



P-ISSN: 2349-8528  
 E-ISSN: 2321-4902  
 IJCS 2020; 8(1): 1992-2003  
 © 2020 IJCS  
 Received: 10-11-2019  
 Accepted: 05-12-2019

**Pushpendra Kumar**  
 Assistant Professor, Department  
 of Agriculture, Roorkee College  
 of Engineering, Roorkee,  
 Uttarakhand, India

**CN Ram**  
 Associate Professor, Department  
 of Vegetable Science, ANDUA  
 and T, Kumarganj, Ayodhya,  
 Uttar Pradesh, India

**MK Singh**  
 Assistant Professor, School of  
 Agriculture, Lovely Professional  
 University Jalandhar,  
 Phagwara, Punjab, India

**Shilpa Saini**  
 Assistant Professor, Department  
 of Agriculture, Roorkee College  
 of Engineering, Roorkee,  
 Uttarakhand, India

**Corresponding Author:**  
**Pushpendra Kumar**  
 Assistant Professor, Department  
 of Agriculture, Roorkee College  
 of Engineering, Roorkee,  
 Uttarakhand, India

## International Journal of Chemical Studies

# Studies on analysis of variance and mean performance of parents and their crosses among various quantitative traits in tomato (*Solanum lycopersicum* L.)

**Pushpendra Kumar, CN Ram, MK Singh and Shilpa Saini**

DOI: <https://doi.org/10.22271/chemi.2020.v8.i1ad.8558>

### Abstract

The present study was carried out during *Rabi* seasons of 2016-17 and 2017-18 at Main Experiment Station of Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) India. The experimental materials of the study comprised of 54 treatments of tomato [40 F<sub>1</sub>'s and 14 parental lines (10 lines *viz.*, NDT-1, NDT-2, NDT-3, NDT-4, NDT-5, NDT-6, NDT-7, NDT-8, Azad T-6, Arka Saurabh and 4 testers *viz.*, Pusa Ruby, Punjab Chhuhara, Arka Vikash and Arka Meghali]. The 14 parents were involved in a crossing programme to develop a line × tester set (10 lines + 4 testers + 40 F<sub>1</sub>'s). The experimental materials (40 F<sub>1</sub>'s and 14 parental lines) were evaluated in Randomized Complete Block Design (RBD) with three replication having each experimental unit with spacing of 60 cm × 50 cm with plot size of 1.2 m × 3.0 m. The observations were recorded on fifteen characters, *viz.*, days to 50% flowering, days to first fruit set, days to first fruit harvest, plant height (cm), number of primary branches per plant, number of fruits per cluster, number of fruits per plant, average fruit weight (g), fruit length (cm), fruit girth (cm), number of locules per fruit, pericarp thickness (mm), total soluble solids (TSS), ascorbic acid (mg/100g fresh fruit) and total fruit yield per plant (kg). Analysis of variance revealed that the differences among treatments were highly significant for all the characters studied in both the years and pooled. Parent Pusa Ruby showed earliest days to 50% flowering among the parents which was followed by NDT-4, NDT-5 and NDT-2 in both the year and pooled. The best F<sub>1</sub> hybrid regarding days to 50% flowering was NDT-4 × Arka Meghali followed by Azad T-6 × Arka Vikas, NDT-1 × Arka Meghali and NDT-6 × Pb. Chhuhara in first year, NDT-4 × Arka Meghali followed by NDT-1 × Arka Meghali, NDT-6 × Pb. Chhuhara and NDT-7 × Arka Vikas in second year, NDT-4 × Arka Meghali followed by NDT-1 × Arka Meghali, NDT-6 × Pb. Chhuhara and Azad T-6 × Arka Vikas in pooled. In parents produced highest total fruit yield per plant was Arka Meghali followed by Arka Vikas, NDT-2 and Arka Saurabh in both the year and pooled. The highest yielding hybrid was NDT-3 × Arka Vikas followed by NDT-2 × Arka Meghali, NDT-2 × Arka Vikas and NDT-4 × Arka Vikas in both the year, NDT-4 × Arka Meghali followed by NDT-2 × Arka Meghali, NDT-6 × Pb. Chhuhara and Azad T-6 × Arka in pooled.

**Keywords:** Analysis of variance and mean performance of parents and their crosses among various quantitative traits in tomato (*Solanum lycopersicum* L.)

### Introduction

Tomato (*Solanum lycopersicum* L.), 2n=2x=24, a member of the family Solanaceae is one of the most popular & extensively cultivated vegetable throughout the world. It is originated from Peru Ecuador and Bolivia region of Andes of South America (Rick, 1969)<sup>[2]</sup>. India ranks third in terms of production after China and USA. In India, total area under tomato cultivation is 0.808 million hectares with production of 19.69 million tonnes and its productivity is 24.4 tonnes per hectare; In India the leading tomato growing states are, Karnataka, West Bengal, Maharashtra, Uttar Pradesh, Haryana, Punjab, Gujarat and Bihar. (Anonymous, 2017)<sup>[1]</sup>.

It is a day neutral warm season crop and grows under wide range of soil and climatic conditions. Though tomato is a self-pollinated crop, the unusual high heterosis observed in it, has been attributed to the fact that, originally tomato was a highly out crossing genus which has later evolved into a self-pollinated one (Rick, 1965)<sup>[3]</sup> and edible part is botanically known as berry (Kalloo *et al.*, 2001)<sup>[4]</sup>. It is globally cultivated for its fleshy fruits and known as

protective food. Under Indian condition, the fruits mainly consumed either as raw or in the preparation of sambar, chatni, pickles etc.

Tomato is also rich in medicinal value. The pulp and juice are digestible, mild aperients, a promoter of gastric secretion and blood purifier. It is reported to have antiseptic properties against intestinal infestations. In the present days, it is gaining more medicinal importance because of the antioxidant property of ascorbic acid and lycopene content. Thus, today it is one of the important raw materials for multimillion food industries. Due to its nutritional values it is also called as "Poor man's apple". In many countries it is considered as "poor man's orange" because of its attractive appearance and nutritive value (Singh *et al.*, 2004) [8-5]. It acts as an antioxidant and scavenger of free radicals, which is often associated with carcinogenesis. Thus, lycopene has great beneficial effects on human health (Khachik *et al.*, 1995) [6].

### Materials and Methods

The present study was carried out during *Rabi* seasons of 2016-17 and 2017-18 at Main Experiment Station of Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) India. The experimental materials of the study comprised of 54 treatments of tomato [40 F<sub>1</sub>'s and 14 parental lines (10 lines *viz.*, NDT-1, NDT-2, NDT-3, NDT-4, NDT-5, NDT-6, NDT-7, NDT-8, Azad T-6, Arka Saurabh and 4 testers *viz.*, Pusa Ruby, Punjab Chhuhara, Arka Vikash and Arka Meghali]. The 14 parents were involved in a crossing programme to develop a line × tester set (10 lines + 4 testers + 40 F<sub>1</sub>'s). The experimental materials (40 F<sub>1</sub>'s and 14 parental lines) were evaluated in Randomized Block Design (RBD) with three replication having each experimental unit with spacing of 60 cm × 50 cm with plot size of 1.2 m × 3.0 m. The observations were recorded on fifteen characters, *viz.*, days to 50% flowering, days to first fruit set, days to first fruit harvest, plant height (cm), number of primary branches per plant, number of fruits per cluster, number of fruits per plant, average fruit weight (g), fruit length (cm), fruit girth (cm), number of locules per fruit, pericarp thickness (mm), total soluble solids (TSS), ascorbic acid (mg/100g fresh fruit) and total fruit yield per plant (kg). The analysis of variance was carried out as suggested by Panse and Sukhatme (1967).

### Result and Discussion

Analysis of variance for line × tester mating design for both the years (Y<sub>1</sub> and Y<sub>2</sub>) had been presented in table 1. Analysis of variance revealed that the differences among treatments were highly significant for all the characters studied during both the years. Further partitioning of treatment variances into parents, crosses, lines and testers revealed highly significant differences among parents as well as crosses for all the fifteen characters. Variances due to parents was highly significant for all the characters during both the years and significant for days to 50% flowering in scound year except days to 50%

flowering in first year while, for days to first fruit set, days to first fruit harvest, number of primary branches per plant and number of locules per fruit in both the year. Variances due to parents *vs.* crosses were highly significant for days to 50% flowering, days to first fruit set, days to first fruit harvest, plant height, number of fruits per plant, average fruit weight (g), pericarp thickness (mm) and total fruit yield per plant (kg) in both the years and ascorbic acid in second year while, significant for number of fruits per cluster and fruit length (cm) in both the years. Variances due to lines *vs.* testers were highly significant for the characters like plant height, number of fruits per plant, average fruit weight (g) and fruit girth (cm) while, significant for number of primary branches per plant and number of locules per fruit in both the years.

The pooled analysis of variance given in table 2 also divided the source of variance into environments found highly significant for all the traits under study. Variances due to treatments and parents were found highly significant for all the traits under study as well as crosses for all the fifteen characters. Variances due to parent *vs* crosses were found highly significant for all the traits under study except for number of locules per fruit and total soluble solids while, significant for fruit girth (cm) and ascorbic acid. Variances due to line *vs* testers were found highly significant for the characters like plant height, number of primary branches per plant, number of fruits per plant, average fruit weight (g), fruit girth (cm), number of locules per fruit while, significant for fruit length (cm) and total fruit yield per plant (kg). The similar results were also reported by Kumar *et al.* (2004) [8].

The mean performance of 14 parental genotypes of tomato for fifteen quantitative characters had been presented in table 3 and table 4. The highest mean performance for total fruit yield per plant was exhibited by Arka Meghali (3.53 kg) followed by Arka Vikas (3.44 kg), NDT-2 (3.28 kg), Arka Saurabh (3.11 kg) and NDT-8 (2.98 kg). The highest yielding hybrid was NDT-3 × Arka Vikas (3.17 kg) followed by NDT-2 × Arka Meghali (3.04 kg), NDT-2 × Arka Vikas (2.99 kg), NDT-4 × Arka Vikas (2.94 kg) and NDT-2 × Pusa Ruby (2.88 kg). The mean values over the parental lines and F<sub>1</sub> hybrids were 2.84 and 2.49 kg, respectively in Y<sub>1</sub>, parents Arka Meghali (3.90 kg) followed by Arka Vikas (3.81 kg), NDT-2 (3.65 kg), Arka Saurabh (3.26 kg) and Azad T-6 (3.19 kg) and hybrid was NDT-3 × Arka Vikas (3.54 kg) followed by NDT-2 × Arka Meghali (3.41 kg), NDT-2 × Arka Vikas (3.36 kg), NDT-4 × Arka Vikas (3.31 kg) and NDT-2 × Pusa Ruby (3.25 kg). The mean values over the parental lines and F<sub>1</sub> hybrids were 3.17 and 2.86 kg, respectively in Y<sub>2</sub> and Arka Meghali (3.71 kg) followed by Arka Vikas (3.63 kg), NDT-2 (3.46 kg), Arka Saurabh (3.18 kg) and NDT-8 (3.05 kg) and hybrid was NDT-3 × Arka Vikas (3.36 kg) followed by NDT-2 × Arka Meghali (3.22 kg), NDT-2 × Arka Vikas (3.17 kg), NDT-4 × Arka Vikas (3.13 kg) and NDT-2 × Pusa Ruby (3.07 kg). The mean values over the parental lines and F<sub>1</sub> hybrids were 3.01 and 2.68 kg, respectively in pooled.

**Table 1:** Analysis of variance (Mean sum of square) for 15 characters of line × tester set of crosses and their parents in tomato (Y<sub>1</sub>=2016-17 and Y<sub>2</sub>=2017-18)

Sources of variation	Years	df	Days to 50% flowering	Days to first fruit set	Days to first fruit harvest	Plant height (cm)	Number of primary branches per plant	Number of fruits per cluster	Number of fruits per plant
Replications	Y <sub>1</sub>	2	1.97	5.85	1.93	7.44	0.79*	0.11	0.19
	Y <sub>2</sub>	2	0.27	5.85	1.93	17.78	0.72	0.10	0.19
Treatments	Y <sub>1</sub>	53	7.55**	6.93**	6.74**	1997.65**	0.50**	0.81**	215.86**
	Y <sub>2</sub>	53	7.26**	6.93**	6.74**	2002.92**	0.50**	0.80**	215.86**
Parents	Y <sub>1</sub>	13	4.56	5.04	4.44	1162.58**	0.36	0.82**	390.43**

	Y <sub>2</sub>	13	5.28*	5.04	4.44	1150.87**	0.36	0.82**	390.43**
Parents (Line)	Y <sub>1</sub>	9	3.92	4.26	3.94	1497.28**	0.32	1.04**	510.02**
	Y <sub>2</sub>	9	4.35	4.26	3.94	1480.81**	0.32	1.04**	510.02**
Parents (Testers)	Y <sub>1</sub>	3	6.87	7.63	6.49	501.95**	0.10	0.29	72.78**
	Y <sub>2</sub>	3	9.84*	7.63	6.49	491.49**	0.10	0.29	72.78**
Lines vs Testers	Y <sub>1</sub>	1	3.31	4.21	2.84	132.17**	1.48*	0.45	267.00**
	Y <sub>2</sub>	1	0.02	4.21	2.84	159.62**	1.48*	0.45	267.00**
Parents vs Crosses	Y <sub>1</sub>	1	26.22**	34.60**	34.24**	2727.06**	0.96	1.72*	2687.98**
	Y <sub>2</sub>	1	20.93**	34.60**	34.24**	3303.22**	0.96	1.49*	2687.98**
Crosses	Y <sub>1</sub>	39	8.06**	6.86**	6.80**	2189.35**	0.53**	0.79**	94.28**
	Y <sub>2</sub>	39	7.57**	6.86**	6.80**	2253.60**	0.53**	0.77**	94.28**
Error	Y <sub>1</sub>	106	2.64	3.31	3.49	11.42	0.25	0.30	2.27
	Y <sub>2</sub>	106	2.65	3.31	3.49	12.05	0.25	0.31	2.27

Table 1: counted...

Sources of variation	Years	Df	Average fruit weight (g)	Fruit length (cm)	Fruit girth (cm)	Number of locules per fruit	Pericarp thickness (mm)	Total soluble solid (TSS)	Ascorbic acid (mg/100 g fresh fruit)	Total fruit yield per plant (kg)
Replications	Y <sub>1</sub>	2	0.09	0.03	3.19	0.10	0.53	0.25	0.49	0.20
	Y <sub>2</sub>	2	0.13	0.03	3.14	0.10	0.46	0.25	15.76	0.16
Treatments	Y <sub>1</sub>	53	231.86**	0.98**	3.30**	1.06**	0.49**	0.84**	262.37**	0.46**
	Y <sub>2</sub>	53	232.13**	0.98**	3.38**	1.06**	0.49**	0.84**	264.10**	0.43**
Parents	Y <sub>1</sub>	13	386.23**	1.53**	5.17**	0.57	0.69**	0.84**	128.74**	0.44**
	Y <sub>2</sub>	13	386.23**	1.53**	5.17**	0.57	0.69**	0.84**	117.56**	0.42**
Parents (Line)	Y <sub>1</sub>	9	354.49**	1.53**	5.21**	0.46	0.86**	1.02**	178.11**	0.20*
	Y <sub>2</sub>	9	354.49**	1.53**	5.21**	0.46	0.86**	1.02**	161.15**	0.16
Parents (Testers)	Y <sub>1</sub>	3	495.69**	1.73**	2.66	0.49	0.40	0.54	22.52*	1.28**
	Y <sub>2</sub>	3	495.69**	1.73**	2.66	0.49	0.40	0.54	22.52*	1.28**
Lines vs Testers	Y <sub>1</sub>	1	343.50**	0.95	12.38**	1.74*	0.04	0.07	3.08	0.12
	Y <sub>2</sub>	1	343.50**	0.95	12.38**	1.74*	0.04	0.07	10.36	0.26
Parents vs Crosses	Y <sub>1</sub>	1	328.71**	1.40*	3.42	0.00	2.20**	0.17	10.54	3.75**
	Y <sub>2</sub>	1	332.09**	1.40*	3.78	0.00	2.20**	0.17	47.32**	3.00**
Crosses	Y <sub>1</sub>	39	177.92**	0.79**	2.68**	1.26**	0.37*	0.86**	313.37**	0.38**
	Y <sub>2</sub>	39	178.20**	0.79**	2.77**	1.26**	0.37*	0.86**	318.51**	0.37**
Error	Y <sub>1</sub>	106	3.60	0.32	1.45	0.36	0.24	0.29	5.86	0.08
	Y <sub>2</sub>	106	3.65	0.32	1.46	0.36	0.24	0.29	6.84	0.09

\*,\*\* Significant at 5% and 1% probability levels, respectively.

Table 2: Pooled ANOVA for 15 characters of line × tester set of crosses and their parents in tomato

Sources of variation	df	Days to 50% flowering	Days to first fruit set	Days to first fruit harvest	Plant height (cm)	Number of primary branches per plant	Number of fruits per cluster	Number of fruits per plant
Replicates	2	1.53	11.71*	3.86	6.02	1.51**	0.20	0.38
Environments	1	847.39**	126.56**	128.60**	262.21**	17.89**	20.06**	128.60**
Rep × Env.	2	0.71	0.00	0.00	19.21	0.00	0.00	0.00
Treatments	53	14.54**	13.86**	13.48**	3943.70**	0.99**	1.60**	431.71**
Parents	13	9.51**	10.07**	8.88**	2313.23**	0.71**	1.64**	780.85**
Parents (Line)	9	8.17**	8.52**	7.88*	2977.99**	0.64**	2.07**	1020.04**
Parents (Testers)	3	16.07**	15.27**	12.97*	992.97**	0.19	0.58	145.55**
Parents (L vs T)	1	1.93	8.42	5.68	291.14**	2.96**	0.91	533.99**
Parent vs Crosses	1	47.00**	69.19**	68.48**	6016.48**	1.92**	3.20**	5375.97**
Crosses	39	15.38**	13.71**	13.60**	4434.04**	1.06**	1.55**	188.56**
Error	212	2.65	3.30	3.49	11.73	0.25	0.30	2.27

Table 2: counted...

Sources of variation	df	Average fruit weight (g)	Fruit length (cm)	Fruit girth (cm)	Number of locules per fruit	Pericarp thickness (mm)	Total soluble solid (TSS)	Ascorbic acid (mg/100 g fresh fruit)	Total fruit yield per plant (kg)
Replicates	2	0.20	0.06	6.32*	0.21	0.98*	0.50	10.31	0.36*
Environments	1	126.09**	23.62**	116.18**	10.50**	13.62**	12.32**	343.61**	10.36**
Rep × Env.	2	0.01	0.00	0.01	0.00	0.00	0.00	5.95	0.00
Treatments	53	463.98**	1.96**	6.67**	2.12**	0.97**	1.69**	514.58**	0.89**
Parents	13	772.46**	3.06**	10.35**	1.13**	1.39**	1.67**	239.99**	0.85**
Parents (Line)	9	708.99**	3.06**	10.42**	0.93**	1.73**	2.04**	330.26**	0.34**
Parents (Testers)	3	991.38**	3.47**	5.31*	0.97*	0.80*	1.08*	45.04**	2.55**
Parents (L vs T)	1	687.00**	1.89*	24.77**	3.49**	0.08	0.15	12.37	0.36*
Parent vs Crosses	1	660.79**	2.79**	7.19*	0.00	4.41**	0.33	51.27*	6.73**
Crosses	39	356.11**	1.58**	5.44**	2.51**	0.74**	1.72**	617.99**	0.75**

Error	212	3.63	0.32	1.46	0.36	0.24	0.29	6.35	0.08
-------	-----	------	------	------	------	------	------	------	------

\*,\*\* Significant at 5% and 1% probability levels, respectively.

**Table 3:** Mean performance, general mean, range, coefficient of variation, critical difference and standard error for 15 characters of line × tester set of 40 F<sub>1</sub>'s and their 14 parents (Y<sub>1</sub>=2016-17 and Y<sub>2</sub>=2017-18) and pooled

Genotypes	Days to 50% flowering			Days to first fruit set			Days to first fruit harvest			Plant height (cm)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
NDT-1 × Pusa Ruby	28.79	31.38	30.09	36.25	37.50	36.88	60.15	61.41	60.78	130.90	132.16	131.53
NDT-1 × Pb. Chhuhara	28.12	31.33	29.73	35.80	37.05	36.42	59.27	60.53	59.90	94.03	95.29	94.66
NDT-1 × Arka Vikas	30.97	33.85	32.41	38.20	39.45	38.83	61.55	62.81	62.18	101.35	102.61	101.98
NDT-1 × Arka Meghali	27.06	30.27	28.67	34.64	35.89	35.26	58.16	59.42	58.79	104.80	116.06	110.43
NDT-2 × Pusa Ruby	31.08	33.96	32.52	37.10	38.35	37.72	60.98	62.24	61.61	108.03	109.29	108.66
NDT-2 × Pb. Chhuhara	28.96	32.17	30.56	36.33	37.58	36.96	60.35	61.61	60.98	67.07	68.33	67.70
NDT-2 × Arka Vikas	31.12	34.33	32.72	38.56	39.81	39.19	62.22	63.48	62.85	76.37	77.63	77.00
NDT-2 × Arka Meghali	30.78	34.66	32.72	39.53	40.78	40.15	62.52	63.78	63.15	82.70	83.96	83.33
NDT-3 × Pusa Ruby	31.44	34.65	33.05	39.24	40.49	39.86	63.18	64.44	63.81	107.69	118.95	113.32
NDT-3 × Pb. Chhuhara	32.12	35.33	33.72	39.49	40.74	40.11	63.11	64.37	63.74	82.03	83.29	82.66
NDT-3 × Arka Vikas	31.89	35.10	33.49	37.91	39.16	38.53	63.11	64.37	63.74	84.53	85.79	85.16
NDT-3 × Arka Meghali	29.00	33.21	31.11	36.19	37.44	36.81	60.13	61.39	60.76	76.32	77.58	76.95
NDT-4 × Pusa Ruby	28.45	31.66	30.06	35.85	37.10	36.48	59.42	60.68	60.05	148.16	149.42	148.79
NDT-4 × Pb. Chhuhara	29.45	31.99	30.72	36.21	37.46	36.84	59.99	61.25	60.62	128.03	130.95	129.49
NDT-4 × Arka Vikas	31.01	34.22	32.61	38.09	39.34	38.72	62.02	63.28	62.65	125.91	127.17	126.54
NDT-4 × Arka Meghali	24.45	28.33	26.39	32.60	33.85	33.22	56.38	57.64	57.01	113.66	114.92	114.29
NDT-5 × Pusa Ruby	29.93	33.14	31.53	37.18	38.43	37.81	61.10	62.36	61.73	150.41	155.00	152.70
NDT-5 × Pb. Chhuhara	27.91	31.12	29.51	35.59	36.84	36.22	59.24	60.50	59.87	138.10	139.36	138.73
NDT-5 × Arka Vikas	30.98	34.19	32.58	38.60	39.85	39.23	62.13	63.39	62.76	134.10	135.36	134.73
NDT-5 × Arka Meghali	30.10	32.31	31.20	36.60	37.85	37.22	60.27	61.53	60.90	131.80	133.06	132.43
NDT-6 × Pusa Ruby	31.45	34.66	33.06	38.88	40.13	39.50	62.56	63.82	63.19	115.43	116.69	116.06
NDT-6 × Pb. Chhuhara	27.53	30.40	28.97	35.66	36.91	36.28	59.54	60.80	60.17	79.44	85.70	82.57
NDT-6 × Arka Vikas	29.79	33.30	31.54	36.93	38.18	37.55	61.15	62.41	61.78	78.37	79.63	79.00
NDT-6 × Arka Meghali	32.16	35.37	33.77	39.53	40.78	40.15	63.18	64.44	63.81	86.72	87.98	87.35
NDT-7 × Pusa Ruby	30.60	33.81	32.20	37.24	38.49	37.87	61.15	62.41	61.78	135.30	136.56	135.93
NDT-7 × Pb. Chhuhara	29.38	32.59	30.99	37.04	38.29	37.66	60.47	61.73	61.10	78.03	79.29	78.66
NDT-7 × Arka Vikas	28.14	30.69	29.41	35.31	36.56	35.94	59.19	60.45	59.82	84.97	84.23	84.60
NDT-7 × Arka Meghali	31.56	34.11	32.83	37.98	39.23	38.60	62.20	63.46	62.83	85.70	85.96	85.83
NDT-8 × Pusa Ruby	30.76	33.97	32.37	38.10	39.35	38.72	62.27	63.53	62.90	123.83	125.09	124.46

Genotypes	Days to 50% flowering			Days to first fruit set			Days to first fruit harvest			Plant height (cm)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
NDT-8 × Pb. Chhuhara	28.99	32.20	30.59	36.03	37.28	36.65	60.48	61.74	61.11	68.17	69.43	68.80
NDT-8 × Arka Vikas	29.79	33.10	31.44	37.28	38.53	37.90	61.36	62.62	61.99	69.83	71.09	70.46
NDT-8 × Arka Meghali	31.45	34.33	32.89	39.07	40.32	39.70	62.19	63.45	62.82	74.63	75.89	75.26
Azad T-6 × Pusa Ruby	30.19	33.40	31.80	38.05	39.30	38.67	61.92	63.18	62.55	157.76	160.02	158.89
Azad T-6 × Pb. Chhuhara	31.45	34.99	33.22	38.87	40.12	39.50	62.51	63.77	63.14	125.30	126.56	125.93
Azad T-6 × Arka Vikas	26.99	31.20	29.10	35.28	36.53	35.91	59.07	60.33	59.70	126.13	127.39	126.76
Azad T-6 × Arka Meghali	29.32	32.93	31.13	37.09	38.34	37.72	60.31	61.57	60.94	131.53	132.79	132.16
Arka Saurabh × Pusa Ruby	29.30	32.97	31.14	37.78	39.03	38.41	61.34	62.60	61.97	127.15	131.75	129.45
Arka Saurabh × Pb. Chhuhara	30.24	33.45	31.84	38.12	39.37	38.75	61.31	62.57	61.94	73.58	74.84	74.21
Arka Saurabh × Arka Vikas	29.45	32.66	31.06	36.98	38.23	37.60	60.47	61.73	61.10	84.37	85.63	85.00
Arka Saurabh × Arka Meghali	30.79	34.00	32.40	38.24	39.49	38.86	62.12	63.38	62.75	70.70	71.96	71.33
<b>Lines</b>												
NDT-1	28.62	32.17	30.40	36.14	37.39	36.77	60.09	61.35	60.72	120.85	122.04	121.44
NDT-2	27.97	31.18	29.58	35.24	36.49	35.87	58.90	60.16	59.53	86.04	87.30	86.67
NDT-3	30.05	33.26	31.66	37.63	38.88	38.26	61.23	62.49	61.86	95.03	96.29	95.66
NDT-4	27.77	30.32	29.05	34.62	35.87	35.24	58.27	59.53	58.90	125.40	126.66	126.03
NDT-5	27.79	31.00	29.40	35.20	36.45	35.83	59.43	60.69	60.06	121.67	122.67	122.17
NDT-6	30.01	33.22	31.61	37.46	38.71	38.08	61.30	62.56	61.93	68.14	69.40	68.77
NDT-7	30.45	33.66	32.06	37.86	39.11	38.49	61.49	62.75	62.12	66.37	67.63	67.00
NDT-8	29.91	33.12	31.52	37.43	38.68	38.05	61.01	62.27	61.64	79.03	80.75	79.89
Azad T-6	27.99	31.20	29.59	35.49	36.74	36.12	59.08	60.34	59.71	110.16	110.82	110.49
Arka Saurabh	30.26	33.14	31.70	36.74	37.99	37.37	60.37	61.63	61.00	85.62	86.88	86.25
<b>Testers</b>												
Pusa Ruby	26.79	30.00	28.40	34.09	35.34	34.72	58.06	59.32	58.69	111.01	111.69	111.35
Punjab Chhuhara	28.12	32.69	30.41	35.68	36.93	36.31	59.31	60.57	59.94	87.20	87.30	87.25
Arka Vikas	28.49	31.70	30.09	35.09	36.34	35.71	59.22	60.48	59.85	82.37	83.63	83.00
Arka Meghali	30.45	34.32	32.39	37.86	39.11	38.49	61.57	62.83	62.20	87.03	88.29	87.66
Mean	29.59	32.82	31.20	36.96	38.21	37.59	60.73	61.99	61.36	101.64	103.44	102.54



C.V.	5.49	4.96	4.72	4.92	4.76	4.33	3.08	3.01	2.72	3.32	3.36	3.20	
S.E. m ±	0.94	0.94	0.60	1.05	1.05	0.66	1.08	1.08	0.68	1.95	2.00	1.34	
C.D. 5%	2.63	2.64	1.67	2.94	2.94	1.85	3.02	3.02	1.90	5.47	5.62	3.73	
Range	Lowest	24.45	28.33	26.39	32.60	33.85	33.22	56.38	57.64	57.01	66.37	67.63	67.00
	Highest	32.16	35.37	33.77	39.53	40.78	40.15	63.18	64.44	63.81	157.76	160.02	158.89

Table 3: counted...

Genotypes	Number of primary branches per plant			Number of fruits per cluster			Number of fruits per plant			Average fruit weight (g)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
Crosses												
NDT-1 × Pusa Ruby	3.65	4.12	3.89	5.23	5.74	5.49	41.48	42.74	42.11	30.06	31.32	30.69
NDT-1 × Pb. Chhuhara	3.99	4.46	4.23	6.16	6.67	6.42	43.55	44.81	44.18	37.10	38.36	37.73
NDT-1 × Arka Vikas	3.49	3.96	3.73	6.10	6.61	6.36	40.39	41.65	41.02	50.38	51.64	51.01
NDT-1 × Arka Meghali	3.02	3.49	3.26	5.33	5.84	5.59	43.89	45.15	44.52	56.08	57.34	56.71
NDT-2 × Pusa Ruby	3.75	4.22	3.99	6.16	6.67	6.42	41.86	43.12	42.49	43.78	45.04	44.41
NDT-2 × Pb. Chhuhara	3.35	3.82	3.59	5.60	6.11	5.86	37.23	38.49	37.86	45.75	47.01	46.38
NDT-2 × Arka Vikas	3.29	3.76	3.53	5.40	5.91	5.66	46.88	48.14	47.51	34.93	36.19	35.56
NDT-2 × Arka Meghali	3.29	3.76	3.53	5.56	6.07	5.82	41.87	43.13	42.50	27.42	28.68	28.05
NDT-3 × Pusa Ruby	3.52	3.99	3.76	5.63	6.14	5.89	45.82	47.08	46.45	30.21	31.47	30.84
NDT-3 × Pb. Chhuhara	3.32	3.79	3.56	4.60	5.11	4.86	44.88	46.14	45.51	34.99	36.25	35.62
NDT-3 × Arka Vikas	3.25	3.72	3.49	4.63	5.14	4.89	44.80	46.06	45.43	39.78	41.04	40.41
NDT-3 × Arka Meghali	2.92	3.39	3.16	4.70	5.21	4.96	44.23	45.49	44.86	27.00	28.26	27.63
NDT-4 × Pusa Ruby	2.95	3.42	3.19	5.40	5.91	5.66	38.56	39.82	39.19	26.32	27.58	26.95
NDT-4 × Pb. Chhuhara	2.95	3.42	3.19	5.40	5.91	5.66	37.58	38.84	38.21	28.68	29.94	29.31
NDT-4 × Arka Vikas	3.89	4.36	4.13	6.10	6.61	6.36	34.38	35.64	35.01	30.33	31.59	30.96
NDT-4 × Arka Meghali	3.09	3.56	3.33	5.60	6.11	5.86	36.53	37.79	37.16	31.20	32.46	31.83
NDT-5 × Pusa Ruby	3.25	3.72	3.49	5.33	5.84	5.59	39.31	40.57	39.94	27.33	28.59	27.96
NDT-5 × Pb. Chhuhara	3.89	4.36	4.13	5.66	6.17	5.92	37.61	38.87	38.24	27.92	29.18	28.55
NDT-5 × Arka Vikas	3.49	3.96	3.73	5.53	6.04	5.79	37.39	38.65	38.02	28.28	29.54	28.91
NDT-5 × Arka Meghali	3.19	3.66	3.43	4.66	5.17	4.92	38.56	39.82	39.19	28.37	29.63	29.00
NDT-6 × Pusa Ruby	3.49	3.96	3.73	5.66	6.17	5.92	31.49	32.75	32.12	31.30	32.56	31.93
NDT-6 × Pb. Chhuhara	3.29	3.76	3.53	4.56	5.07	4.82	36.89	38.15	37.52	30.23	31.49	30.86
NDT-6 × Arka Vikas	3.79	4.26	4.03	5.63	6.14	5.89	27.50	28.76	28.13	33.65	34.24	33.95
NDT-6 × Arka Meghali	3.99	4.46	4.22	4.80	5.31	5.06	29.95	31.21	30.58	34.22	35.48	34.85
NDT-7 × Pusa Ruby	3.19	3.66	3.43	4.66	5.17	4.92	36.85	38.11	37.48	33.89	35.15	34.52
NDT-7 × Pb. Chhuhara	3.69	4.16	3.93	5.23	5.74	5.49	35.10	36.36	35.73	36.31	37.57	36.94
NDT-7 × Arka Vikas	3.49	3.96	3.73	6.03	6.54	6.29	28.72	29.98	29.35	40.75	42.01	41.38
NDT-7 × Arka Meghali	3.89	4.36	4.13	5.10	5.28	5.19	40.86	42.12	41.49	45.37	46.63	46.00
NDT-8 × Pusa Ruby	3.62	4.09	3.86	6.16	6.67	6.42	33.56	34.82	34.19	34.07	35.33	34.70

Genotypes	Number of primary branches per plant			Number of fruits per cluster			Number of fruits per plant			Average fruit weight (g)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
NDT-8 × Pb. Chhuhara	3.75	4.22	3.99	5.94	6.45	6.19	34.55	35.81	35.18	36.32	37.58	36.95
NDT-8 × Arka Vikas	3.82	4.29	4.06	6.38	6.56	6.47	34.29	35.55	34.92	34.06	35.32	34.69
NDT-8 × Arka Meghali	3.19	3.66	3.42	5.60	6.11	5.86	28.59	29.85	29.22	42.63	43.89	43.26
Azad T-6 × Pusa Ruby	3.99	4.46	4.23	5.53	6.04	5.79	27.77	29.03	28.40	39.33	40.59	39.96
Azad T-6 × Pb. Chhuhara	3.79	4.26	4.03	4.56	5.07	4.82	29.58	30.84	30.21	37.83	39.09	38.46
Azad T-6 × Arka Vikas	4.02	4.49	4.26	5.05	5.56	5.31	27.73	28.99	28.36	39.55	40.81	40.18
Azad T-6 × Arka Meghali	4.49	4.96	4.73	5.83	6.34	6.09	32.23	33.49	32.86	48.03	49.29	48.66
Arka Saurabh × Pusa Ruby	2.69	3.16	2.93	5.93	6.44	6.19	36.13	37.39	36.76	56.68	57.94	57.31
Arka Saurabh × Pb. Chhuhara	3.25	3.72	3.49	5.10	5.61	5.36	38.78	40.04	39.41	36.01	37.27	36.64
Arka Saurabh × Arka	2.49	2.96	2.73	5.66	6.17	5.92	40.89	42.15	41.52	33.47	34.73	34.10

Vikas												
Arka Saurabh × Arka Meghali	2.89	3.36	3.13	5.60	6.11	5.86	45.41	46.67	46.04	33.00	34.26	33.63
Lines												
NDT-1	3.69	4.16	3.93	6.10	6.61	6.36	33.36	34.62	33.99	50.68	51.94	51.31
NDT-2	4.15	4.62	4.39	5.36	5.87	5.62	37.37	38.63	38.00	59.32	60.58	59.95
NDT-3	3.52	3.99	3.76	4.43	4.94	4.69	35.24	36.50	35.87	36.37	37.63	37.00
NDT-4	3.95	4.42	4.19	4.20	4.71	4.46	45.26	46.52	45.89	30.03	31.29	30.66
NDT-5	4.19	4.66	4.43	5.70	6.21	5.96	45.23	46.49	45.86	31.08	32.34	31.71
NDT-6	3.45	3.92	3.69	5.40	5.91	5.66	73.56	74.82	74.19	25.35	26.61	25.98
NDT-7	3.42	3.89	3.66	5.63	6.14	5.89	66.61	67.87	67.24	25.07	26.33	25.70
NDT-8	3.39	3.86	3.63	5.70	6.21	5.96	51.23	52.49	51.86	37.23	38.49	37.86
Azad T-6	3.62	4.09	3.86	5.13	5.64	5.39	44.58	45.84	45.21	39.26	40.52	39.89
Arka Saurabh	4.15	4.62	4.39	5.10	5.61	5.36	49.88	51.14	50.51	40.69	41.95	41.32
Testers												
Pusa Ruby	3.49	3.96	3.73	4.83	5.34	5.09	37.96	39.22	38.59	36.33	37.59	36.96
Punjab Chhuhara	3.15	3.62	3.39	4.73	5.24	4.99	40.88	42.14	41.51	29.67	30.93	30.30
Arka Vikas	3.49	3.96	3.73	5.26	5.77	5.52	42.23	43.49	42.86	56.01	57.27	56.64
Arka Meghali	3.22	3.69	3.46	5.36	5.87	5.62	49.54	50.80	50.17	53.35	54.61	53.98
Mean	3.51	3.98	3.74	5.39	5.88	5.64	39.75	41.01	40.38	36.91	38.16	37.53
C.V.	14.23	12.58	11.95	10.18	9.45	8.78	3.79	3.67	3.34	5.14	5.01	4.54
S.E. m ±	0.29	0.29	0.18	0.32	0.32	0.20	0.87	0.87	0.55	1.10	1.10	0.70
C.D. 5%	0.81	0.81	0.51	0.89	0.90	0.56	2.44	2.44	1.53	3.07	3.09	1.94
Range	Lowest	2.49	2.96	2.73	4.20	4.71	4.46	27.50	28.76	25.07	25.07	25.70
	Highest	4.49	4.96	4.73	6.38	6.67	6.47	73.56	74.82	59.32	59.32	59.95

Table 3: counted...

Genotypes	Fruit length (cm)			Fruit girth (cm)			Number of locules per fruit			Pericarp thickness (mm)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
<b>Crosses</b>												
NDT-1 × Pusa Ruby	6.16	6.70	6.43	11.72	12.93	12.33	4.30	4.66	4.48	3.90	4.31	4.11
NDT-1 × Pb. Chhuhara	7.22	7.76	7.49	13.20	14.41	13.81	4.47	4.83	4.65	4.25	4.66	4.46
NDT-1 × Arka Vikas	7.12	7.66	7.39	12.93	14.14	13.54	4.50	4.86	4.68	4.04	4.45	4.25
NDT-1 × Arka Meghali	7.14	7.68	7.41	13.08	14.29	13.68	4.77	5.13	4.95	3.93	4.34	4.14
NDT-2 × Pusa Ruby	6.84	7.38	7.11	11.64	12.85	12.25	4.63	4.99	4.81	4.58	4.99	4.79
NDT-2 × Pb. Chhuhara	6.84	7.38	7.11	13.08	14.29	13.69	4.10	4.46	4.28	4.79	5.20	5.00
NDT-2 × Arka Vikas	5.97	6.51	6.24	12.01	13.22	12.62	5.13	5.49	5.31	5.07	5.48	5.28
NDT-2 × Arka Meghali	6.81	7.35	7.08	12.24	13.45	12.85	4.37	4.73	4.55	4.61	5.02	4.82
NDT-3 × Pusa Ruby	6.25	6.79	6.52	11.96	13.17	12.57	1.90	2.26	2.08	4.58	4.99	4.79
NDT-3 × Pb. Chhuhara	7.12	7.66	7.39	12.01	13.22	12.62	3.60	3.96	3.78	4.35	4.76	4.56
NDT-3 × Arka Vikas	6.59	7.13	6.86	12.36	13.57	12.97	3.33	3.69	3.51	4.55	4.96	4.76
NDT-3 × Arka Meghali	6.17	6.71	6.44	12.70	13.91	13.31	4.47	4.83	4.65	4.09	4.50	4.30
NDT-4 × Pusa Ruby	7.60	8.14	7.87	14.21	15.42	14.82	4.83	5.19	5.01	3.98	4.39	4.19
NDT-4 × Pb. Chhuhara	7.03	7.57	7.30	14.14	15.35	14.75	4.97	5.33	5.15	3.98	4.39	4.19
NDT-4 × Arka Vikas	7.06	7.60	7.33	12.57	13.78	13.18	4.07	4.43	4.25	4.91	5.32	5.12
NDT-4 × Arka Meghali	6.14	6.68	6.41	11.92	13.13	12.53	4.13	4.49	4.31	4.35	4.76	4.56
NDT-5 × Pusa Ruby	5.48	6.02	5.75	10.56	11.77	11.17	3.80	4.16	3.98	4.47	4.88	4.68
NDT-5 × Pb. Chhuhara	5.91	6.45	6.18	11.54	12.75	12.15	3.97	4.33	4.15	4.53	4.94	4.74
NDT-5 × Arka Vikas	6.29	6.83	6.56	13.27	14.48	13.88	3.60	3.96	3.78	4.69	5.10	4.90
NDT-5 × Arka Meghali	7.00	7.54	7.27	14.41	15.62	15.02	4.23	4.59	4.41	4.69	5.10	4.90
NDT-6 × Pusa Ruby	6.03	6.57	6.30	11.96	13.17	12.57	5.70	6.06	5.88	4.22	4.63	4.43
NDT-6 × Pb. Chhuhara	6.44	6.98	6.71	12.14	13.02	12.58	5.17	5.53	5.35	4.73	5.14	4.93
NDT-6 × Arka Vikas	7.54	8.08	7.81	12.24	13.45	12.85	3.90	4.26	4.08	4.42	4.83	4.63
NDT-6 × Arka Meghali	6.47	7.01	6.74	11.87	12.75	12.31	3.93	4.29	4.11	5.12	5.53	5.33
NDT-7 × Pusa Ruby	6.42	6.96	6.69	13.54	14.75	14.15	4.00	4.36	4.18	4.29	4.70	4.49
NDT-7 × Pb. Chhuhara	7.76	8.30	8.03	13.13	14.34	13.74	4.33	4.69	4.51	4.42	4.83	4.63
NDT-7 × Arka Vikas	6.72	7.26	6.99	12.86	14.07	13.47	3.83	4.19	4.01	4.85	5.26	5.06
NDT-7 × Arka Meghali	6.56	7.10	6.83	13.28	14.49	13.89	4.87	5.23	5.05	4.33	4.74	4.54
NDT-8 × Pusa Ruby	7.19	7.73	7.46	12.96	14.17	13.57	3.97	4.33	4.15	4.15	4.56	4.36

Genotypes	Fruit length (cm)			Fruit girth (cm)			Number of locules per fruit			Pericarp thickness (mm)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
NDT-8 × Pb. Chhuhara	6.19	6.73	6.46	13.06	14.27	13.67	3.83	4.19	4.01	5.34	5.75	5.55
NDT-8 × Arka Vikas	6.66	7.20	6.93	13.01	14.22	13.62	3.90	4.26	4.08	5.00	5.41	5.21
NDT-8 × Arka Meghali	6.64	7.18	6.91	13.20	14.41	13.81	5.13	5.49	5.31	4.90	5.31	5.11
Azad T-6 × Pusa Ruby	6.82	7.36	7.09	12.80	14.01	13.41	5.00	5.36	5.18	4.69	5.10	4.90
Azad T-6 × Pb. Chhuhara	6.71	7.25	6.98	11.84	13.05	12.45	4.37	4.73	4.55	4.34	4.75	4.55
Azad T-6 × Arka Vikas	6.89	7.43	7.16	12.09	13.30	12.70	4.87	5.23	5.05	4.59	5.00	4.80

Azad T-6 × Arka Meghali	6.89	7.43	7.16	13.07	14.28	13.68	4.57	4.93	4.75	4.52	4.93	4.72
Arka Saurabh × Pusa Ruby	7.18	7.72	7.45	13.01	14.22	13.62	4.30	4.66	4.48	4.29	4.70	4.50
Arka Saurabh × Pb. Chhuhara	6.48	7.02	6.75	14.80	16.01	15.41	4.87	5.23	5.05	4.65	5.06	4.86
Arka Saurabh × Arka Vikas	7.66	8.20	7.93	15.28	16.49	15.89	4.77	5.13	4.95	3.95	4.36	4.16
Arka Saurabh × Arka Meghali	6.56	7.10	6.83	12.20	13.41	12.81	4.13	4.49	4.31	4.29	4.70	4.50
<b>Lines</b>												
NDT-1	7.09	7.63	7.36	13.56	14.77	14.17	4.77	5.13	4.95	5.52	5.93	5.73
NDT-2	7.70	8.24	7.97	13.36	14.57	13.97	5.17	5.53	5.35	4.92	5.33	5.13
NDT-3	6.53	7.07	6.80	14.50	15.71	15.11	4.67	5.03	4.85	4.89	5.30	5.10
NDT-4	7.93	8.47	8.20	15.47	16.68	16.08	4.50	4.86	4.68	4.22	4.63	4.43
NDT-5	6.53	7.07	6.80	12.49	13.70	13.09	4.37	4.73	4.55	4.45	4.86	4.66
NDT-6	6.29	6.83	6.56	12.46	13.67	13.07	4.23	4.59	4.41	4.29	4.70	4.50
NDT-7	6.41	6.95	6.68	11.50	12.71	12.11	4.40	4.76	4.58	4.29	4.70	4.50
NDT-8	6.50	7.04	6.77	12.16	13.37	12.77	3.77	4.13	3.95	4.49	4.90	4.70
Azad T-6	6.93	7.47	7.20	13.53	14.74	14.14	4.60	4.96	4.78	5.79	6.20	6.00
Arka Saurabh	8.30	8.84	8.57	15.20	16.41	15.81	4.03	4.39	4.21	4.85	5.26	5.06
<b>Testers</b>												
Pusa Ruby	6.40	6.94	6.67	12.30	13.51	12.91	3.90	4.26	4.08	4.39	4.80	4.60
Punjab Chhuhara	5.90	6.44	6.17	11.06	12.27	11.67	3.53	3.89	3.71	4.85	5.26	5.06
Arka Vikas	7.70	8.24	7.97	13.36	14.57	13.97	4.07	4.43	4.25	5.15	5.56	5.36
Arka Meghali	6.76	7.30	7.03	12.16	13.37	12.77	4.50	4.86	4.68	4.42	4.83	4.63
Mean	6.77	7.31	7.04	12.84	14.03	13.44	4.32	4.68	4.50	4.56	4.97	4.76
C.V.	8.36	7.74	7.19	9.37	8.62	8.03	13.93	12.85	11.96	10.67	9.81	9.15
S.E. m ±	0.33	0.33	0.21	0.69	0.70	0.44	0.35	0.35	0.22	0.28	0.28	0.18
C.D. 5%	0.92	0.92	0.58	1.95	1.96	1.23	0.97	0.97	0.61	0.79	0.79	0.50
Range	Lowest	5.48	6.02	5.75	10.56	11.77	1.90	2.26	2.08	3.90	4.31	4.11
	Highest	8.30	8.84	8.57	15.47	16.68	5.70	6.06	5.88	5.79	6.20	6.00

Table 3: counted...

Genotypes	Total soluble solid (TSS)			Ascorbic acid (mg/100 g fresh fruit)			Total fruit yield per plant (kg)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
<b>Crosses</b>									
NDT-1 × Pusa Ruby	5.08	5.47	5.28	33.33	34.22	33.77	2.66	3.03	2.85
NDT-1 × Pb. Chhuhara	5.00	5.39	5.20	25.53	32.35	28.94	2.78	2.99	2.88
NDT-1 × Arka Vikas	5.84	6.23	6.04	26.53	26.75	26.64	2.67	3.04	2.86
NDT-1 × Arka Meghali	4.98	5.37	5.18	36.09	48.64	42.37	2.64	3.01	2.83
NDT-2 × Pusa Ruby	5.97	6.36	6.17	43.22	44.11	43.66	2.88	3.25	3.07
NDT-2 × Pb. Chhuhara	5.40	5.79	5.60	34.93	36.82	35.87	2.60	2.97	2.79
NDT-2 × Arka Vikas	6.18	6.57	6.38	31.55	33.43	32.49	2.99	3.36	3.17
NDT-2 × Arka Meghali	6.12	6.51	6.32	32.77	33.99	33.38	3.04	3.41	3.22
NDT-3 × Pusa Ruby	5.92	6.31	6.12	32.09	33.31	32.70	2.67	3.04	2.86
NDT-3 × Pb. Chhuhara	5.34	5.73	5.54	35.09	36.31	35.70	2.85	3.22	3.04
NDT-3 × Arka Vikas	5.76	6.15	5.96	39.08	40.20	39.64	3.17	3.54	3.36
NDT-3 × Arka Meghali	5.96	6.35	6.16	37.27	39.20	38.24	2.60	2.97	2.79
NDT-4 × Pusa Ruby	5.22	5.61	5.42	40.49	41.53	41.01	2.44	2.81	2.63
NDT-4 × Pb. Chhuhara	5.22	5.61	5.42	42.00	43.20	42.60	2.44	2.81	2.63
NDT-4 × Arka Vikas	5.52	5.91	5.72	44.07	45.29	44.68	2.94	3.31	3.13
NDT-4 × Arka Meghali	5.12	5.51	5.32	43.03	44.25	43.64	2.32	2.69	2.51
NDT-5 × Pusa Ruby	4.50	4.89	4.70	46.87	55.75	51.31	1.74	2.11	1.92
NDT-5 × Pb. Chhuhara	6.00	6.39	6.20	61.09	61.31	61.20	2.35	2.72	2.54
NDT-5 × Arka Vikas	4.96	5.35	5.16	58.70	58.92	58.81	1.74	2.11	1.92
NDT-5 × Arka Meghali	5.72	6.11	5.92	60.31	61.53	60.92	2.30	2.67	2.49
NDT-6 × Pusa Ruby	4.99	5.38	5.19	32.86	34.08	33.47	2.66	3.03	2.85
NDT-6 × Pb. Chhuhara	5.74	6.13	5.94	32.53	33.75	33.14	1.57	1.94	1.75
NDT-6 × Arka Vikas	5.84	6.23	6.03	30.87	32.09	31.48	2.40	2.77	2.59
NDT-6 × Arka Meghali	4.68	5.07	4.88	32.53	33.75	33.14	2.30	2.67	2.49
NDT-7 × Pusa Ruby	5.04	5.43	5.24	28.75	34.64	31.70	1.94	2.31	2.13
NDT-7 × Pb. Chhuhara	6.40	6.79	6.60	27.20	28.42	27.81	1.84	2.21	2.03
NDT-7 × Arka Vikas	5.01	5.40	5.21	28.75	29.97	29.36	2.35	2.72	2.54
NDT-7 × Arka Meghali	4.85	5.24	5.05	28.42	29.64	29.03	2.44	2.70	2.57
NDT-8 × Pusa Ruby	5.62	6.01	5.82	29.09	30.31	29.70	2.60	2.97	2.79

Genotypes	Total soluble solid (TSS)			Ascorbic acid (mg/100 g fresh fruit)			Total fruit yield per plant (kg)		
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled
NDT-8 × Pb. Chhuhara	4.43	4.82	4.63	38.61	35.49	37.05	2.62	2.93	2.78
NDT-8 × Arka Vikas	5.69	6.08	5.88	42.28	45.16	43.72	2.61	2.98	2.80
NDT-8 × Arka Meghali	5.06	5.45	5.26	48.72	50.94	49.83	2.29	2.85	2.57

Azad T-6 × Pusa Ruby	5.26	5.65	5.46	49.39	51.61	50.50	2.60	2.94	2.77	
Azad T-6 × Pb. Chhuhara	5.72	6.11	5.92	54.12	57.67	55.89	2.36	2.68	2.52	
Azad T-6 × Arka Vikas	5.49	5.88	5.69	55.45	58.00	56.72	2.59	2.96	2.78	
Azad T-6 × Arka Meghali	5.90	6.29	6.10	57.57	58.79	58.18	2.31	2.68	2.49	
Arka Saurabh × Pusa Ruby	5.92	6.31	6.12	28.47	40.69	34.58	2.85	3.22	3.04	
Arka Saurabh × Pb. Chhuhara	5.34	5.73	5.54	31.42	32.64	32.03	2.63	3.00	2.82	
Arka Saurabh × Arka Vikas	4.92	5.31	5.12	33.31	32.53	32.92	2.51	2.88	2.69	
Arka Saurabh × Arka Meghali	6.92	7.31	7.12	31.48	33.70	32.59	2.44	2.91	2.68	
<b>Lines</b>										
NDT-1	5.92	6.31	6.12	40.78	42.00	41.39	2.76	3.13	2.94	
NDT-2	5.42	5.81	5.62	31.87	40.09	35.98	3.28	3.65	3.46	
NDT-3	4.92	5.31	5.12	27.24	28.46	27.85	2.63	3.00	2.82	
NDT-4	4.45	4.84	4.65	28.78	30.00	29.39	2.46	2.83	2.64	
NDT-5	6.42	6.81	6.62	32.76	33.98	33.37	2.51	2.88	2.69	
NDT-6	5.72	6.11	5.92	39.31	41.20	40.26	2.76	3.13	2.94	
NDT-7	5.38	5.77	5.58	43.40	44.62	44.01	2.76	3.03	2.89	
NDT-8	6.12	6.51	6.32	47.13	48.35	47.74	2.98	3.12	3.05	
Azad T-6	5.92	6.31	6.12	49.62	50.84	50.23	2.82	3.19	3.01	
Arka Saurabh	5.38	5.77	5.58	41.46	40.02	40.74	3.11	3.26	3.18	
<b>Testers</b>										
Pusa Ruby	4.95	5.34	5.15	34.14	35.36	34.75	2.47	2.84	2.65	
Punjab Chhuhara	5.55	5.94	5.75	37.55	38.77	38.16	2.26	2.63	2.44	
Arka Vikas	5.98	6.37	6.18	38.03	39.25	38.64	3.44	3.81	3.63	
Arka Meghali	5.41	5.80	5.61	40.82	42.04	41.43	3.53	3.90	3.71	
Mean	5.49	5.88	5.68	38.50	40.55	39.53	2.58	2.94	2.76	
C.V.	9.73	9.09	8.41	6.29	6.45	6.91	10.85	10.05	9.41	
S.E. m ±	0.31	0.31	0.19	1.40	1.51	1.11	0.16	0.17	0.11	
C.D. 5%	0.86	0.86	0.54	3.92	4.23	3.10	0.45	0.48	0.30	
Range	Lowest	4.43	4.82	4.63	25.53	26.75	26.64	1.57	1.94	1.75
	highest	6.92	7.31	7.12	61.09	61.53	61.20	3.53	3.90	3.71

**Table 4:** Range of variation in mean values and grand means of various traits Y<sub>1</sub>=2016-17 and Y<sub>2</sub>=2017-18 and pooled

Characters	Range of mean values						Mean over						Grand mean		
	Parents			Crosses			Parents			Crosses			Y <sub>1</sub>	Y <sub>2</sub>	Pooled
	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled	Y <sub>1</sub>	Y <sub>2</sub>	Pooled			
Days to 50% flowering	26.79-30.45	30.00-34.32	28.40-32.39	24.45-32.16	28.33-35.37	26.39-33.77	28.91	32.21	30.56	29.82	33.03	31.43	29.59	32.82	31.20
Days to first fruit set	34.09-37.86	35.34-39.11	34.72-38.49	32.60-39.53	33.85-40.78	33.22-40.15	36.18	37.43	36.81	37.24	38.49	37.86	36.96	38.21	37.59
Days to first fruit harvest	58.06-61.57	59.32-62.83	58.69-62.20	56.38-63.18	57.64-64.44	57.01-63.81	59.95	61.21	60.58	61.00	62.26	61.63	60.73	61.99	61.36
Plant height (cm)	66.37-125.40	67.63-126.66	67.00-126.03	67.07-157.76	68.33-160.02	67.70-158.89	94.71	95.81	95.26	104.07	106.11	105.09	101.64	103.44	102.54
Number of primary branches per plant	3.15-4.19	3.62-4.66	3.39-4.43	2.49-4.49	2.96-4.96	2.73-4.73	3.64	4.11	3.87	3.46	3.93	3.70	3.51	3.98	3.74
Number of fruits per cluster	4.20-6.10	4.71-6.61	4.46-6.36	4.56-6.38	5.07-6.67	4.82-6.47	5.21	5.72	5.47	5.45	5.94	5.69	5.39	5.88	5.64
Number of fruits per plant	33.36-73.56	34.62-74.82	33.99-74.19	27.50-46.88	28.76-48.14	28.13-47.51	46.64	47.90	47.27	37.34	38.60	37.97	39.75	41.01	40.38
Average fruit weight (g)	25.07-59.32	26.33-60.58	25.70-59.95	26.32-56.68	27.58-57.94	26.95-57.31	39.32	40.58	39.95	36.07	37.31	36.69	36.91	38.16	37.53
Fruit length (cm)	5.90-8.30	6.44-8.84	6.17-8.57	5.48-7.76	6.02-8.30	5.75-8.03	6.92	7.46	7.19	6.71	7.25	6.98	6.77	7.31	7.04
Fruit girth (cm)	11.06-15.47	12.27-16.68	11.67-16.08	10.56-15.28	11.77-16.49	11.17-15.89	13.08	14.29	13.69	12.75	13.94	13.35	12.84	14.03	13.44
Number of locules per fruit	3.53-5.17	3.89-5.53	3.71-5.35	1.90-5.70	2.26-6.06	2.08-5.88	4.32	4.68	4.50	4.32	4.68	4.50	4.32	4.68	4.50
Pericarp thickness (mm)	4.22-5.79	4.63-6.20	4.43-6.00	3.90-5.34	4.31-5.75	4.11-5.55	4.75	5.16	4.96	4.49	4.90	4.69	4.56	4.97	4.76
Total soluble solid (TSS)	4.45-6.42	4.84-6.81	4.65-6.62	4.43-6.92	4.82-7.31	4.63-7.12	5.54	5.93	5.74	5.47	5.86	5.66	5.49	5.88	5.68
Ascorbic acid (mg/100 g fresh fruit)	27.24-49.62	28.46-50.84	27.85-50.23	25.53-61.09	26.75-61.53	26.64-61.20	38.06	39.64	38.85	38.65	40.87	39.76	38.50	40.55	39.53
Total fruit yield per plant (kg)	2.26-3.53	2.63-3.90	2.44-3.71	1.57-3.17	1.94-3.54	1.75-3.36	2.84	3.17	3.01	2.49	2.86	2.68	2.58	2.94	2.76



The above mentioned genotypes may be used as donor parents in hybridization programme for developing high yielding varieties of respective groups. Some other genotypes exhibiting very high mean performance for characters other than fruit yield per plant are also listed in table 3. These lines merits due consideration as promising parents for hybridization programme for bringing over all improvement in plant genetic architecture in a component breeding approach ultimately leading to high yielding tomato genotypes even if they have moderate or low fruit yield. In this context, the most desirable parents were Pusa Ruby (26.79 days) showed earliest days to 50% flowering among the parents followed by NDT-4 (27.77 days), NDT-5 (27.79 days), NDT-2 (27.97 days) and Azad T-6 (27.99 days). The best F<sub>1</sub> hybrid regarding days to 50% flowering was NDT-4 × Arka Meghali (24.45 days) followed by Azad T-6 × Arka Vikas (26.99 days), NDT-1 × Arka Meghali (27.06 days), NDT-6 × Punjab Chhuhara (27.53 days) and NDT-5 × Pb. Chhuhara (27.91 days). Average over the parental mean (28.91 days) and average over the F<sub>1</sub> hybrid mean (29.82 days) were more or less of the same order in Y<sub>1</sub>. Parent Pusa Ruby (30.00 days) followed by NDT-4 (30.32 days), NDT-5 (31.00 days), NDT-2 (31.18 days) and Azad T-6 (31.20 days) and F<sub>1</sub> hybrid was NDT-4 × Arka Meghali (28.33 days) followed by NDT-1 × Arka Meghali (30.27 days), NDT-6 × Punjab Chhuhara (30.40 days), NDT-7 × Arka Vikas (30.69 days) and NDT-5 × Pb. Chhuhara (31.12 days). Average over the parental mean (32.21 days) and average over the F<sub>1</sub> hybrid mean (33.03 days) were more or less of the same order in Y<sub>2</sub> and Parent Pusa Ruby (28.40 days) followed by NDT-4 (29.05 days), NDT-5 (29.40 days), NDT-2 (29.58 days) and Azad T-6 (29.59 days) and F<sub>1</sub> hybrid was NDT-4 × Arka Meghali (26.39 days) followed by NDT-1 × Arka Meghali (28.67 days), NDT-6 × Punjab Chhuhara (28.97 days), Azad T-6 × Arka Vikas (29.10 days) and NDT-7 × Arka Vikas (29.41 days). Average over the parental mean (30.56 days) and average over the F<sub>1</sub> hybrid mean (31.43 days) were more or less of the same order in pooled.

Earliest days to first fruit set was showed in parent Pusa Ruby (34.09 days) followed by NDT-4 (34.62 days), Arka Vikas (35.09 days), NDT-5 (35.20 days) and NDT-2 (35.34 days). The best F<sub>1</sub> hybrid regarding days to first fruit set was NDT-4 × Arka Meghali (32.60 days) followed by NDT-1 × Arka Meghali (34.64 days), Azad T-6 × Arka Vikas (35.28 days), NDT-7 × Arka Vikas (35.31 days) and NDT-5 × Pb. Chhuhara (35.59 days). Average over the parental mean (36.18 days) and average over the F<sub>1</sub> hybrid mean (37.24 days) were more or less of the same order in Y<sub>1</sub>, Parent Pusa Ruby (35.34 days) followed by NDT-4 (35.87 days), Arka Vikas (36.34 days), NDT-5 (36.45 days) and NDT-2 (36.49 days) and F<sub>1</sub> hybrid was NDT-4 × Arka Meghali (33.85 days) followed by NDT-1 × Arka Meghali (35.89 days), Azad T-6 × Arka Vikas (36.53 days), NDT-7 × Arka Vikas (36.56 days) and NDT-5 × Pb. Chhuhara (36.84 days). Average over the parental mean (37.43 days) and average over the F<sub>1</sub> hybrid mean (38.49 days) were more or less of the same order in Y<sub>2</sub> and Parent Pusa Ruby (34.72 days) followed by NDT-4 (35.24 days), Arka Vikas (35.71 days), NDT-5 (35.83 days) and NDT-2 (35.87 days) and F<sub>1</sub> hybrid was NDT-4 × Arka Meghali (33.22 days) followed by NDT-1 × Arka Meghali (35.26 days), Azad T-6 × Arka Vikas (35.91 days), NDT-7 × Arka Vikas (35.94 days) and NDT-5 × Pb. Chhuhara (36.22 days). Average over the parental mean (36.81 days) and average over the F<sub>1</sub> hybrid mean (37.86 days) were more or less of the same order in pooled.

An earliest day to first fruit harvest was showed in parents Pusa Ruby (58.06 days) followed by NDT-4 (58.27 days), NDT-2 (58.90 days), Azad T-6 (59.08 days) and Arka Vikas (59.22 days). The best F<sub>1</sub> hybrid regarding days to first fruit harvest was NDT-4 × Arka Meghali (56.38 days) followed by NDT-1 × Arka Meghali (58.16 days), Azad T-6 × Arka Vikas (59.07 days), NDT-7 × Arka Vikas (59.19 days) and NDT-5 × Pb. Chhuhara (59.24 days). Average over the parental mean (59.95 days) and average over the F<sub>1</sub> hybrid mean (61.00 days) were more or less of the same order in Y<sub>1</sub> Parent Pusa Ruby (59.32 days) followed by NDT-4 (59.53 days), NDT-2 (60.16 days), Azad T-6 (60.34 days) and Arka Vikas (60.48 days) and F<sub>1</sub> hybrid was NDT-4 × Arka Meghali (57.64 days) followed by NDT-1 × Arka Meghali (59.42 days), Azad T-6 × Arka Vikas (60.33 days), NDT-7 × Arka Vikas (60.45 days) and NDT-5 × Pb. Chhuhara (60.50 days). Average over the parental mean (61.21 days) and average over the F<sub>1</sub> hybrid mean (62.26 days) were more or less of the same order in Y<sub>2</sub> and Parent Pusa Ruby (58.69 days) followed by NDT-4 (58.90 days), NDT-2 (59.53 days), Azad T-6 (59.71 days) and Arka Vikas (59.85 days) and F<sub>1</sub> hybrid was NDT-4 × Arka Meghali (57.01 days) followed by NDT-1 × Arka Meghali (58.79 days), Azad T-6 × Arka Vikas (59.70 days), NDT-7 × Arka Vikas (59.82 days) and NDT-5 × Pb. Chhuhara (59.87 days). Average over the parental mean (60.58 days) and average over the F<sub>1</sub> hybrid mean (61.63 days) were more or less of the same order in pooled.

Maximum plant height was recorded in parents NDT-4 (125.40 cm) followed by NDT-5 (121.67 cm), NDT-1 (120.85 cm), Pusa Ruby (111.01 cm) and Azad T-6 (110.16 cm). The F<sub>1</sub> hybrid Azad T-6 × Pusa Ruby (157.76 cm) was the tallest with respect to this trait followed by NDT-5 × Pusa Ruby (150.41 cm), NDT-4 × Pusa Ruby (148.16 cm), NDT-5 × Pb. Chhuhara (138.10 cm) and NDT-7 × Pusa Ruby (135.30 cm). Average over the parental mean (94.71 cm) and average over the F<sub>1</sub> hybrid mean (104.07 cm) in Y<sub>1</sub>, NDT-4 (126.66 cm) followed by NDT-5 (122.67 cm), NDT-1 (122.04 cm), Pusa Ruby (111.69 cm) and Azad T-6 (110.82 cm) and F<sub>1</sub> hybrid Azad T-6 × Pusa Ruby (160.02 cm) was the tallest with respect to this trait followed by NDT-5 × Pusa Ruby (155.00 cm), NDT-4 × Pusa Ruby (149.42 cm), NDT-5 × Pb. Chhuhara (139.36 cm) and NDT-7 × Pusa Ruby (136.56 cm). Average over the parental mean (95.81 cm) and average over the F<sub>1</sub> hybrid mean (106.11 cm) in Y<sub>2</sub> and NDT-4 (126.66 cm) followed by NDT-5 (122.67 cm), NDT-1 (122.04 cm), Pusa Ruby (111.69 cm) and Azad T-6 (110.82 cm) and F<sub>1</sub> hybrid Azad T-6 × Pusa Ruby (158.89 cm) was the tallest with respect to this trait followed by NDT-5 × Pusa Ruby (152.70 cm), NDT-4 × Pusa Ruby (148.79 cm), NDT-5 × Pb. Chhuhara (138.73 cm) and NDT-7 × Pusa Ruby (135.93 cm). Average over the parental mean (95.26 cm) and average over the F<sub>1</sub> hybrid mean (105.09 cm) in pooled.

Maximum number of primary branches per plant was recorded in parental line NDT-5 (4.19) followed by NDT-2 and Arka Saurabh (4.15), NDT-4 (3.95), NDT-1 (3.69) and Azad T-6 (3.62), F<sub>1</sub> hybrids Azad T-6 × Arka Meghali (4.49) had maximum number of primary branches per plant followed by Azad T-6 × Arka Vikas (4.02), NDT-1 × Pb. Chhuhara, NDT-6 × Arka Meghali and Azad T-6 × Pusa Ruby (3.99), NDT-7 × Arka Meghali (3.89) and NDT-8 × Arka Vikas (3.82). The mean values over the parental lines and F<sub>1</sub> hybrids were 3.64 and 3.46, respectively in Y<sub>1</sub>, parent NDT-5 (4.66) followed by NDT-2 and Arka Saurabh (4.62), NDT-4 (4.42), NDT-1 (4.16) and Azad T-6 (4.09) and F<sub>1</sub> hybrids Azad T-6 × Arka Meghali (4.96) followed by Azad T-6 × Arka Vikas

(4.49), NDT-1 × Pb. Chhuhara, NDT-6 × Arka Meghali and Azad T-6 × Pusa Ruby (4.46), NDT-4 × Arka Vikas, NDT-5 × Pb. Chhuhara and NDT-7 × Arka Meghali (4.36) and NDT-8 × Arka Vikas (4.29). The mean values over the parental lines and F<sub>1</sub> hybrids were 4.11 and 3.93, respectively in Y<sub>2</sub> and NDT-5 (4.43) followed by NDT-2 and Arka Saurabh (4.39), NDT-4 (4.19), NDT-1 (3.93) and Azad T-6 (3.86) and F<sub>1</sub> hybrids Azad T-6 × Arka Meghali (4.73) had maximum number of primary branches per plant followed by Azad T-6 × Arka Vikas (4.26), NDT-1 × Pb. Chhuhara and Azad T-6 × Pusa Ruby (4.23), NDT-6 × Arka Meghali (4.22) and NDT-4 × Arka Vikas, NDT-5 × Pb. Chhuhara and NDT-7 × Arka Meghali (4.13). The mean values over the parental lines and F<sub>1</sub> hybrids were 3.87 and 3.70, respectively in pooled.

Highest number of fruits per cluster was recorded in parents NDT-1 (6.10) followed by NDT-5 and NDT-8 (5.70), NDT-7 (5.63), NDT-6 (5.40) and NDT-2 and Arka Meghali (5.36). Among the hybrids, the highest number of fruits per cluster was observed in NDT-8 × Arka Vikas (6.38) which was followed by NDT-1 × Pb. Chhuhara, NDT-2 × Pusa Ruby and NDT-8 × Pusa Ruby (6.16), NDT-1 × Arka Vikas and NDT-4 × Arka Vikas (6.10), NDT-7 × Arka Vikas (6.03) and NDT-8 × Pb. Chhuhara (5.94). The mean values over the parental lines and F<sub>1</sub> hybrids were 5.21 and 5.45, respectively in Y<sub>1</sub>, parent NDT-1 (6.61) followed by NDT-5 and NDT-8 (6.21), NDT-7 (6.14), NDT-6 (5.91) and NDT-2 and Arka Meghali (5.87). Among the hybrids NDT-1 × Pb. Chhuhara, NDT-2 × Pusa Ruby and NDT-8 × Pusa Ruby (6.67) which was followed by NDT-1 × Arka Vikas and NDT-4 × Arka Vikas (6.61), NDT-8 × Arka Vikas (6.56), NDT-7 × Arka Vikas (6.54) and Arka Saurabh × Pusa Ruby (6.44). The mean values over the parental lines and F<sub>1</sub> hybrids were 5.72 and 5.94, respectively in Y<sub>2</sub> and parent NDT-1 (6.36) followed by NDT-5 and NDT-8 (5.96), NDT-7 (5.89), NDT-6 (5.66) and NDT-2 and Arka Meghali (5.62) and hybrid NDT-8 × Arka Vikas (6.47) which was followed by NDT-1 × Pb. Chhuhara, NDT-2 × Pusa Ruby and NDT-8 × Pusa Ruby (6.42), NDT-1 × Arka Vikas and NDT-4 × Arka Vikas (6.36), NDT-7 × Arka Vikas (6.29) and NDT-8 × Pb. Chhuhara (6.19). The mean values over the parental lines and F<sub>1</sub> hybrids were 5.47 and 5.69, respectively in pooled.

Highest number of fruits per plant was recorded in parents NDT-6 (73.56) followed by NDT-7 (66.61), NDT-8 (51.23), Arka Saurabh (49.88) and Arka Meghali (49.54). Among the hybrids, the highest number of fruits per plant was observed in NDT-2 × Arka Vikas (46.88) which was followed by NDT-3 × Pusa Ruby (45.82), Arka Saurabh × Arka Meghali (45.41), NDT-3 × Pb. Chhuhara (44.88) and NDT-3 × Arka Vikas (44.80). The mean value of 46.64 over the parents and 37.34 over the hybrids in Y<sub>1</sub>, parent NDT-6 (74.82) followed by NDT-7 (67.87), NDT-8 (52.49), and Arka Saurabh (51.14) and Arka Meghali (50.80). Among the hybrids NDT-2 × Arka Vikas (48.14) which was followed by NDT-3 × Pusa Ruby (47.08), Arka Saurabh × Arka Meghali (46.67), NDT-3 × Pb. Chhuhara (46.14) and NDT-3 × Arka Vikas (46.06). The mean value of 47.90 over the parents and 38.60 over the hybrids in Y<sub>2</sub> and parent NDT-6 (74.19) followed by NDT-7 (67.24), NDT-8 (51.86), and Arka Saurabh (50.51) and Arka Meghali (50.17). Among the hybrids NDT-2 × Arka Vikas (47.51) which was followed by NDT-3 × Pusa Ruby (46.45), Arka Saurabh × Arka Meghali (46.04), NDT-3 × Pb. Chhuhara (45.51) and NDT-3 × Arka Vikas (45.43). The mean value of 47.27 over the parents and 37.47 over the hybrids in pooled.

Heaviest fruit produced in parents NDT-2 (59.32 g) followed by Arka Vikas (56.01 g), Arka Meghali (53.35 g), NDT-1 (50.68 g) and Arka Saurabh (40.69 g). Among the hybrids, the highest fruit weight was exhibited by the Arka Saurabh × Pusa Ruby (56.68 g) followed by NDT-1 × Arka Meghali (56.08 g), NDT-1 × Arka Vikas (50.38 g), Azad T-6 × Arka Meghali (48.03 g) and NDT-2 × Pb. Chhuhara (45.75 g) in descending order and the mean values over the parental lines and F<sub>1</sub> hybrids were 39.32 g and 36.07 g, respectively in Y<sub>1</sub>, parent NDT-2 (60.58 g) followed by Arka Vikas (57.27 g), Arka Meghali (54.61 g), NDT-1 (51.94 g) and Arka Saurabh (41.95 g). Among the hybrids Arka Saurabh × Pusa Ruby (57.94 g) followed by NDT-1 × Arka Meghali (57.34 g), NDT-1 × Arka Vikas (51.64 g), Azad T-6 × Arka Meghali (49.29 g) and NDT-2 × Pb. Chhuhara (47.01 g) in descending order. The mean values over the parental lines and F<sub>1</sub> hybrids were 40.58 g and 37.31 g, respectively in Y<sub>2</sub> and parent NDT-2 (59.95 g) followed by Arka Vikas (56.64 g), Arka Meghali (53.98 g), NDT-1 (51.31 g) and Arka Saurabh (41.32 g). Among the hybrids Arka Saurabh × Pusa Ruby (57.31 g) followed by NDT-1 × Arka Meghali (56.71 g), NDT-1 × Arka Vikas (51.01 g), Azad T-6 × Arka Meghali (48.66 g) and NDT-2 × Pb. Chhuhara (46.38 g) in descending order. The mean values over the parental lines and F<sub>1</sub> hybrids were 39.95 g and 36.69 g, respectively in pooled.

Largest fruit length were recorded in parents Arka Saurabh (8.30 cm) followed by NDT-4 (7.93 cm), NDT-2 and Arka Vikas (7.70 cm), NDT-1 (7.09 cm) and Arka Meghali (6.76 cm). Among the hybrids NDT-7 × Pb. Chhuhara (7.76 cm) displayed maximum fruit length followed by Arka Saurabh × Arka Vikas (7.66 cm), NDT-4 × Pusa Ruby (7.60 cm) and NDT-6 × Arka Vikas (7.54 cm) and NDT-1 × Pb. Chhuhara (7.22 cm). The mean value of 6.92 cm over the parents and crosses of 6.71 cm in Y<sub>1</sub>, parent Arka Saurabh (8.84 cm) followed by NDT-4 (8.47 cm), NDT-2 and Arka Vikas (8.24 cm), NDT-1 (7.63 cm) and Azad T-6 (7.47 cm). Among the hybrids NDT-7 × Pb. Chhuhara (8.30 cm) followed by Arka Saurabh × Arka Vikas (8.20 cm), NDT-4 × Pusa Ruby (8.14 cm) and NDT-6 × Arka Vikas (8.08 cm) and NDT-1 × Pb. Chhuhara (7.76 cm). The mean value of 7.46 cm over the parents and crosses of 7.25 cm in Y<sub>2</sub> and parent Arka Saurabh (8.57 cm) followed by NDT-4 (8.20 cm), NDT-2 and Arka Vikas (7.97 cm), NDT-1 (7.36 cm) and Azad T-6 (7.20 cm). Among the hybrids NDT-7 × Pb. Chhuhara (8.03 cm) followed by Arka Saurabh × Arka Vikas (7.93 cm), NDT-4 × Pusa Ruby (7.87 cm) and NDT-6 × Arka Vikas (7.81 cm) and NDT-1 × Pb. Chhuhara (7.49 cm). The mean value of 7.19 cm over the parents and crosses of 6.98 cm in pooled.

Maximum fruit girth in parental line NDT-4 (15.47 cm) followed by Arka Saurabh (15.20 cm), NDT-3 (14.50 cm), NDT-1 (13.56 cm) and Azad T-6 (13.53 cm). Among the hybrids Arka Saurabh × Arka Vikas (15.28 cm) bore the maximum fruit girth followed by Arka Saurabh × Pb. Chhuhara (14.80 cm), NDT-5 × Arka Meghali (14.41 cm), NDT-4 × Pusa Ruby (14.21 cm) and NDT-4 × Pb. Chhuhara (14.14 cm). The mean values over the parental lines and F<sub>1</sub> hybrids were 13.08 cm and 12.75 cm, respectively in Y<sub>1</sub>, parental line NDT-4 (16.68 cm) followed by Arka Saurabh (16.41 cm), NDT-3 (15.71 cm), NDT-1 (14.77 cm) and Azad T-6 (14.74 cm). Among the hybrids Arka Saurabh × Arka Vikas (16.49 cm) followed by Arka Saurabh × Pb. Chhuhara (16.01 cm), NDT-5 × Arka Meghali (15.62 cm), NDT-4 × Pusa Ruby (15.42 cm) and NDT-4 × Pb. Chhuhara (15.35 cm). The mean values over the parental lines and F<sub>1</sub> hybrids were 14.29 cm and 13.94 cm, respectively in Y<sub>2</sub> and parental

line NDT-4 (16.08 cm) followed by Arka Saurabh (15.81 cm), NDT-3 (15.11 cm), NDT-1 (14.17 cm) and Azad T-6 (14.14 cm). Among the hybrids Arka Saurabh × Arka Vikas (15.89 cm) bore the maximum fruit girth followed by Arka Saurabh × Pb.Chhuhara (15.41 cm), NDT-5 × Arka Meghali (15.02 cm), NDT-4 × Pusa Ruby (14.82 cm) and NDT-4 × Pb. Chhuhara (14.75 cm). The mean values over the parental lines and F<sub>1</sub> hybrids were 13.69 cm and 13.35 cm, respectively in pooled.

Maximum number of locules per fruit were recorded in patents NDT-2 (5.17) followed by NDT-1 (4.77), NDT-3 (4.67), Azad T-6 (4.60) and NDT-4 and Arka Meghali (4.50). Among the hybrid NDT-6 × Pusa Ruby (5.70) had maximum number of locules per fruit followed by NDT-6 × Pb. Chhuhara (5.15), NDT-2 × Arka Vikas and NDT-8 × Arka Meghali (5.13), Azad T-6 × Pusa Ruby (5.00) and NDT-4 × Pb. Chhuhara (4.97). The mean values over the parental lines and F<sub>1</sub> hybrids were 4.32 and 4.32, respectively in Y<sub>1</sub>, NDT-2 (5.53) followed by NDT-1 (5.13), NDT-3 (5.03), Azad T-6 (4.96) and NDT-4 and Arka Meghali (4.86). Among the hybrid NDT-6 × Pusa Ruby (6.06) had maximum number of locules per fruit followed by NDT-6 × Pb. Chhuhara (5.53), NDT-2 × Arka Vikas and NDT-8 × Arka Meghali (5.49), Azad T-6 × Pusa Ruby (5.36) and NDT-4 × Pb. Chhuhara (5.33). The mean values over the parental lines and F<sub>1</sub> hybrids were 4.68 and 4.68, respectively in Y<sub>2</sub> and NDT-2 (5.35) followed by NDT-1 (4.95), NDT-3 (4.85), Azad T-6 (4.78) and NDT-4 and Arka Meghali (4.68). Among the hybrid NDT-6 × Pusa Ruby (5.88) had maximum number of locules per fruit followed by NDT-6 × Pb. Chhuhara (5.35), NDT-2 × Arka Vikas and NDT-8 × Arka Meghali (5.31), Azad T-6 × Pusa Ruby (5.18) and NDT-4 × Pb. Chhuhara (5.15). The mean values over the parental lines and F<sub>1</sub> hybrids were 4.50 and 5.50, respectively in pooled.

Maximum pericarp thickness were recorded in patents Azad T-6 (5.79 mm) followed by NDT-1 (5.52 mm), Arka Vikas (5.15 mm), NDT-2 (4.92 mm) and NDT-3 (4.89 mm). Among the hybrid NDT-8 × Pb. Chhuhara (5.34 mm) had maximum pericarp thickness followed by NDT-6 × Arka Meghali (5.12 mm), NDT-2 × Arka Vikas (5.07 mm), NDT-8 × Arka Vikas (5.00 mm) and NDT-4 × Arka Vikas (4.91 mm). The mean values over the parental lines and F<sub>1</sub> hybrids were 4.75 mm and 4.49 mm, respectively in Y<sub>1</sub>, Azad T-6 (6.20 mm) followed by NDT-1 (5.93 mm), Arka Vikas (5.56 mm), NDT-2 (5.33 mm) and NDT-3 (5.30 mm). Among the hybrid NDT-8 × Pb. Chhuhara (5.75 mm) had maximum pericarp thickness followed by NDT-6 × Arka Meghali (5.53 mm), NDT-2 × Arka Vikas (5.58 mm), NDT-8 × Arka Vikas (5.41 mm) and NDT-4 × Arka Vikas (5.32 mm). The mean values over the parental lines and F<sub>1</sub> hybrids were 5.16 mm and 4.90 mm, respectively in Y<sub>2</sub> and Azad T-6 (6.00 mm) followed by NDT-1 (5.73 mm), Arka Vikas (5.36 mm), NDT-2 (5.13 mm) and NDT-3 (5.10 mm). Among the hybrid NDT-8 × Pb. Chhuhara (5.55 mm) had maximum pericarp thickness followed by NDT-6 × Arka Meghali (5.33 mm), NDT-2 × Arka Vikas (5.28 mm), NDT-8 × Arka Vikas (5.21 mm) and NDT-4 × Arka Vikas (5.12 mm). The mean values over the parental lines and F<sub>1</sub> hybrids were 4.96 mm and 4.69 mm, respectively in pooled.

Maximum total soluble solids were recorded in parental line NDT-5 (6.42 °B) followed by NDT-8 (6.12 °B), Arka Vikas (5.98 °B), NDT-1 and Azad T-6 (5.92 °B) and NDT-6 (5.72 °B). Among the hybrids, Arka Saurabh × Arka Meghali (6.92 °B) showed highest total soluble solids followed by NDT-7 × Pb. Chhuhara (6.40 °B), NDT-2 × Arka Vikas (6.18 °B),

NDT-2 × Arka Meghali (6.12 °B) and NDT-5 × Pb. Chhuhara (6.00 °B). The mean values over the parental lines and F<sub>1</sub> hybrids were 5.54 °B and 5.47 °B, respectively in Y<sub>1</sub>, NDT-5 (6.81 °B) followed by NDT-8 (6.51 °B), Arka Vikas (6.37 °B), NDT-1 and Azad T-6 (6.31 °B) and NDT-6 (6.11 °B). Among the hybrids, Arka Saurabh × Arka Meghali (7.31 °B) showed highest total soluble solids followed by NDT-7 × Pb. Chhuhara (6.79 °B), NDT-2 × Arka Vikas (6.57 °B), NDT-2 × Arka Meghali (6.51 °B) and NDT-5 × Pb. Chhuhara (6.39 °B). The mean values over the parental lines and F<sub>1</sub> hybrids were 5.93 °B and 5.86 °B, respectively in Y<sub>2</sub> and NDT-5 (6.62 °B) followed by NDT-8 (6.32 °B), Arka Vikas (6.18 °B), NDT-1 and Azad T-6 (6.12 °B) and NDT-6 (5.92 °B). Among the hybrids, Arka Saurabh × Arka Meghali (7.12 °B) showed highest total soluble solids followed by NDT-7 × Pb. Chhuhara (6.60 °B), NDT-2 × Arka Vikas (6.38 °B), NDT-2 × Arka Meghali (6.32 °B) and NDT-5 × Pb. Chhuhara (6.20 °B). The mean values over the parental lines and F<sub>1</sub> hybrids were 5.74 °B and 5.66 °B, respectively in pooled.

Maximum ascorbic acid were recorded in patents Azad T-6 (49.62 mg) followed by NDT-8 (47.13 mg), NDT-7 (43.40 mg), Arka Saurabh (41.46 mg) and Arka Meghali (40.82 mg). Among the hybrid NDT-5 × Pb. Chhuhara (61.09 mg) had maximum ascorbic acid followed by NDT-5 × Arka Meghali (60.31 mg), NDT-5 × Arka Vikas (58.70 mg), Azad T-6 × Arka Meghali (57.57 mg) and Azad T-6 × Arka Vikas (55.45 mg). The mean values over the parental lines and F<sub>1</sub> hybrids were 38.06 mg and 38.65 mg, respectively in Y<sub>1</sub>, Azad T-6 (50.84 mg) followed by NDT-8 (48.35 mg), NDT-7 (44.62 mg), Arka Meghali (42.04 mg) and NDT-1 (42.00 mg). Among the hybrid NDT-5 × Arka Meghali (61.53 mg) had maximum ascorbic acid followed by NDT-5 × Pb. Chhuhara (61.31 mg), NDT-5 × Arka Vikas (58.92 mg), Azad T-6 × Arka Meghali (58.79 mg) and Azad T-6 × Arka Vikas (58.00 mg). The mean values over the parental lines and F<sub>1</sub> hybrids were 39.64 mg and 40.87 mg, respectively in Y<sub>2</sub> and Azad T-6 (50.23 mg) followed by NDT-8 (47.74 mg), NDT-7 (44.01 mg), Arka Meghali (41.43 mg) and NDT-1 (41.39 mg). Among the hybrid NDT-5 × Pb. Chhuhara (61.20 mg) had maximum ascorbic acid followed by NDT-5 × Arka Meghali (60.92 mg), NDT-5 × Arka Vikas (58.81 mg), Azad T-6 × Arka Meghali (58.18 mg) and Azad T-6 × Arka Vikas (56.72 mg). The mean values over the parental lines and F<sub>1</sub> hybrids were 38.85 mg and 39.76 mg, respectively in pooled.

### Acknowledgment

The work on tomato reported in this paper has been supported by research and teaching faculties of Department of Genetics and Plant Breeding, N.D.U.A.T and We would also like to thank Late Mr. Murli Mohan Khetan for statistical analysis.

### References

1. Anonymous. Data base Horticultural Statistics at a Glance India, 2017.
2. Rick CM. Origin of cultivated tomato, current status of the problem. International Botanical Congress, 1969, 180.
3. Rick CM. Cytogenetics of the tomato. Advances in Genetics. 1965; 8:267-382.
4. Kalloo G, Banerjee MK, Tewari RN, Pachouri DC. Vegetable tuber crops and spices. 1st Edi. Directorate of information and Publication of Agriculture, I.C.A.R. New Delhi, 2001, 10-25.



5. Singh NP, Bharadwaj AK, Kumar A, Singh KM. Modern technology on vegetable production. International Book Distributing Company. Lucknow, 2004, 84-98.
6. Khachik F, Beecher GR, Smit JC. Lactin, lycopene and their oxidative metabolism in chemoprevention of cancer. *Journal of Cell Biochemistry*. 1995; 22:109-126.
7. Panse VG, Shukhatme PV. *Statistical Methods for Agricultural Workers*. 2nd Edn. ICAR, New Delhi. 1967; 1:52-157.
8. Kumar S, Singh T, Singh B, Singh JP. Studies on heritability and genetic advance in tomato (*Lycopersicon esculentum* Mill.). *Progressive Agriculture*. 2004; 4(1):76-77.