cone surrounding the stigma leading to self-pollination. Hybrid vigor in tomato was first observed by Hedrick and Booth (1907). Tremendous improvement has been made in various aspects by exploitation of tomato being most important to growers, consumers and to the processing industry, there is a pressing need to increase its productivity to fulfil the increasing demand. Although, a lot of genetic studies have been done in tomato and as a consequence a large number of varieties/hybrids have been developed. However, there is still lack of adequate information for a very strong improvement programme to increase area and quality specific varieties. Development of hybrids with extreme earliness, quality, uniformity and adaptability to adverse conditions, is easily possible in tomato because it is a self-pollinated crop.

2. MATERIALS AND METHODS

The present investigation was carried out at the Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya (UP), India, during *Rabi*, 2021-22 (Y_1) and 2022–23 (Y_2). The experimental farm falls under a humid subtropical climate and is located between 24.47° and 26.54°N latitude and 81.84° and 83.58°E longitude at an altitude of 98 m above mean sea level.

The experimental materials comprised ten promising varieties of tomato which were selected on the basis of genetic variability from the germplasm stock maintained in the Department of Vegetable Science. The selected parental lines *i.e.*, were NDT-4, NDT-5, NDT Sel-3, NDT-P-1, NDTSel-1, 2012/TOLCVRes-1, NDTSel-2, 2019/TOLCVRes-2, 2019/TOLCV Res -4, 2019/TOLCV Res -6, crossed in all possible cross combinations

(excluding reciprocal) during *Rabi* season of 2020-2021 to get 45 F_1 s for the study of the mean performance of parental line and their resultant F_1.

The experiments were grown in a Randomized Block Design (RBD) with three replications to evaluate the performance of 45 F_1 hybrids and their 10 parental lines of tomato. The crop was sown in single row spaced 60 cm apart with a plant-to-plant spacing of 50 cm.

Observations were recorded for eighteen economic and quality traits, days to 50% flowering, days to first fruit harvest, plant height (cm), primary branches per plant, average fruit weight (g), pericarp thickness (mm), locules per fruit, fruits per cluster, polar diameter (cm), equatorial diameter(cm), marketable fruit yield per plant (kg), total soluble solids (%), titrable acidity (%), ascorbic acid content (mg/100g), reducing sugar (mg/100g), non-reducing sugar (mg/100g), total sugar (mg/100g), total fruit yield per plant (kg), fruits per plant *viz.*. *Per se* performance was evaluated for parents and hybrids following the method suggested by Panse and Sukhatme for analysis of variance of experimental for eighteen yield and yield contributing traits.

3. **RESULT AND DISCUSSION**

Selection of suitable parents and proper breeding methodology are basic steps for the improvement of yield and attributing traits. The selection of parents having high *per se* performance would be of merit in producing better hybrids and hence the parents selected for the crossing program were evaluated based on their *per se* performances. The most important trait fruit yield per plant and other quality traits results for pooled data are discussed below. A perusal of Table 1 revealed that days to 50% flowering ranged from 28.71 to 41.47 for parents and F_1 hybrids with an overall mean of 35.50. Among the parents, P6 (33.05) and P 10 (33.28) exhibited minimum days to 50% flowering while P8 (41.44) took maximum days to 50% flowering. Out of 45 crosses, hybrids that exhibited maximum days to 50% flowering were P3x P4 (41.47) followed by P4x P8 (41.29) while cross P1x P3 (28.71) took minimum days to 50% flowering. Days to first fruit harvest ranged from 67.70 to 91.24 for parents and F_1 hybrids with an overall mean of 84.11. Among the parents, P6 (76.13) and P9 (81.78) exhibited minimum days to first fruit harvest while P4 (90.81) took maximum Days to first fruit harvest Out of 45 crosses, hybrids that exhibited maximum days to first fruit harvest was P4x P5 (91.24) followed by P5x P9 (91.05) while P2x P6 (72.63) cross took minimum days to first fruit harvest. Similar findings suggested by Pattnaik *et al.*, 2020; Panthee *et al.*, 2015.

Plant height ranged from 70.10 to 142.86 for parents and F_1 hybrids with an overall mean of 109.47. P 10 (78.08) and P 9 (80.19) exhibited minimum plant height among the parents, while P6 (132.46) took maximum plant height. Out of 45 crosses, hybrids that exhibited maximum plant height were P1 XP3 (142.86) followed by P1 XP4 (139.83) while crossing P2 XP9 (70.10), took minimum plant height. Primary branches per plant ranged from 4.28 to 7.00 for parents and F_1 hybrids with an overall mean of 5.56. Among the parents, P10 (4.39) and P9 (4.42) exhibited minimum primary branches per plant while P 6 (6.97) took maximum primary branches per plant. Out of 45 crosses, hybrids that exhibited maximum primary branches per plant were P1x P7 (7.00) followed by P6x P7 (6.97) while cross P2x P10 (4.28) took minimum primary branches per plant. Fruits per plant ranged from 23.94 to 35.79 for parents and F_1 hybrids with an overall mean of 28.36. Among the parents, P9 (23.99) P2 (24.24) exhibited minimum fruits per plant while P6 (34.13) took maximum fruits per plant. Out of 45 crosses, hybrids that exhibited maximum fruits per plant were P1XP3 (35.79) followed by P5XP7 (32.30) while P8XP9 (23.94) cross took minimum fruits per plant.

Average fruit weight (g) ranged 63.94 from to 92.34 for parents and F_1 hybrids with an overall mean of 78.63. Among the parents, P1 (61.94) and P2 (70.77) exhibited minimum average fruit weight (g) while P 3 (84.54) took maximum average fruit weight (g). Out of 45 crosses, hybrids that exhibited maximum average fruit weight (g) were P1XP3 (92.34) followed by P1XP4 (89.85) while P6XP9 (64.44) cross took minimum average fruit weight (g). Pericarp thickness (mm) ranged from 4.14 to 5.34 for parents and F_1 hybrids with an overall mean of 4.67 Among the parents P1 (4.22) and P2 (4.22) exhibited minimum pericarp thickness (mm) while P 6 (5.34) took maximum pericarp thickness (mm). Out of 45 crosses, hybrids that exhibited maximum pericarp thickness (mm) were P4XP 7 (5.17) followed by P1XP 3 (5.12) while cross P1XP6 (4.14) took minimum pericarp thickness (mm). Locules per fruit ranged from 3.83 to 5.21 for parents and F_1 hybrids with an overall mean of 4.51. Among the parents P8 (4.00) and P9 (4.12) exhibited minimum locules per fruit while P6 (4.77), took maximum locules per fruit. Out of 45 crosses, hybrids that exhibited maximum locules per fruit were P1XP 3 (5.21) followed by P1XP8 (5.16) while cross P2XP6 (3.83) took minimum locules per fruit. Similar findings were reported by Singh *et al.,* 2020.

Fruit per cluster ranged from 3.39 to 4.73 for parents and F_1 hybrids with an overall mean of 3.98. Among the parents, P9 (3.69) and P1 (3.78) exhibited minimum fruit per cluster, while P6 (4.5) took maximum fruit per cluster. Out of 45 crosses, hybrids that exhibited maximum fruit per cluster were P4XP6 (4.73) followed by P4XP5 (4.71) while P2XP3 (3.39) cross took minimum fruit per clusters. Polar diameter (cm) ranged from 4.51 to 6.27 for parents and F_1 hybrids with an overall mean of 5.56. Among the parents P1 (4.51) and P5 (5.08) exhibited minimum polar diameter (cm) while P6 (6.27) took maximum polar diameter (cm). Out of 45 crosses, hybrids that exhibited maximum polar diameter (cm) were P1XP3 (6.25) followed by P5XP7 (6.13) while cross P2XP8 (4.85) took minimum polar diameter (cm). Equatorial diameter (cm) ranged from 7.96 to 9.58 for parents and F_1 hybrids with an overall mean of 8.91. Among the parents P1 (7.96) and P7 (8.81) exhibited minimum equatorial diameter (cm) while P10 (9.28) took maximum equatorial diameter(cm). Out of 45 crosses, hybrids that exhibited maximum equatorial diameter (cm) were P5XP7 (9.58) followed by P1XP6 (9.39) while cross P3XP8 (8.02) took minimum equatorial diameter (cm). Similar findings suggested by Mohamed *et al.*, 2012 and Mishra *et al.*, 2021.

Marketable fruit yield per plant (kg) ranged from 1.6 to 2.93 for parents and F_1 hybrids with an overall mean of 2.25. Among the parents, P9 (1.6) and P8 (1.890) exhibited minimum marketable fruit yield per plant (kg) while P6 (2.93) took maximum marketable fruit yield per plant (kg). Out of 45 crosses, hybrids P3XP7 (82.89) that exhibited maximum marketable fruit yield per plant (kg) were P3XP7 (2.89) followed by P3XP4 (2.71) while cross P2XP9 (1.78) took minimum marketable fruit yield per plant (kg)Total soluble solids (%) ranged from 3.4 to 4.74 for parents and F_1 hybrids with an overall mean of 4.03. Among the parents P9 (3.62) and P7 (3.69) exhibited minimum total soluble solids (%) while P2 (4.74) took maximum total soluble solids (%). Out of 45 crosses, hybrids that exhibited maximum total soluble solids (%) were P1XP10 (4.71) followed by P1XP9 (4.67) while cross P6XP9 (3.4) took minimum total soluble solids (%). Titrable acidity (%) ranged from 0.36 to 0.46 for parents and F_1 hybrids with an overall mean of 0.41. Among the parents P1 (0.36) and P2 (0.39) exhibited minimum titrable acidity (%) while P3 (0.45) took maximum titrable acidity (%). Out of 45 crosses, hybrids that exhibited maximum titrable acidity (%) were P1XP3 (0.46) followed by P1XP8 (0.45) while cross P4XP10 (0.36) took minimum titrable acidity (%). Ascorbic acid content (mg/100g) ranged from 19.37 to 21.67 for parents and F_1 hybrids with an overall mean of 20.36 Among the parents P1 (19.37) and P3 (19.91) exhibited minimum ascorbic acid content (mg/100g) while P9 (21.67). took

maximum ascorbic acid content (mg/100g). Out of 45 crosses, hybrids that exhibited maximum ascorbic acid content (mg/100g) were P6XP7 (21.51) followed by P1XP3 (21.28) while cross P7XP10 (19.63) took minimum ascorbic acid content (mg/100g). Similar finding suggested by Muhammad *et al.,* 2013.

Reducing Sugar (mg/100g) ranged from 1.17 to 1.53 for parents and F_1 hybrids with an overall mean of 1.41 Among the parent P10 (1.17) and P1(1.26) exhibited minimum Reducing Sugar (mg/100g) while P4 (1.5) took maximum reducing Sugar (mg/100g). Out of 45 crosses, hybrids that exhibited maximum reducing Sugar (mg/100g) were P4XP5 (1.53) followed by P1XP3 (1.52) while P2XP10 (1.3) cross took minimum reducing Sugar (mg/100g). Non reducing Sugar (mg/100g) ranged from 1.8 to 2.72 for parents and F_1 hybrids with an overall mean of 2.48. Among the parents P8 (1.97) and P1(1.98) exhibited minimum non reducing Sugar (mg/100g) while P7 (2.66) took maximum non reducing Sugar (mg/100g). Out of 45 crosses, hybrids that exhibited maximum non reducing Sugar (mg/100g) were P1XP8 (2.72) followed by P3XP7 (2.67) while cross P8XP9 (1.8) took minimum non reducing Sugar (mg/100g).

Total sugar (mg/100g) ranged from 3.15 to 4.17 for parents and F_1 hybrids with an overall mean of 3.89. Among the parents P1 (3.15) and P8 (3.37) exhibited minimum total sugar (mg/100g) while P6 (4.15) took maximum total sugar (mg/100g). Out of 45 crosses, hybrids that exhibited maximum total sugar (mg/100g) were P1XP8 (4.17) followed by P1XP9 (4.08) while cross P8XP9 (3.31) took minimum total sugar (mg/100g). Total fruit yield per plant (kg) ranged from 1.9 to 3.33 for parents and F_1 hybrids with an overall mean of 2.7. Among the parents P 9 (1.9) and P1 (2.13) exhibited minimum Total fruit yield per plant (kg) while P 3 (3.27) took maximum total fruit yield per plant (kg). Out of 45 crosses, hybrids that exhibited maximum total fruit yield per plant (kg) were P3XP4 (3.33) followed by P1XP3 (3.21) while cross P2XP9 (2.17) took minimum total fruit yield per plant (kg). Similar finding suggested by Gautuam *et al*. and Ibrahim *et al.,* 2020.

CONCLUSION

Based on performance, parent P 3 (3.27 kg) exhibited the highest yield per plant followed by P6 (3.20 kg). The *per se* performance of crosses *i.e.* P3XP4 (3.33kg), followed by P2 x P9 (2.17 kg) produced significantly higher yield per plant than the general mean. These hybrids may be exploited as a new variety after selection and subjected to multi-locational trials for their release as cultivation on a commercial scale.

References

1. Gautam, N.; Kumar, M.; Kumar, D.; Kumar, S.; Vikram, A.; Dogra, R. K. and Sharma, S. 2018.Studies for important quality traits in tomato (*Solanum lycopersicum* L.). *Int. J. Chem. Stud.*, 6(2): 1992-1996
2. Ibrahim, M. I. M. and EI- Mansy, A. B. 2020. Performance, Manifestation of Heterosis and Combining Ability for Growth, Productivity and Fruit Quality of Indeterminate Tomato. *J. Plant Prod., Mansoura univ.,* 11 (12):1553-1561.
3. Mishra, A.; Nandi, A.; Sahu, G. S.; Das, S.; Mohanty, I. C.; Pattanayak, S. K. and Tripathy, 2021.Tomato (*Solanum lycopersicum*) hybrids for growth, yield and quality traits. *J. Pharma Inn.*; 10(6): 220-229
4. Mohamed, S. M.; Ali, E. E. and Mohamed, T. Y. 2012. Study of heritability and genetic variability among different plant and fruit characters of tomato (*Solanum lycopersicon* L.). *Intl. J. Scientific Technol. Res.*, 1(2): 55-58.
5. Muhammad, Y. S.; Muhammad, A. and Qumer, I. 2013. Diallel analysis of yield and some yield components in tomato (*Solanum lycopersicum* L.). *Pak. J. Bot.*, 45(4): 1247-1250.
6. Panthee, D. R.; Veazie, P. P.; Anderson, C. and Ibrahem, R. 2015. Diallel analysis for lycopene content in the hybrids derived from different colored parents in tomato. Amer. *J. Plant Sci.*, 6: 1483-1492.
7. Pattnaik, P.; Singh, A. K.; Kumar, B.; Mishra, D.; Singh, B. K.; Barman, K. and Pal, A. K. 2020. Analysis of heterotic pattern of F1's in tomato (*Solanum lycopersicum* L.) for the improvement of yield and quality traits. *Int. J. Chem. Stud.*, 8(4):3160-3165.
8. Singh, B.; Kaul, S.; Naresh, R. K.; Goswami, A.; Sharma, O.D. and Singh, S.K. 2011. Genetic heritability and genetic advance of yield and its components in tomato (*Lycopersicon esculentum* Mill.) *Plant Arch.*; 11(1): 521-523.

Table 1. Mean performance, general mean, range, coefficient of variation and critical difference for Eighteen characters of diallel set of 45 F_1's and their 10 parents in tomato for eighteen different parameters during overseason pooled

Sr. No.	Genotypes	Days to 50% flowering	Days to first fruit harvest	Plant height (cm)	Primary branches per plant	Fruits per plant	Average fruit weight (g)	Pericarp thickness (mm)	Locules per fruit	Fruits per cluster
		Pooled	Pooled	Pooled	Pooled	Pooled	Pooled	Pooled	Pooled	Pooled
1.	P_1	36.33	84.33	122.1	5.84	24.43	63.94	4.22	4.37	3.78
2.	P_2	38.08	86.75	81.5	4.83	24.24	70.77	4.22	4.5	4.03
3.	P_3	35.9	87.74	94	5.14	24.68	84.54	4.32	4.41	4.02
4.	P_4	34.44	90.81	96.56	4.98	30.82	74.59	4.51	4.75	4.32
5.	P_5	33.45	85.71	103.62	5.53	26.55	79.69	4.46	4.6	4.37
6.	P_6	33.05	76.13	132.46	6.97	34.13	83.79	5.34	4.77	4.5
7.	P_7	36.65	87.21	118.1	5.97	31.81	72.26	4.76	4.39	4.05
8.	P_8	41.44	87.6	96.44	5.41	28.29	82.98	4.57	4	3.89
9.	P_9	34.93	81.78	80.19	4.42	23.99	74.67	4.81	4.12	3.69
10.	P_{10}	33.28	88.36	78.08	4.39	28.17	81.83	4.3	4.51	3.96
1.	P1XP2	32.16	75.71	132.35	5.72	29.25	79.11	4.95	4.71	4.07
2.	P1XP3	28.71	67.7	142.86	6.34	35.79	92.34	5.12	5.21	4.51
3.	P1XP4	32.02	78.82	139.83	5.9	30.98	89.85	4.99	4.95	4.4
4.	P1XP5	34.84	80.03	135.89	5.88	30.75	88.36	4.69	4.82	4.14
5.	P1XP6	37.09	79.85	131.44	6.44	29.42	85.16	4.14	4.79	3.72
6.	P1XP7	39.5	78.82	130.43	7	28.73	83.17	4.68	5.07	4
7.	P1XP8	37.71	80.67	117.49	6.26	28.87	79.3	4.71	5.16	4.38
8.	P1XP9	30.88	78.53	118.22	5.51	30.84	88.86	4.45	4.99	4.16
9.	P1XP10	32.18	76.91	118.49	5.39	29.92	85.82	4.2	4.94	4.28
10.	P2XP3	32.21	88.44	71.93	4.68	25	68.25	4.5	4.42	3.39
11.	P2XP4	32.75	89.48	85.19	4.79	31.16	78.85	4.93	4.37	3.63
12.	P2XP5	38.31	77.27	113.67	4.99	29.37	74.34	4.94	3.9	3.93
13.	P2XP6	32.62	72.63	119.04	4.77	25.3	70.18	4.93	3.83	3.67
14.	P2XP7	32.62	83.43	111.73	4.78	25.51	71.1	4.96	4.31	3.9
15.	P2XP8	40.13	90.09	96.05	4.74	27.74	70.75	4.66	4.84	3.9
16.	P2XP9	38.63	77.89	70.1	4.49	31.93	78.53	4.36	4.94	3.94
17.	P2XP10	35.27	75.39	71.86	4.28	30.59	85.21	4.25	4.47	4.03
18.	P3XP4	41.47	90.03	109.26	6.17	27.33	77.54	4.41	3.95	3.98
19.	P3XP5	36.56	90.59	112.63	6.01	26.24	76.81	4.82	3.91	4.03
20.	P3XP6	31.93	79.82	126.66	6.6	24.48	66.5	4.8	4.36	4.27
21.	P3XP7	32.76	76.57	128.11	6.82	27.47	69.15	4.78	4.84	4.2
22.	P3XP8	38.47	90.34	112.12	6.01	26.94	82.01	4.46	4.93	4.15
23.	P3XP9	38.35	86.71	102.52	5.51	27.78	87.01	4.93	4.51	3.79
24.	P3XP10	34.28	84.19	100.56	5.2	32.12	83.69	4.95	4.44	3.91
25.	P4XP5	34.5	91.24	105.55	5.22	27.51	81.86	4.93	4.36	4.71

26.	**P4XP6**	31.43	83.74	124.38	5.66	26.45	87.02	4.99	4.05	4.73
27.	**P4XP7**	36.2	82.6	123.04	5.85	26.67	80.25	5.17	4.54	4.19
28.	**P4XP8**	41.29	89.64	99.63	5.35	31.84	73.05	5.08	4.03	3.62
29.	**P4XP9**	38.12	89.67	87.61	4.67	30.18	84.91	4.64	4.06	3.69
30.	**P4XP10**	33.11	84.77	85.99	4.49	26.2	84.64	4.37	4.51	3.9
31.	**P5XP6**	33.48	90.23	124.98	6.78	27.21	76.21	4.62	4.57	4.03
32.	**P5XP7**	33.33	81.1	131.67	6.85	32.3	86.81	4.49	4.95	3.98
33.	**P5XP8**	38.42	82.77	121.81	5.98	31.47	85.84	4.23	4.99	4.04
34.	**P5XP9**	35.57	91.05	107.3	5.51	25.06	73.09	4.32	4.54	3.68
35.	**P5XP10**	32.34	81.36	121.82	6.16	29.5	79.39	4.9	4.87	3.99
36	**P6XP7**	33.43	86.91	131.95	6.97	30.34	73.85	5.08	4.33	4.24
37.	**P6XP8**	36.65	90.66	122.96	5.86	26.12	70.07	5	4.41	3.45
38.	**P6XP9**	37.72	89.75	117.81	5.02	24.55	64.44	4.69	3.98	3.48
39.	**P6XP10**	38.2	87.64	115.49	5.28	27.77	66.88	4.86	3.99	3.67
40.	**P7XP8**	34.06	83.81	121.95	6.47	31.71	78.67	4.38	4.85	4.27
41.	**P7XP9**	35.67	84.26	119.55	6.1	28.14	81.72	4.52	4.86	3.77
42.	**P7XP10**	40.51	89.47	117.91	6.3	28.54	79.44	4.95	3.91	3.87
43.	**P8XP9**	39.22	87.49	79.15	4.62	25.27	78.23	4.45	4.48	3.5
44.	**P8XP10**	34.48	82.48	78.47	4.42	23.94	77.1	4.59	4.45	3.56
45.	**P9XP10**	35.61	88.99	80.35	4.54	28.25	80.47	4.56	4.36	3.56
	Mean	**35.5**	**84.11**	**109.47**	**5.56**	**28.36**	**78.63**	**4.67**	**4.51**	**3.98**
	C.V.	10.73	9.65	11.97	11.03	12.68	11.61	9.42	10.1	12.95
	S.E.±M	1.55	3.31	5.35	0.25	1.47	3.73	0.18	0.19	0.21
	C.D. 5%	4.33	9.22	14.89	0.7	4.09	10.38	0.5	0.52	0.59
Range	**Lowest**	28.71	67.7	70.1	4.28	23.94	63.94	4.14	3.83	**3.39**
	highest	41.47	91.24	142.86	7	35.79	92.34	5.34	5.21	**4.73**

Table 2 : Mean performance, general mean, range, coefficient of variation and critical difference for Eighteen characters of diallel set of 45 F2's and their 10 parents in tomato for eighteen different parameters during overseason pooled

Sr. No.	**Genotypes**	**Polar diameter (cm)**	**Equitorial diameter (cm)**	**Marketable fruit yield per plant (kg)**	**Total soluble solids (%)**	**Titrable acidity (%)**	**Ascorbic acid content (mg/100g)**	**Reducing Sugar (mg/100g)**	**Non-Reducing Sugar (mg/100g)**	**Total sugar (mg/100g)**	**Total fruit yield per plant (kg)**
		Pooled	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**
1.	P_1	4.51	7.96	2.08	4.11	0.36	19.37	1.26	1.98	3.15	2.13
2.	P_2	5.65	9.02	2.31	4.74	0.39	20.15	1.38	2.45	3.83	2.71
3.	P_3	5.59	9.13	2.85	3.9	0.45	19.91	1.35	2.53	3.88	3.27
4.	P_4	5.91	9.08	2.22	4.02	0.43	20	1.5	2.5	3.99	2.75
5.	P_5	5.08	9.36	2.02	4.33	0.4	20.53	1.37	2.5	3.86	2.47
6.	P_6	6.27	9.39	2.93	3.87	0.44	21.23	1.5	2.65	4.15	3.2
7.	P_7	6.04	8.81	2.49	3.69	0.42	20.09	1.49	2.66	4.15	3.03
8.	P_8	5.77	8.96	1.89	3.83	0.39	20.59	1.41	1.97	3.37	2.27
9.	P_9	5.37	9.24	1.6	3.62	0.4	21.67	1.35	2.58	3.93	1.9

10.	P_{10}	5.99	9.28	2.13	3.94	0.4	20.72	1.17	2.54	3.7	2.56
1.	P1XP2	5.47	8.79	2.38	4.31	0.4	20.31	1.41	2.28	3.69	2.64
2.	P1XP3	6.25	9.26	2.7	4.51	0.46	21.28	1.52	2.65	4.17	3.21
3.	P1XP4	5.9	8.81	2.63	4.55	0.43	20.8	1.42	2.55	3.97	3.13
4.	P1XP5	5.95	9.22	2.46	4.5	0.43	20.61	1.45	2.55	4	3.03
5.	P1XP6	5.9	9.39	2.11	4.2	0.4	20.63	1.41	2.44	3.85	2.55
6.	P1XP7	5.87	9.22	2.11	4.48	0.43	20.3	1.39	2.49	3.88	2.48
7.	P1XP8	5.88	9.22	2.44	4.46	0.45	20.37	1.45	2.72	4.17	3
8.	P1XP9	5.78	8.79	2.62	4.67	0.41	21.13	1.45	2.63	4.08	3
9.	P1XP10	5.98	8.83	2.54	4.71	0.41	21.21	1.39	2.49	3.87	2.63
10.	P2XP3	5.66	8.54	2.35	4.43	0.42	19.87	1.38	2.5	3.89	3.03
11.	P2XP4	5.16	8.53	2.21	3.97	0.43	19.72	1.42	2.52	3.95	2.72
12.	P2XP5	4.99	8.97	1.93	4.25	0.41	19.64	1.38	2.56	3.95	2.28
13.	P2XP6	5.59	9.02	1.85	4.09	0.38	20.16	1.36	2.4	3.75	2.23
14.	P2XP7	4.96	8.89	2.13	3.96	0.36	20.18	1.38	2.57	3.95	2.67
15.	P2XP8	4.85	8.84	2.09	4.09	0.38	19.95	1.43	2.41	3.84	2.31
16.	P2XP9	5.6	8.96	1.78	3.92	0.36	20.12	1.43	2.27	3.7	2.17
17.	P2XP10	5.5	9.19	2.34	4.16	0.42	19.84	1.3	2.53	3.83	2.7
18.	P3XP4	5.26	9.21	2.71	3.63	0.42	19.86	1.5	2.55	4.05	3.33
19.	P3XP5	5.21	8.55	2.35	3.89	0.39	19.81	1.36	2.48	3.83	2.77
20.	P3XP6	5.79	8.36	2.69	3.93	0.41	20.47	1.36	2.45	3.81	3.08
21.	P3XP7	5.38	8.13	2.89	3.78	0.42	20.58	1.42	2.67	4.08	2.86
22.	P3XP8	5.52	8.02	2.26	3.65	0.42	19.85	1.46	2.56	4.02	2.48
23.	P3XP9	5.94	9.01	2.17	3.41	0.44	20.02	1.37	2.51	3.88	2.74
24.	P3XP10	5.83	8.82	2.27	3.48	0.44	19.97	1.41	2.61	4.02	2.85
25	P4XP5	5.16	8.7	2.21	4.35	0.4	19.98	1.53	2.38	3.89	3
26	P4XP6	5.09	8.12	2.24	4.05	0.38	20.08	1.47	2.41	3.88	3.03
27	P4XP7	5.65	8.68	2.13	3.65	0.38	20.25	1.41	2.5	3.91	2.66
28	P4XP8	4.85	8.95	2.27	3.6	0.39	21.01	1.32	2.61	3.93	2.74
29	P4XP9	5.09	8.43	2.08	3.57	0.38	19.95	1.36	2.44	3.8	2.79
30	P4XP10	5.06	8.55	2.22	3.89	0.36	19.85	1.37	2.34	3.71	2.82
31.	P5XP6	5.99	9.38	2.01	4	0.41	19.89	1.42	2.6	4.01	2.56
32.	P5XP7	6.13	9.58	2.22	4.34	0.43	20.83	1.4	2.61	4.01	3.11
33.	P5XP8	5.97	9.35	2.14	4.64	0.45	20.73	1.46	2.57	4.02	2.82
34.	P5XP9	5.71	9.09	1.87	4.05	0.41	19.96	1.46	2.39	3.85	2.04
35.	P5XP10	6.05	9.21	2.39	4.14	0.4	20.58	1.48	2.53	4.01	2.58
36.	P6XP7	5.67	9.19	2.38	4.52	0.4	21.51	1.48	2.51	3.98	2.96
37.	P6XP8	5.64	8.99	2.22	4.07	0.41	20.41	1.47	2.37	3.85	2.61
38.	P6XP9	5.14	9.21	2.14	3.4	0.39	20.77	1.46	2.35	3.81	2.72
39.	P6XP10	5.2	9.27	2.12	3.43	0.43	20.33	1.39	2.5	3.89	2.9
40.	P7XP8	5.63	8.58	2.33	3.71	0.4	20.31	1.41	2.63	4.05	2.96
41.	P7XP9	5.39	8.25	2.24	3.7	0.41	20	1.44	2.62	4.06	2.47
42.	P7XP10	5	8.27	2.05	3.7	0.38	19.63	1.37	2.65	4.03	2.22
43.	P8XP9	5.88	9.3	2.03	4.09	0.42	21.26	1.51	1.8	3.31	2.6

44.	**P8XP10**	5.35	9.2	2.08	4	0.4	20.87	1.45	2.41	3.87	2.34
45.	**P9XP10**	5.88	9.21	1.8	3.59	0.42	20.47	1.31	2.56	3.87	2.19
	Mean	**5.56**	**8.91**	**2.25**	**4.03**	**0.41**	**20.36**	**1.41**	**2.48**	**3.89**	**2.7**
	C.V.	10.15	6.91	16.65	10.86	9.89	5	7.03	9.09	6.77	15.44
	S.E.±M	0.23	0.25	0.15	0.18	0.02	0.42	0.04	0.09	0.11	0.17
	C.D. 5%	0.64	0.7	0.43	0.5	0.05	1.16	0.11	0.26	0.3	0.47
Range	**Lowest**	**4.51**	**7.96**	**1.6**	**3.4**	**0.36**	**19.37**	**1.17**	**1.8**	**3.15**	**1.9**
	highest	**6.27**	**9.58**	**2.93**	**4.74**	**0.46**	**21.67**	**1.53**	**2.72**	**4.17**	**3.33**