



# Estimation of Heterosis for Yield and Quality Traits in Bottle Gourd [*Lagenaria siceraria* (mol.) Standl.] Over Seasons under Salt Affected Soil

Anoj Yadav <sup>a+++\*</sup>, G. C. Yadav <sup>a#</sup>, Ruchika Abha <sup>b+++</sup>,  
Vikash Singh <sup>b+++</sup> and Prabhakar Yadav <sup>c</sup>

<sup>a</sup> Department of Vegetable Science, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya 224229 (U.P.), India.

<sup>b</sup> Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedker University, Lucknow-226025, India.

<sup>c</sup> Department of Agriculture, Rama University, Kanpur, India.

## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

## Article Information

DOI: 10.9734/IJPSS/2023/v35i183472

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/103704>

Original Research Article

Received: 24/05/2023

Accepted: 28/07/2023

Published: 09/08/2023

## ABSTRACT

Present investigations were carried out in bottle gourd to assess the magnitude of heterosis over better-parent and standard variety for yield and quality traits. Twenty seven bottle gourd hybrids generated by crossing 9 lines with 3 testers cross, along with their twelve parents evaluated in a randomized complete block design with three replication at the Main Experiment Station (which is salt affected), Department of Vegetable Science, ANDUA&T, Kumarganj, Ayodhya, during the of

<sup>++</sup> Research Scholar;

<sup>#</sup> Professor;

<sup>\*</sup> Corresponding author: E-mail: [anojyadav005@gmail.com](mailto:anojyadav005@gmail.com);

*Zaid* seasons of year 2020 and 2021. The pooled estimates of heterosis for total fruit yield per plant ranged from -9.71% (Narendra Pooja × Narendra Rashmi) to 119.39% (NDBG-13 × Narendra Rashmi) and -1.57% (Narendra Pooja × Narendra Rashmi) to 116.18% (NDBG-13 × Narendra Rashmi) over better parent and standard variety, respectively. The best heterotic cross for number of fruit per plant was NDBG-21 × Pusa Naveen and NDBG-13 × Narendra Rashmi was over better parent and standard variety, respectively. Maximum heterotic effect in respect of number of fruit per plant was found in the cross NDBG-21 × Pusa Naveen over better parent and NDBG-13 × Narendra Rashmi over standard variety and maximum picking duration was observed in the cross NDBG-Sel-1 × Narendra Prabha over better parent and standard variety. In terms of fruit yield per plant the highest heterobeltiosis was shown by the crosses NDBG-13 × Narendra Rashmi and standard heterosis was observed in cross NDBG-13 × Narendra Prabha. The soil type of experimental site was sandy loam with average fertility level and pH in the range of 7.5-8.5.

**Keywords:** Heterosis; bottle gourd; salt affected soil.

## 1. INTRODUCTION

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is one of the popular cucurbit vegetable crop with  $2n = 2x = 22$ . It is an important cultivated annual cucurbitaceous crop grown throughout the country. Being warm season vegetable crop it thrives well in warm and humid climate but at present it's off season cultivation has progressively stretched throughout the year in northern Indian plains [1]. It is mainly grown for its fruits for culinary purposes and seeds which are good source of oil and protein. This delicious vegetable is also known by other names such as *bottle squash*, *calabash gourd*, *white flowered gourd*, *doodhi* and *lowki*. It is highly cross pollinated crop due to its monoecious and andromonoecious nature. Bottle gourd is the largest produced cucurbitaceous vegetables in the world preferred in both urban and rural population. In India, the total area covered under bottle gourd is 0.117 million ha with production of 2.18 million tonnes and its productivity is 18.6 tonnes per ha [2].

The exploitation of heterosis is much easier in cross-pollinated vegetable crops. Bottle gourd being monoecious provides ample scope for the utilization of the hybrid vigour for yield improvement of this crop. Keeping in view the scope of bottle gourd hybrids the present experiments were executed to estimate the heterosis over better parent and standard variety over seasons to get the promising hybrids of the futures.

## 2. MATERIALS AND METHODS

The present research work was conducted during *Zaid* seasons of 2019-20 ( $Y_1$ ) and 2020-21 ( $Y_2$ ) to study heterosis over better-parent and

standard variety using line × tester mating design at the Main Experiment Station (MES) of the Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Ayodhya (U.P.) India. The soil of this farm have more than 8 pH and alkaline in nature. The observations were recorded on twenty five characters.

The experimental materials for the present investigation comprised of nine promising and diverse inbred lines/varieties with three testers of bottle gourd selected on the basis of genetic variability from the germplasm stock maintained in the Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) India. The selected parental lines *i.e.*; NDBG-28 ( $L_1$ ), NDBG-13 ( $L_2$ ), NDBG-15 ( $L_3$ ), Narendra Pooja ( $L_4$ ), NDBG-104 ( $L_5$ ), NDBG-Sel-1 ( $L_6$ ), Narendra Kamna ( $L_7$ ), NDBG-21( $L_8$ ), NDBG-22 ( $L_9$ ) were crossed with three testers *viz.* Pusa Naveen ( $T_1$ ), Narendra Prabha ( $T_2$ ), Narendra Rashmi ( $T_3$ ) to get 27  $F_1$  seed. Parental lines (9 lines and 3 testers) were also selfed/sibbed to get the true to type seeds. The present experiments were conducted in RBD with three replications to appraise the performance of 27  $F_1$  hybrids and their 12 parents (9 lines and 3 testers) for the study of heterobeltiosis and standard heterosis for twenty three fruit yield and quality attributing traits. The crop was sown in rows spaced at 3 meters apart with a plant to plant spacing of 0.50 meter. Sowing was done on 20 March, 2019-20 and 19 March, 2020-21. All the recommended agronomic package of practices and protection measures were followed to raise good crops. Observations were recorded on days to first male flower anthesis, days to first female flower anthesis, node number to first male

flower appearance, node number to first female flower appearance, length of pedicel of male flower (cm), length of pedicel of female flower (cm), days to first harvest, primary branches per plant, vine length (m), number of node per vine, internodal length (cm), picking duration, peduncle length (cm), fruit length (cm), average fruit circumference (cm), average fruit weight (kg), number of fruit per plant, fruit yield per plant (kg), total soluble solids (%), reducing sugars (%), non-reducing sugar (%), total sugars (%) and dry matter (g/100 g) [1]. The estimation of heterobeltiosis and standard heterosis were done as per the method suggested by Hayes et al., [3].

### 3. RESULTS AND DISCUSSION

The exploitation of heterosis refers as the superiority of  $F_1$  hybrid over its parents in terms of yield and its attributing characters. The exploitation of heterosis requires an intensive evaluation of germplasm to find out diverse donors with high nicking of genes and further identification of superior crosses. In present study, the estimates of heterosis over better parent and standard variety (Narendra Prabha) over two years and pooled were calculated for 27  $F_1$ 's to assess their genetic potential as breeding material and presented in Table 1.

Perusal of Table 1 revealed that nature and magnitude of heterosis differed for different characters and over seasons in various cross combinations. In case of fruit yield per plant, in  $Y_1$  the magnitude of heterobeltiosis and standard heterosis ranged from -2.54 to 117.59 per cent and 2.95 to 115.24 per cent, in  $Y_2$ , -16.76 to 121.17 and -8.79 to 118.36 and in pooled, -9.71 to 119.93 per cent and -1.57 to 116.18 per cent, respectively. Out of twenty seven  $F_1$  hybrids, twenty four crosses in  $Y_1$  and twenty crosses in  $Y_2$  and twenty five crosses in pooled showed significant and positive heterosis over better parent. The best five crosses with positive and significant heterosis over better parent were NDBG-13 x Narendra Rashmi, NDBG-21 x Pusa Naveen, NDBG-13 x Narendra Prabha, NDBG-Sel-1 x Narendra Rashmi and NDBG-22 x Pusa Naveen in  $Y_1$ , NDBG-13 x Narendra Rashmi, NDBG-13 x Narendra Prabha, Narendra Kamna x Narendra Rashmi, NDBG-Sel-1 x Narendra Rashmi and NDBG-21 x Pusa Naveen in  $Y_2$  and NDBG-13 x Narendra Rashmi, NDBG-13 x Narendra Prabha, NDBG-21 x Pusa Naveen, NDBG-Sel-1 x Narendra Rashmi and Narendra Kamna x Narendra Rashmi in pooled while, twenty one crosses in  $Y_1$ , nineteen crosses in  $Y_2$

and twenty four crosses in pooled showed significant heterosis in desirable direction over standard variety. The best five crosses, namely NDBG-13 x Narendra Rashmi, NDBG-13 x Narendra Prabha, NDBG-Sel-1 x Narendra Rashmi, NDBG-Sel-1 x Pusa Naveen and Narendra Pooja x Pusa Naveen in  $Y_1$ , NDBG-13 x Narendra Rashmi, NDBG-13 x Narendra Prabha, NDBG-Sel-1 x Narendra Rashmi, Narendra Kamna x Narendra Rashmi and NDBG-Sel-1 x Pusa Naveen in  $Y_2$  and NDBG-13 x Narendra Rashmi(116.8%), NDBG-13 x Narendra Prabha (90.64%), NDBG-Sel-1 x Narendra Rashmi(81.38%), Narendra Kamna x Narendra Rashmi (71.78%) and NDBG-Sel-1 x Pusa Naveen (63.81) in pooled were found significant heterotic for fruit yield per plant over standard variety. A perusal of results further revealed that crosses exhibiting significant and negative estimates of heterosis for one or both types of heterosis for total fruit yield also exhibited significant and positive estimates of heterosis for other important yield attributing traits. In contrast, none of the crosses showed significant and desirable heterosis for all the traits. The above the results are in conformity with the findings of Ghuge et al. [4], Gautam et al. [5], Malviya et al. [6], Padmakshi [7], Niva et al. [8], Quamruzzaman and Ahmad [9], Quamruzzaman et al. [10] and Geeta et al. [11].

For earliness negative heterosis is desirable to select superior hybrids. Since  $F_1$  hybrids with negative heterosis for days to first male flower anthesis, days to first female flower anthesis, node number to first male flower appearance, node number to first female flower appearance and days to first harvest will be earlier as compared to parents, thereby increasing their productivity per day per unit area and as a consequence fetch good prices in the present market by early supply of produce. A close examination of heterosis value of total fruit yield per plant revealed that one hybrids (Narendra Pooja x Pusa Naveen) in  $Y_1$  and pooled showed significant and negative heterosis over better parent for days to first male flower anthesis and days to first female flower anthesis. For total fruit yield per plant, only two hybrids (NDBG-Sel-1 x Narendra Rashmi and NDBG-13 x Narendra Rashmi) showed negative and significant heterosis over better parent and standard variety in both the years as well as in pooled for node number to first male flower anthesis while, NDBG-Sel-1 x Narendra Rashmi showed negative and significant heterosis over better parent and standard variety in both the years as

**Table 1. Estimates of heterosis (%) over better parent (BP) and standard variety (SV) Narendra Prabha over two years (Y<sub>1</sub>, Y<sub>2</sub>) and pooled**

S. No.	Crosses	Days to first male flower anthesis						Days to first female flower anthesis					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 × Pusa Naveen	-2.19	-0.74	0.7	2.14	-0.72	0.73	-5.41	-1.41	1.28	0.64	-1.97	-0.33
2	NDBG-28 × Narendra Prabha	-2.22	-2.22	-0.71	-0.71	-1.45	-1.45	0	0	-0.64	-1.27	-0.67	-0.67
3	NDBG-28 × Narendra Rashmi	-5.93*	-5.93*	-5.63**	-4.29*	-5.78**	-5.09**	-4.9	-4.23	4.49	3.82	-0.33	0
4	NDBG-13 × Pusa Naveen	-4.93	0	3.52	5.00**	-0.7	2.55	-4.03	0.7	6.41*	5.73*	-0.64	3.34*
5	NDBG-13 × Narendra Prabha	9.63**	9.63**	20.00**	20.00**	14.91**	14.91**	8.45**	8.45**	11.54**	10.83**	9.70**	9.70**
6	NDBG-13 × Narendra Rashmi	13.33**	13.33**	18.31**	20.00**	15.88**	16.73**	12.59**	13.38**	17.95**	17.20**	15.00**	15.38**
7	NDBG-15 × Pusa Naveen	-7.75**	-2.96	-4.17*	-1.43	-5.94**	-2.18	-7.38*	-2.82	6.96**	7.64**	-1.92	2.68
8	NDBG-15 × Narendra Prabha	5.19	5.19	10.71**	10.71**	8.00**	8.00**	3.52	3.52	0	0	1.67	1.67
9	NDBG-15 × Narendra Rashmi	6.67*	6.67*	9.15**	10.71**	7.94**	8.73**	6.99*	7.75*	6.37*	6.37*	6.67**	7.02**
10	Narendra Pooja × Pusa Naveen	-9.15**	-4.44	1.46	-0.71	-4.63**	-2.55	-7.38*	-2.82	4.79	-2.55	-1.69	-2.68
11	Narendra Pooja × Narendra Prabha	3.7	3.7	24.09**	21.43**	12.73**	12.73**	4.93	4.93	24.66**	15.92**	11.82**	10.70**
12	Narendra Pooja × Narendra Rashmi	4.44	4.44	10.95**	8.57**	5.78**	6.55**	3.5	4.23	20.55**	12.10**	9.46**	8.36**
13	NDBG-104 × Pusa Naveen	-6.34*	-1.48	-2.08	0.71	-4.20**	-0.36	-6.04*	-1.41	-4.88	-0.64	-5.43**	-1
14	NDBG-104 × Narendra Prabha	5.19	5.19	17.14**	17.14**	11.27**	11.27**	8.45**	8.45**	16.56**	16.56**	12.71**	12.71**
15	NDBG-104 × Narendra Rashmi	21.48**	21.48**	19.01**	20.71**	20.22**	21.09**	21.68**	22.54**	21.02**	21.02**	21.33**	21.74**
16	NDBG-Sel-1 × Pusa Naveen	-2.21	-1.48	9.30**	0.71	3.40*	-0.36	-3.42	-0.7	4.76	-1.91	0.68	-1.34
17	NDBG-Sel-1 × Narendra Prabha	-2.22	-2.22	9.30**	0.71	3.02*	-0.73	-2.82	-2.82	8.16**	1.27	1.37	-0.67
18	NDBG-Sel-1 × Narendra Rashmi	2.96	2.96	13.95**	5.00**	7.92**	4.00**	1.4	2.11	12.24**	5.1	5.80**	3.68*
19	Narendra Kamna × Pusa Naveen	-2.13	2.22	3.47	6.43**	0.35	4.36**	-1.34	3.52	4.32	7.64**	1.28	5.69**
20	Narendra Kamna × Narendra Prabha	11.11**	11.11**	15.00**	15.00**	13.09**	13.09**	10.56**	10.56**	15.29**	15.29**	13.04**	13.04**
21	Narendra Kamna × Narendra Rashmi	13.33**	13.33**	15.49**	17.14**	14.44**	15.27**	13.29**	14.08**	12.74**	12.74**	13.00**	13.38**
22	NDBG-21 × Pusa Naveen	13.43**	12.59**	20.29**	18.57**	16.91**	15.64**	14.29**	12.68**	19.74**	15.92**	17.12**	14.38**
23	NDBG-21 × Narendra Prabha	10.45**	9.63**	14.49**	12.86**	12.50**	11.27**	14.29**	12.68**	11.84**	8.28**	13.01**	10.37**
24	NDBG-21 × Narendra Rashmi	0.75	0	7.25**	5.71**	4.04**	2.91*	2.86	1.41	9.87**	6.37*	6.51**	4.01*
25	NDBG-22 × Pusa Naveen	1.41	6.67*	6.94**	10.00**	4.20**	8.36**	2.68	7.75*	4.27	8.92**	3.51*	8.36**
26	NDBG-22 × Narendra Prabha	7.41**	7.41**	12.14**	12.14**	9.82**	9.82**	9.15**	9.15**	12.74**	12.74**	11.04**	11.04**
27	NDBG-22 × Narendra Rashmi	12.59**	12.59**	16.20**	17.86**	14.44**	15.27**	11.89**	12.68**	14.01**	14.01**	13.00**	13.38**
No. of crosses with significant positive heterosis		9	10	19	19	19	18	11	11	18	18	16	18
No. of crosses with significant negative heterosis		4	1	2	1	4	1	3	0	0	0	1	0
Range of heterosis		-9.15 to 21.48	-5.93 to 21.48	-5.63 to 24.09	-4.29 to 21.43	-5.94 to 20.22	-5.09 to 21.09	-7.38 to 21.68	-4.23 to 22.54	-4.88 to 24.66	-1.91 to 21.02	-5.43 to 21.33	-2.68 to 21.74

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. Crosses No.	Node number to first male flower appearance						Node number to first female flower appearance						
	Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	
1	NDBG-28 × Pusa Naveen	7.69	0	6.67*	4.35	7.14**	2.27	17.65**	7.14	6.15	27.78**	11.21**	17.27**
2	NDBG-28 × Narendra Prabha	15.38**	7.14	13.33**	10.87**	14.29**	9.09**	13.73**	3.57	11.11*	11.11*	7.27*	7.27*
3	NDBG-28 × Narendra Rashmi	10.26*	2.38	0	-2.17	4.76	0	7.84	-1.79	-18.46**	-1.85	-6.90*	-1.82
4	NDBG-13 × Pusa Naveen	7.89	-2.38	4.55	0	6.10*	-1.14	16.67**	0	-6.35	9.26	3.6	4.55
5	NDBG-13 × Narendra Prabha	2.63	-7.14	-4.55	-8.70**	-1.22	-7.95**	8.33	-7.14	12.96*	12.96*	2.73	2.73
6	NDBG-13 × Narendra Rashmi	-26.32**	-33.33**	-31.82**	-34.78**	-29.27**	-34.09**	-6.25	-19.64**	4.76	22.22**	0	0.91
7	NDBG-15 × Pusa Naveen	-17.95**	-23.81**	-23.40**	-21.74**	-20.93**	-22.73**	-9.80*	-17.86**	10.53*	16.67**	0.93	-0.91
8	NDBG-15 × Narendra Prabha	10.26*	2.38	4.35	4.35	5.81*	3.41	9.80*	0	18.52**	18.52**	11.11**	9.09*
9	NDBG-15 × Narendra Rashmi	0	-7.14	-10.64**	-8.70**	-5.81*	-7.95**	0	-8.93*	26.32**	33.33**	13.89**	11.82**
10	Narendra Pooja × Pusa Naveen	4.76	4.76	0	4.35	2.22	4.55	5.66	0	-9.52*	5.56	-2.59	2.73
11	Narendra Pooja × Narendra Prabha	-4.76	-4.76	-2.17	-2.17	-3.41	-3.41	7.55	1.79	-5.56	-5.56	-1.82	-1.82
12	Narendra Pooja × Narendra Rashmi	0	2.38	-7.84**	2.17	-5.26*	2.27	3.77	-1.79	-12.70**	1.85	-5.17	0
13	NDBG-104 × Pusa Naveen	-2.38	-2.38	-6.25*	-2.17	-4.44	-2.27	-5.36	-5.36	6.45	22.22**	0.85	8.18*
14	NDBG-104 × Narendra Prabha	-16.67**	-16.67**	-21.74**	-21.74**	-19.32**	-19.32**	-16.07**	-16.07**	-22.22**	-22.22**	-19.09**	-19.09**
15	NDBG-104 × Narendra Rashmi	-4.76	-4.76	-4.17	0	-4.44	-2.27	-3.57	-3.57	-8.06	5.56	-5.93	0.91
16	NDBG-Sel-1 × Pusa Naveen	7.69	0	0	-2.17	3.57	-1.14	11.76*	1.79	-19.05**	-5.56	-5.26	-1.82
17	NDBG-Sel-1 × Narendra Prabha	-2.56	-9.52*	-6.67*	-8.70**	-4.76	-9.09**	-1.96	-10.71*	-7.41	-7.41	-9.09*	-9.09*
18	NDBG-Sel-1 × Narendra Rashmi	-30.77**	-35.71**	-33.33**	-34.78**	-32.14**	-35.23**	-19.61**	-26.79**	-23.81**	-11.11*	-21.93**	-19.09**
19	Narendra Kamna × Pusa Naveen	-26.19**	-26.19**	-29.17**	-26.09**	-27.78**	-26.14**	-21.05**	-19.64**	-5	5.56	-12.82**	-7.27*
20	Narendra Kamna × Narendra Prabha	-11.90**	-11.90**	-8.70**	-8.70**	-10.23**	-10.23**	-8.93*	-8.93*	11.11*	11.11*	0.91	0.91
21	Narendra Kamna × Narendra Rashmi	4.35	14.29**	5.88*	17.39**	5.15*	15.91**	14.04**	16.07**	6.67	18.52**	10.26**	17.27**
22	NDBG-21 × Pusa Naveen	12.20**	9.52*	8.51**	10.87**	10.23**	10.23**	21.15**	12.50**	-6.45	7.41	6.14	10.00**
23	NDBG-21 × Narendra Prabha	-7.32	-9.52*	-8.70**	-8.70**	-9.09**	-9.09**	-3.85	-10.71*	9.26	9.26	-0.91	-0.91
24	NDBG-21 × Narendra Rashmi	-4.88	-7.14	-8.51**	-6.52*	-6.82**	-6.82**	-5.77	-12.50**	-12.90**	0	-9.65**	-6.36
25	NDBG-22 × Pusa Naveen	4.76	4.76	-6.25*	-2.17	-1.11	1.14	1.69	7.14	10.53*	16.67**	1.65	11.82**
26	NDBG-22 × Narendra Prabha	-2.38	-2.38	4.35	4.35	1.14	1.14	-3.57	-3.57	16.67**	16.67**	6.36	6.36
27	NDBG-22 × Narendra Rashmi	-22.22**	-16.67**	-23.53**	-15.22**	-22.92**	-15.91**	-15.87**	-5.36	-15.79**	-11.11*	-16.53**	-8.18*
No. of crosses with significant positive heterosis		4	2	4	3	6	3	7	2	8	12	5	8
No. of crosses with significant negative heterosis		6	9	14	12	11	12	6	10	8	3	7	5
Range of heterosis		-30.77 to 15.38	-35.71 to 14.29	-33.33 to 13.33	-34.78 to 17.39	-32.14 to 14.29	-35.23 to 15.91	-21.05 to 21.15	-26.79 to 16.07	-23.81 to 26.32	-22.22 to 33.33	-21.93 to 13.89	-19.27 to 17.27

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. Crosses No.	Length of pedicel of male flower						Length of pedicel of female flower						
	Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	
1	NDBG-28 × Pusa Naveen	-14.52*	-10.17	-15.87**	-11.67*	-15.20**	-10.92**	-25.00**	0	-21.05**	0	-22.97**	0
2	NDBG-28 × Narendra Prabha	-11.86	-11.86	-15.00**	-15.00**	-13.45**	-13.45**	-3.7	-3.7	-10	-10	-7.02	-7.02
3	NDBG-28 × Narendra Rashmi	-12	-25.42**	-9.8	-23.33**	-10.00*	-24.37**	-21.88**	-7.41	-29.41**	-20.00**	-25.76**	-14.04*
4	NDBG-13 × Pusa Naveen	-30.65**	-27.12**	-28.57**	-25.00**	-29.60**	-26.05**	-16.67*	11.11	-23.68**	-3.33	-20.27**	3.51
5	NDBG-13 × Narendra Prabha	-27.12**	-27.12**	-31.67**	-31.67**	-29.41**	-29.41**	3.7	3.7	0	0	1.75	1.75
6	NDBG-13 × Narendra Rashmi	-24.00**	-35.59**	-20.00**	-33.33**	-22.00**	-34.45**	-15.63*	0	-17.65**	-6.67	-16.67**	-3.51
7	NDBG-15 × Pusa Naveen	-33.87**	-30.51**	-38.10**	-35.00**	-36.00**	-32.77**	-30.77**	0	-35.71**	-10	-33.33**	-5.26
8	NDBG-15 × Narendra Prabha	-22.03**	-22.03**	-21.67**	-21.67**	-21.85**	-21.85**	-35.90**	-7.41	-42.86**	-20.00**	-39.51**	-14.04*
9	NDBG-15 × Narendra Rashmi	-14	-27.12**	-8	-23.33**	-11.00*	-25.21**	-38.46**	-11.11	-35.71**	-10	-37.04**	-10.53
10	Narendra Pooja × Pusa Naveen	-20.97**	-16.95*	-20.63**	-16.67**	-20.80**	-16.8**	-27.78**	-3.7	-31.58**	-13.33*	-29.73**	-8.77
11	Narendra Pooja × Narendra Prabha	-28.81**	-28.81**	-35.00**	-35.00**	-31.93**	-31.93**	-35.48**	-25.93**	-32.35**	-23.33**	-33.85**	-24.56**
12	Narendra Pooja × Narendra Rashmi	-5.26	-8.47	-8.33	-8.33	-6.84	-8.40*	-12.5	3.7	-20.59**	-10	-16.67**	-3.51
13	NDBG-104 × Pusa Naveen	-23.44**	-16.95*	-19.05**	-15.00**	-20.00**	-15.97**	-29.27**	7.41	-28.57**	0	-28.92**	3.51
14	NDBG-104 × Narendra Prabha	-34.38**	-28.81**	-25.00**	-25.00**	-27.50**	-26.89**	-36.59**	-3.7	-35.71**	-10	-36.14**	-7.02
15	NDBG-104 × Narendra Rashmi	-9.38	-1.69	1.79	-5	-4.17	-3.36	-43.90**	-14.81	-42.86**	-20.00**	-43.37**	-17.54**
16	NDBG-Sel-1 × Pusa Naveen	-18.75**	-11.86	-25.37**	-16.67**	-22.14**	-14.29**	-19.44**	7.41	-15.79**	6.67	-17.57**	7.02
17	NDBG-Sel-1 × Narendra Prabha	-20.31**	-13.56	-19.40**	-10.00*	-19.85**	-11.76**	-10.34	-3.7	-6.67	-6.67	-5.26	-5.26
18	NDBG-Sel-1 × Narendra Rashmi	-18.75**	-11.86	-23.88**	-15.00**	-21.37**	-13.45**	18.75*	40.74**	17.65**	33.33**	18.18**	36.84**
19	Narendra Kamna × Pusa Naveen	-11.29	-6.78	-14.29**	-10.00*	-12.80**	-8.40*	-22.22**	3.7	-28.95**	-10	-25.68**	-3.51
20	Narendra Kamna × Narendra Prabha	-15.25*	-15.25*	-13.33**	-13.33**	-14.29**	-14.29**	10.71	14.81	16.67*	16.67*	15.79**	15.79**
21	Narendra Kamna × Narendra Rashmi	-3.7	-11.86	-3.57	-10.00*	-3.64	-10.92**	-3.13	14.81	-5.88	6.67	-4.55	10.53
22	NDBG-21 × Pusa Naveen	-27.42**	-23.73**	-31.75**	-28.33**	-29.60**	-26.05**	-8.33	22.22*	-15.79**	6.67	-12.16**	14.04*
23	NDBG-21 × Narendra Prabha	-18.03*	-15.25*	-15.00**	-15.00**	-16.53**	-15.13**	-11.11	-11.11	-20.00**	-20.00**	-15.79**	-15.79**
24	NDBG-21 × Narendra Rashmi	9.84	13.56	0	0	4.96	6.72	-15.63*	0	-14.71*	-3.33	-15.15**	-1.75
25	NDBG-22 × Pusa Naveen	-8.06	-3.39	-9.52*	-5	-8.80*	-4.2	-22.22**	3.7	-21.05**	0	-21.62**	1.75
26	NDBG-22 × Narendra Prabha	-22.03**	-22.03**	-20.00**	-20.00**	-21.01**	-21.01**	6.25	25.93**	8.57	26.67**	7.46	26.32**
27	NDBG-22 × Narendra Rashmi	-1.89	-11.86	0	-10.00*	-0.93	-10.92**	9.38	29.63**	8.57	26.67**	8.96	28.07**
No. of crosses with significant positive heterosis		0	0	0	0	0	0	1	4	2	4	2	5
No. of crosses with significant negative heterosis		17	15	20	23	22	24	16	1	19	9	19	5
Range of heterosis		-34.38 to 9.84	-35.59 to 13.56	-38.10 to 1.79	-35.00 to 0	-36.00 to 4.96	-34.45 to 6.72	-38.46 to 18.75	-25.93 to 40.74	-42.86 to 17.65	-23.33 to 33.33	-43.37 to 18.18	-24.56 to 36.84

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table. 1. Contd....

S. No.	Crosses	Days to first harvest						Primary branches per plant					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 x Pusa Naveen	-4.68	-0.61	1.1	1.1	-1.7	0.29	-15.00*	-7.27	-13.64**	-5	-14.29**	-6.09
2	NDBG-28 x Narendra Prabha	2.44	2.44	-0.55	-0.55	0.87	0.87	1.82	1.82	1.67	1.67	1.74	1.74
3	NDBG-28 x Narendra Rashmi	-3.64	-3.05	8.62**	4.42	2.65	0.87	7.84	0	5.26	0	6.48	0
4	NDBG-13 x Pusa Naveen	-1.75	2.44	7.95**	4.97	0.85	3.77*	58.33**	72.73**	54.55**	70.00**	56.35**	71.30**
5	NDBG-13 x Narendra Prabha	6.71*	6.71*	11.93**	8.84**	7.83**	7.83**	-23.64**	-23.64**	-20.00**	-20.00**	-21.74**	-21.74**
6	NDBG-13 x Narendra Rashmi	10.91**	11.59**	18.39**	13.81**	14.75**	12.75**	60.78**	49.09**	52.63**	45.00**	56.48**	46.96**
7	NDBG-15 x Pusa Naveen	-5.85*	-1.83	7.14**	7.73**	-2.47	3.19*	-3.33	5.45	-3.03	6.67	-3.17	6.09
8	NDBG-15 x Narendra Prabha	5.49*	5.49*	0.55	0.55	2.9	2.9	-7.27	-7.27	-6.67	-6.67	-6.96	-6.96
9	NDBG-15 x Narendra Rashmi	4.85	5.49*	9.77**	5.52*	7.37**	5.51**	17.65*	9.09	15.79**	10.00*	16.67**	9.57*
10	Narendra Pooja x Pusa Naveen	-5.85*	-1.83	4.68	-1.1	-2.58	-1.45	8.33	18.18*	7.58	18.33**	7.94*	18.26**
11	Narendra Pooja x Narendra Prabha	4.88	4.88	20.47**	13.81**	9.57**	9.57**	5.45	5.45	3.23	6.67	4.27	6.09
12	Narendra Pooja x Narendra Rashmi	3.03	3.66	16.96**	10.50**	9.14**	7.25**	23.64**	23.64**	19.35**	23.33**	21.37**	23.48**
13	NDBG-104 x Pusa Naveen	-4.09	0	-8.21**	-1.1	-6.28**	-0.58	43.33**	56.36**	37.88**	51.67**	40.48**	53.91**
14	NDBG-104 x Narendra Prabha	6.10*	6.10*	11.05**	11.05**	8.70**	8.70**	-23.64**	-23.64**	-20.00**	-20.00**	-21.74**	-21.74**
15	NDBG-104 x Narendra Rashmi	16.97**	17.68**	20.11**	15.47**	18.58**	16.52**	-11.76	-18.18*	-10.53*	-15.00**	-11.11**	-16.52**
16	NDBG-Sel-1 x Pusa Naveen	-2.96	0	2.34	-3.31	-0.29	-1.74	-16.67*	-9.09	-15.15**	-6.67	-15.87**	-7.83*
17	NDBG-Sel-1 x Narendra Prabha	0	0	8.19**	2.21	2.65	1.16	-10.17	-3.64	-7.81	-1.67	-8.94*	-2.61
18	NDBG-Sel-1 x Narendra Rashmi	0.61	1.22	9.94**	3.87	4.42**	2.61	-3.39	3.64	-1.56	5	-2.44	4.35
19	Narendra Kamna x Pusa Naveen	-3.51	0.61	4.3	7.18**	-0.28	4.06*	15.00*	25.45**	13.64**	25.00**	14.29**	25.22**
20	Narendra Kamna x Narendra Prabha	8.54**	8.54**	10.50**	10.50**	9.57**	9.57**	16.36*	16.36*	16.67**	16.67**	16.52**	16.52**
21	Narendra Kamna x Narendra Rashmi	12.73**	13.41**	14.94**	10.50**	13.86**	11.88**	37.25**	27.27**	31.58**	25.00**	34.26**	26.09**
22	NDBG-21 x Pusa Naveen	9.70**	10.37**	19.76**	10.50**	14.76**	10.43**	43.33**	56.36**	39.39**	53.33**	41.27**	54.78**
23	NDBG-21 x Narendra Prabha	9.15**	9.15**	13.77**	4.97	11.14**	6.96**	7.27	7.27	8.33	8.33	7.83*	7.83*
24	NDBG-21 x Narendra Rashmi	1.82	2.44	12.57**	3.87	7.23**	3.19*	15.69	7.27	14.04**	8.33	14.81**	7.83*
25	NDBG-22 x Pusa Naveen	1.75	6.10*	-3.08	4.42	-0.82	5.22**	73.33**	89.09**	66.67**	83.33**	69.84**	86.09**
26	NDBG-22 x Narendra Prabha	7.32**	7.32**	9.39**	9.39**	8.41**	8.41**	63.64**	63.64**	56.67**	56.67**	60.00**	60.00**
27	NDBG-22 x Narendra Rashmi	9.70**	10.37**	12.07**	7.73**	10.91**	8.99**	44.44**	41.82**	40.00**	40.00**	42.11**	40.87**
No. of crosses with significant positive heterosis		11	13	19	14	15	18	12	12	13	13	14	15
No. of crosses with significant negative heterosis		2	0	1	0	1	0	6	3	5	3	6	4
Range of heterosis		-5.85 to 16.97	-3.05 to 17.68	-8.21 to 20.47	-1.1 to 15.47	-6.28 to 18.58	-1.74 to 16.52	-23.64 to 73.64	-23.64 to 89.09	-20.00 to 66.67	-20.00 to 83.33	-21.74 to 69.84	-21.74 to 86.09

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. No.	Crosses	Vine length						Number of node per vine					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 x Pusa Naveen	-5.47	6.14	-18.10**	4.94	-12.74**	5.49*	-15.02**	-3.49	-15.31**	-2.26	-15.17**	-2.86
2	NDBG-28 x Narendra Prabha	13.91**	13.91**	20.91**	20.91**	17.71**	17.71**	-6.59	-6.59	-4.14	-4.14	-5.34	-5.34
3	NDBG-28 x Narendra Rashmi	17.97**	6.46	16.53**	9.89**	18.23**	8.32**	2.88	-3.1	2.36	-2.26	2.62	-2.67
4	NDBG-13 x Pusa Naveen	12.91**	26.78**	3.26	32.32**	7.36**	29.79**	-11.26**	0.78	-12.05**	1.5	-11.67**	1.15
5	NDBG-13 x Narendra Prabha	30.26**	30.26**	29.96**	36.88**	33.86**	33.86**	35.66**	35.66**	37.59**	37.59**	36.64**	36.64**
6	NDBG-13 x Narendra Rashmi	26.63**	17.71**	14.80**	20.91**	19.84**	19.45**	23.87**	16.67**	24.02**	18.42**	23.94**	17.56**
7	NDBG-15 x Pusa Naveen	-4.71	7	-12.46**	12.17**	-9.17**	9.81**	5.46	19.77**	9.77*	26.69**	7.67*	23.28**
8	NDBG-15 x Narendra Prabha	-6.64	-6.64	-7.58*	-2.66	-4.48*	-4.48*	0.39	0.39	5.26	5.26	2.86	2.86
9	NDBG-15 x Narendra Rashmi	35.27**	14.50**	11.55**	17.49**	21.57**	16.12**	2.88	-3.1	4.33	-0.38	3.62	-1.72
10	Narendra Pooja x Pusa Naveen	3.34	16.03**	-1.78	25.86**	0.39	21.37**	-8.53*	3.88	-7.17	7.14	-7.83*	5.53
11	Narendra Pooja x Narendra Prabha	14.77**	14.77**	17.49**	17.49**	16.25**	16.25**	-3.1	-3.1	-4.14	-4.14	-3.63	-3.63
12	Narendra Pooja x Narendra Rashmi	65.15**	39.79**	29.03**	21.67**	44.58**	29.95**	-1.23	-6.98	-0.79	-5.26	-1.01	-6.11
13	NDBG-104 x Pusa Naveen	2.46	23.98**	3.69	38.78**	3.16	32.02**	12.63**	27.91**	12.38**	29.70**	12.50**	28.82**
14	NDBG-104 x Narendra Prabha	-2.65	17.80**	-12.78**	16.73**	-8.40**	17.22**	-7.36	-7.36	-6.02	-6.02	-6.68	-6.68
15	NDBG-104 x Narendra Rashmi	-7.69*	11.70**	-13.64**	15.59**	-11.07**	13.81**	-5.76	-11.24*	-4.71	-8.65	-5.03	-9.92*
16	NDBG-Sel-1 x Pusa Naveen	-0.48	11.74**	-11.28**	13.69**	-6.69**	12.80**	-26.62**	-16.67**	-26.71**	-15.41**	-26.67**	-16.03**
17	NDBG-Sel-1 x Narendra Prabha	27.55**	27.55**	24.83**	39.54**	28.04**	34.06**	-14.23**	-11.24*	-15.16**	-11.65*	-14.71**	-11.45**
18	NDBG-Sel-1 x Narendra Rashmi	19.18**	14.77**	-1.36	10.27**	7.28**	12.32**	-17.23**	-14.34**	-17.33**	-13.91**	-17.28**	-14.12**
19	Narendra Kamna x Pusa Naveen	4.95	17.84**	-5.34*	21.29**	-0.97	19.72**	-16.04**	-4.65	-18.57**	-6.02	-17.33**	-5.34
20	Narendra Kamna x Narendra Prabha	3.84	6.32	9.89**	9.89**	7.75**	8.26**	4.96	6.59	5.13	7.89	5.05	7.25
21	Narendra Kamna x Narendra Rashmi	17.38**	20.19**	24.62**	23.19**	21.25**	21.82**	1.15	2.71	1.47	4.14	1.31	3.44
22	NDBG-21 x Pusa Naveen	18.95**	33.56**	9.79**	40.68**	13.68**	37.43**	-2.05	11.24*	-2.93	12.03*	-2.5	11.64**
23	NDBG-21 x Narendra Prabha	-12.91**	-4.29	-8.42**	-0.76	-10.49**	-2.37	28.29**	28.29**	29.70**	29.70**	29.01**	29.01**
24	NDBG-21 x Narendra Rashmi	-18.82**	-10.79*	-11.58**	-4.18	-14.92**	-7.20**	10.70*	4.26	9.38	5.26	10.24*	4.77
25	NDBG-22 x Pusa Naveen	24.66**	39.97**	13.65**	45.63**	18.32**	43.04**	-15.02**	-3.49	-15.31**	-2.26	-15.17**	-2.86
26	NDBG-22 x Narendra Prabha	13.43**	20.55**	9.59**	21.67**	11.30**	21.16**	48.26**	48.84**	47.99**	51.88**	48.12**	50.38**
27	NDBG-22 x Narendra Rashmi	10.45*	17.39**	7.19*	19.01**	8.65**	18.27**	13.90**	14.34**	12.82**	15.79**	13.35**	15.08**
No. of crosses with significant positive heterosis		18	20	14	23	6	24	7	8	7	8	8	8
No. of crosses with significant negative heterosis		3	1	9	0	11	2	8	4	7	3	6	4
Range of heterosis		-18.82 to 65.15	-10.79 to 39.97	-18.10 to 29.96	-4.18 to 45.63	-14.92 to 44.58	-7.20 to 43.04	-26.62 to 48.26	-16.67 to 48.84	-26.71 to 47.99	-15.41 to 51.88	-26.67 to 48.12	-16.03 to 50.38

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively



Table 1. Contd....

S. No.	Crosses	Internodal length						Picking duration					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 x Pusa Naveen	-10.14	-9.17	-4.1	-6.82	-6.06	-8.08*	-15.67**	10.78**	-15.49**	10.09**	-15.58**	10.43**
2	NDBG-28 x Narendra Prabha	-18.14**	-18.14**	-20.81**	-20.81**	-19.38**	-19.38**	2.24	34.31**	1.41	32.11**	1.81	33.18**
3	NDBG-28 x Narendra Rashmi	-17.92**	-8.8	-12.13*	-11.03*	-15.36**	-9.83*	0.75	32.35**	-1.41	28.44**	-0.36	30.33**
4	NDBG-13 x Pusa Naveen	-21.53**	-20.68**	-14.91**	-23.35**	-18.65**	-21.92**	2.31	30.39**	0.72	28.44**	1.49	29.38**
5	NDBG-13 x Narendra Prabha	4.03	4.03	0.53	0.53	2.4	2.4	-21.54**	0	-23.74**	-2.75	-22.68**	-1.42
6	NDBG-13 x Narendra Rashmi	-10.85*	-0.94	-3.28	-2.07	-7.51*	-1.47	-16.15**	6.86	-17.99**	4.59	-17.10**	5.69*
7	NDBG-15 x Pusa Naveen	8.39	12.20*	25.48**	13.04*	17.31**	12.59**	-16.67**	2.94	-16.79**	0	-16.73**	1.42
8	NDBG-15 x Narendra Prabha	4.25	7.91	8.03	8.03	7.97*	7.97*	-8.73**	12.75**	-8.40**	10.09**	-8.56**	11.37**
9	NDBG-15 x Narendra Rashmi	-23.93**	-15.48**	-16.33**	-15.28**	-20.57**	-15.39**	-0.78	24.51**	-2.22	21.10**	-1.52	22.75**
10	Narendra Pooja x Pusa Naveen	-18.20**	-10.54	-19.97**	-14.88**	-19.01**	-12.56**	-1.49	29.41**	0	27.52**	-0.73	28.44**
11	Narendra Pooja x Narendra Prabha	-22.93**	-15.71**	-23.34**	-18.47**	-23.12**	-16.99**	-16.42**	9.80**	-15.83**	7.34	-16.12**	8.53**
12	Narendra Pooja x Narendra Rashmi	-40.31**	-33.68**	-26.90**	-22.26**	-33.66**	-22.37**	-14.93**	11.76**	-14.39**	9.17*	-14.65**	10.43**
13	NDBG-104 x Pusa Naveen	2.09	3.2	3.69	-6.59	2.79	-1.35	-8.73**	12.75**	-10.45**	10.09**	-9.62**	11.37**
14	NDBG-104 x Narendra Prabha	-21.39**	-21.39**	-19.49**	-19.49**	-20.51**	-20.51**	5.56	30.39**	2.99	26.61**	4.23*	28.44**
15	NDBG-104 x Narendra Rashmi	-27.94**	-19.94**	-21.53**	-20.55**	-25.11**	-20.22**	-15.63**	5.88	-17.04**	2.75	-16.35**	4.27
16	NDBG-Sel-1 x Pusa Naveen	-30.31**	-25.08**	-20.15**	-25.62**	-25.95**	-25.33**	-1.89	1.96	-2.7	-0.92	-2.3	0.47
17	NDBG-Sel-1 x Narendra Prabha	-35.26**	-30.39**	-36.71**	-36.71**	-33.88**	-33.33**	33.02**	38.24**	33.33**	35.78**	33.18**	36.97**
18	NDBG-Sel-1 x Narendra Rashmi	-32.70**	-25.22**	-23.09**	-22.13**	-28.46**	-23.78**	8.59**	36.27**	6.67*	32.11**	7.60**	34.12**
19	Narendra Kamna x Pusa Naveen	-20.29**	-19.42**	-25.36**	-22.49**	-22.12**	-20.85**	15.00**	35.29**	14.96**	33.94**	14.98**	34.60**
20	Narendra Kamna x Narendra Prabha	0.23	0.23	-5.49	-1.84	-2.33	-0.73	-4.17	12.75**	-5.51	10.09**	-4.86*	11.37**
21	Narendra Kamna x Narendra Rashmi	-23.06**	-14.51*	-18.64**	-15.51**	-20.19**	-14.97**	2.34	28.43**	2.96	27.52**	2.66	27.96**
22	NDBG-21 x Pusa Naveen	-17.75**	-16.85**	-11.73*	-20.48**	-15.12**	-18.54**	-14.29**	0	-15.87**	-2.75	-15.10**	-1.42
23	NDBG-21 x Narendra Prabha	34.10**	34.10**	30.56**	30.56**	32.46**	32.46**	12.61**	31.37**	11.90**	29.36**	12.24**	30.33**
24	NDBG-21 x Narendra Rashmi	5.09	16.77**	8.42	9.78	6.56	13.52**	2.34	28.43**	0.74	24.77**	1.52	26.54**
25	NDBG-22 x Pusa Naveen	-31.82**	-31.08**	-27.38**	-32.93**	-29.08**	-31.94**	13.39**	24.51**	15.38**	23.85**	14.41**	24.17**
26	NDBG-22 x Narendra Prabha	23.42**	23.42**	25.12**	25.12**	24.21**	24.21**	20.54**	32.35**	22.22**	31.19**	21.40**	31.75**
27	NDBG-22 x Narendra Rashmi	-12.08*	-2.31	-3.8	-2.6	-8.43*	-2.45	3.13	29.41**	0.74	24.77**	1.9	27.01**
No. of crosses with significant positive heterosis		2	4	3	3	4	5	6	21	6	20	7	22
No. of crosses with significant negative heterosis		18	14	16	16	18	16	10	0	10	0	11	0
Range of heterosis		-40.31 to 34.10	-33.68 to 34.10	-36.71 to 30.56	-36.71 to 30.56	-33.88 to 32.46	-33.33 to 32.46	-21.54 to 33.02	-0 to 38.34	-23.74 to 33.33	-2.75 to 35.78	-22.68 to 33.18	-1.42 to 36.97

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. No.	Crosses	Peduncle length						Fruit length					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 × Pusa Naveen	-12.00*	2.33	-12.50**	-6.67	-12.24**	-2.27	0.08	3.59	14.17	22.32*	7.19	12.88
2	NDBG-28 × Narendra Prabha	-20.45**	-18.60**	-20.00**	-20.00**	-19.32**	-19.32**	5.65	9.37	10	17.86	7.85	13.58
3	NDBG-28 × Narendra Rashmi	-9.09	-6.98	-7.14	-13.33**	-8.14*	-10.23**	3.83	7.48	12.5	20.54	8.2	13.95
4	NDBG-13 × Pusa Naveen	-32.00**	-20.93**	-31.25**	-26.67**	-31.63**	-23.86**	11.84	8.06	13.27	14.29	13.08	11.15
5	NDBG-13 × Narendra Prabha	18.60**	18.60**	6.67	6.67	12.5**	12.50**	17.03	17.03	23.21*	23.21*	20.10*	20.10*
6	NDBG-13 × Narendra Rashmi	30.23**	30.23**	30.95**	22.22**	30.59**	26.14**	-12.9	-15.78	3.51	5.36	-4.55	-5.3
7	NDBG-15 × Pusa Naveen	6	23.26**	6.25	13.33**	6.12	18.18**	-1.32	-2.08	8.85	9.82	4.69	3.82
8	NDBG-15 × Narendra Prabha	6.98	6.98	6.67	6.67	6.82	6.82	6.84	6.84	25.89*	25.89*	16.29	16.29
9	NDBG-15 × Narendra Rashmi	2.33	2.33	7.14	0	4.71	1.14	2.91	2.12	1.75	3.57	3.65	2.84
10	Narendra Pooja × Pusa Naveen	4	20.93**	10.42*	17.78**	7.14*	19.32**	23.75	21.56	22.12*	23.21*	25.46**	22.38*
11	Narendra Pooja × Narendra Prabha	-23.91**	-18.60**	-26.67**	-26.67**	-25.27**	-22.73**	12.5	12.5	16.96	16.96	14.71	14.71
12	Narendra Pooja × Narendra Rashmi	-4.35	2.33	-6.67	-6.67	-5.49	-2.27	12.37	10.39	11.4	13.39	12.76	11.88
13	NDBG-104 × Pusa Naveen	-30.00**	-18.60**	-29.17**	-24.44**	-29.59**	-21.59**	9.96	7.78	3.1	18.75	6.28	13.22
14	NDBG-104 × Narendra Prabha	2.17	9.3	6.67	6.67	4.4	7.95*	14.35	14.35	-1.55	13.39	6.9	13.88
15	NDBG-104 × Narendra Rashmi	21.74**	30.23**	22.22**	22.22**	21.98**	26.14**	7.99	5.84	-17.83	-5.36	-5.86	0.29
16	NDBG-Sel-1 × Pusa Naveen	14.00*	32.56**	20.83**	28.89**	17.35**	30.68**	2.05	-0.65	-7.52	9.82	-3.17	4.54
17	NDBG-Sel-1 × Narendra Prabha	4.65	4.65	2.22	2.22	3.41	3.41	16.18	16.18	-2.26	16.07	7.56	16.12
18	NDBG-Sel-1 × Narendra Rashmi	6.98	6.98	14.29**	6.67	10.59**	6.82	10.86	7.93	-5.26	12.5	2.06	10.19
19	Narendra Kamna × Pusa Naveen	-12.00*	2.33	-6.25	0	-9.18**	1.14	13.11	6.7	0.82	9.82	6.57	8.25
20	Narendra Kamna × Narendra Prabha	30.23**	30.23**	22.22**	22.22**	26.14**	26.14**	23.41	23.41	13.11	23.21*	21.40*	23.31*
21	Narendra Kamna × Narendra Rashmi	13.95*	13.95*	14.29**	6.67	14.12**	10.23**	17.59	13.69	7.38	16.96	13.52	15.31
22	NDBG-21 × Pusa Naveen	-12.50*	13.95*	-9.09*	11.11*	-10.81**	12.50**	-5.71	-6.62	11.97	16.96	3.29	5.08
23	NDBG-21 × Narendra Prabha	-5.36	23.26**	1.82	24.44**	-1.8	23.86**	33.94*	33.94*	30.77**	36.61**	32.96**	35.26**
24	NDBG-21 × Narendra Rashmi	-32.14**	-11.63	-34.55**	-20.00**	-33.33**	-15.91**	18.21	17.08	-33.33**	-30.36**	-8.04	-6.45
25	NDBG-22 × Pusa Naveen	74.00**	102.33**	79.17**	91.11**	76.53**	96.59**	-28.25	-27.00	-29.91**	-26.79*	-29.08**	-26.90**
26	NDBG-22 × Narendra Prabha	8.33	20.93**	8.51*	13.33**	8.42*	17.05**	-18.07	-16.65	-29.06**	-25.89*	-23.59**	-21.24*
27	NDBG-22 × Narendra Rashmi	-4.17	6.98	-4.26	0	-4.21	3.41	-19.06	-17.66	-32.48**	-29.46**	-25.81**	-23.52**
No. of crosses with significant positive heterosis		7	12	9	10	10	13	1	1	4	6	4	4
No. of crosses with significant negative heterosis		8	5	6	6	9	6	0	0	4	4	3	3
Range of heterosis		-32.14 to 74.00	-20.93 to 102.33	-34.55 to 79.17	-26.67 to 91.11	-33.33 to 76.53	-23.86 to 96.59	-28.25 to 33.94	-27.00 to 33.94	-33.33 to 30.77	-30.36 to 36.61	-29.08 to 32.96	-26.90 to 35.26

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. No.	Crosses	Average fruit circumference						Average fruit weight					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 × Pusa Naveen	7.06	2.62	-1.52	-8.45	2.78	-2.99	12.79	-20.00*	-9.29	-34.79**	1.62	-27.43**
2	NDBG-28 × Narendra Prabha	-1.19	-1.19	-18.31*	-18.31*	-9.86	-9.86	-36.98**	-36.98**	-43.78**	-43.78**	-40.39**	-40.39**
3	NDBG-28 × Narendra Rashmi	-3.65	-2.95	4.76	-7.04	0.35	-5.02	-26.72**	-30.47**	-27.36**	-30.88**	-27.04**	-30.67**
4	NDBG-13 × Pusa Naveen	-1.43	-0.07	0	-7.04	2.13	-3.6	2.62	-27.21**	-8.33	-34.10**	-2.92	-30.67**
5	NDBG-13 × Narendra Prabha	5.25	6.7	5.63	5.63	6.16	6.16	-34.19**	-34.19**	-33.64**	-33.64**	-33.91**	-33.91**
6	NDBG-13 × Narendra Rashmi	7.92	9.4	12.7	0	10.56	4.64	-35.05**	-38.37**	-32.45**	-35.71**	-33.74**	-37.04**
7	NDBG-15 × Pusa Naveen	-3.43	-3.38	2.94	-1.41	-0.27	-2.38	-11.68	-15.58	-34.62**	-37.79**	-23.18**	-26.74**
8	NDBG-15 × Narendra Prabha	0.85	0.9	4.23	4.23	2.58	2.58	-30.47**	-30.47**	-32.03**	-32.03**	-31.25**	-31.25**
9	NDBG-15 × Narendra Rashmi	-1.55	-0.84	10.29	5.63	4.66	2.44	-16.55	-20.23*	-37.29**	-40.32**	-26.94**	-30.32**
10	Narendra Pooja × Pusa Naveen	15.03	10.26	-8	-2.82	2.91	3.63	-46.64**	-39.07**	-46.79**	-38.94**	-46.71**	-39.00**
11	Narendra Pooja × Narendra Prabha	6.18	6.18	-16.00*	-11.27	-3.34	-2.66	-30.14**	-20.23*	-60.64**	-54.84**	-45.50**	-37.62**
12	Narendra Pooja × Narendra Rashmi	1.41	2.14	-10.67	-5.63	-2.49	-1.8	-41.34**	-33.02**	-47.79**	-40.09**	-44.59**	-36.57**
13	NDBG-104 × Pusa Naveen	-10.7	-10.86	0	-7.04	-3.51	-8.93	-23.06**	-19.30*	-44.47**	-41.01**	-33.88**	-30.21**
14	NDBG-104 × Narendra Prabha	-5.71	-5.71	-9.86	-9.86	-7.81	-7.81	-38.80**	-35.81**	-19.09**	-14.06*	-28.84**	-24.88**
15	NDBG-104 × Narendra Rashmi	-13.57	-12.95	-15.87	-25.35**	-14.66*	-19.23**	-11.75	-7.44	-37.09**	-33.18**	-24.56**	-20.37**
16	NDBG-Sel-1 × Pusa Naveen	-1.72	-5.8	1.52	-5.63	-0.11	-5.72	-55.63**	-50.47**	-4.36	1.15	-30.56**	-24.54**
17	NDBG-Sel-1 × Narendra Prabha	5.01	5.01	2.82	2.82	3.9	3.9	-30.63**	-22.56**	-45.97**	-42.86**	-38.13**	-32.75**
18	NDBG-Sel-1 × Narendra Rashmi	-4.94	-4.25	3.03	-4.23	1.18	-4.24	-51.25**	-45.58**	-8.71	-3.46	-30.46**	-24.42**
19	Narendra Kamna × Pusa Naveen	1.97	2.05	0	-7.04	1.01	-2.55	-13.36	-38.14**	-23.08**	-44.70**	-17.99*	-41.44**
20	Narendra Kamna × Narendra Prabha	-1.04	-0.95	-11.27	-11.27	-6.18	-6.18	-37.21**	-37.21**	-44.93**	-44.93**	-41.09**	-41.09**
21	Narendra Kamna × Narendra Rashmi	0.14	0.87	0	-7.04	0.4	-3.14	-42.40**	-45.35**	5.81	0.69	-18.15**	-22.22**
22	NDBG-21 × Pusa Naveen	54.31**	61.03**	20.90*	14.08	38.22**	37.24**	4.28	-20.70*	-51.36**	-62.90**	-23.71**	-41.90**
23	NDBG-21 × Narendra Prabha	-8	-3.99	-14.08	-14.08	-9.11	-9.11	-47.44**	-47.44**	-8.06	-8.06	-27.66**	-27.66**
24	NDBG-21 × Narendra Rashmi	-8.79	-4.82	13.43	7.04	1.91	1.19	-28.43**	-32.09**	-15.74**	-19.82**	-22.05**	-25.93**
25	NDBG-22 × Pusa Naveen	20.41*	19.46*	13.89	15.49	17.07*	17.45*	-24.52**	-16.98*	-55.67**	-52.30**	-40.00**	-34.72**
26	NDBG-22 × Narendra Prabha	13.26	13.26	6.94	8.45	10.47	10.83	-22.83**	-15.12	-57.82**	-54.61**	-40.21**	-34.95**
27	NDBG-22 × Narendra Rashmi	7.87	8.65	15.28	16.90*	12.47	12.83	-28.75**	-21.63*	-26.12**	-20.51**	-27.45**	-21.06**
No. of crosses with significant positive heterosis		2	2	1	1	2	2	0	0	0	0	0	0
No. of crosses with significant negative heterosis		0	0	2	2	1	1	2	24	21	23	25	27
Range of heterosis		-13.57 to 54.31	-12.95 to 61.03	-18.31 to 20.90	-25.35 to 16.90	-14.66 to 38.22	-19.23 to 37.24	-55.63 to 12.79	-50.47 to 0	-60.64 to 5.81	-62.90 to 0.69	-46.71 to 1.62	-41.90 to 0

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. No.	Crosses	Number of fruit per plant						Fruit yield per plant					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 x Pusa Naveen	73.95**	138.87**	2.46	47.03**	37.47**	93.02**	50.97**	45.62**	-3.94	-4.88	23.06**	20.28**
2	NDBG-28 x Narendra Prabha	21.95	67.46**	75.20**	151.41**	49.12**	109.38**	29.11**	29.11**	41.21**	41.21**	35.18**	35.18**
3	NDBG-28 x Narendra Rashmi	0.62	38.17*	0.98	44.92**	0.8	41.54**	-1.89	-2.95	0	0	-0.3	-1.47
4	NDBG-13 x Pusa Naveen	60.00**	127.61**	33.68**	98.45**	46.58**	113.05**	62.07**	53.79**	33.77**	29.98**	47.70**	41.84**
5	NDBG-13 x Narendra Prabha	84.95**	163.10**	89.15**	180.79**	87.09**	171.93**	94.99**	94.99**	86.33**	86.33**	90.64**	90.64**
6	NDBG-13 x Narendra Rashmi	90.89**	171.55**	128.64**	239.41**	110.14**	205.43**	117.59**	115.24**	121.17**	118.36**	119.39**	116.81**
7	NDBG-15 x Pusa Naveen	106.70**	104.37**	79.10**	79.10**	92.84**	91.75**	28.12*	20.94	16.02	10.35	22.03**	15.63*
8	NDBG-15 x Narendra Prabha	96.34**	96.34**	96.61**	96.61**	96.47**	96.47**	38.35**	38.35**	33.30**	33.30**	35.82**	35.82**
9	NDBG-15 x Narendra Rashmi	108.91**	118.03**	121.77**	130.23**	115.31**	124.12**	35.09**	33.63**	38.97**	37.21**	37.04**	35.42**
10	Narendra Pooja x Pusa Naveen	109.52**	101.55**	112.08**	103.39**	110.79**	102.47**	50.32**	63.03**	13.46	24.32**	31.73**	43.61**
11	Narendra Pooja x Narendra Prabha	113.10**	113.10**	189.12**	189.12**	151.06**	151.06**	20.13*	30.29**	19.07**	30.47**	19.60**	30.38**
12	Narendra Pooja x Narendra Rashmi	39.41*	45.49*	47.35**	52.97**	43.36**	49.22**	-2.54	5.7	-16.76*	-8.79	-9.71	-1.57
13	NDBG-104 x Pusa Naveen	105.86**	98.03**	141.97**	132.06**	123.86**	115.02**	26.19*	20.35	42.00**	36.04**	34.14**	28.22**
14	NDBG-104 x Narendra Prabha	108.59**	108.59**	37.71**	37.71**	73.20**	73.20**	58.60**	58.60**	18.16*	18.16*	38.31**	38.31**
15	NDBG-104 x Narendra Rashmi	97.57**	106.20**	81.09**	87.99**	89.36**	97.11**	11.23	10.03	27.10**	25.49**	19.19*	17.79*
16	NDBG-Sel-1 x Pusa Naveen	81.41**	74.51**	60.97**	54.38**	71.22**	64.46**	71.04**	71.88**	54.90**	55.96**	62.93**	63.89**
17	NDBG-Sel-1 x Narendra Prabha	110.28**	110.28**	133.05**	133.05**	121.65**	121.65**	31.51**	32.15**	30.55**	31.45**	31.03**	31.80**
18	NDBG-Sel-1 x Narendra Rashmi	91.50**	99.86**	84.08**	91.10**	87.80**	95.49**	78.18**	79.06**	82.44**	83.69**	80.32**	81.38**
19	Narendra Kamna x Pusa Naveen	44.30*	40.85*	96.87**	95.20**	70.75**	67.98**	59.60**	11.11	51.31**	7.13	55.41**	9.11
20	Narendra Kamna x Narendra Prabha	85.92**	85.92**	79.38**	79.38**	82.65**	82.65**	44.25**	44.25**	-2.54	-2.54	20.77**	20.77**
21	Narendra Kamna x Narendra Rashmi	73.01**	80.56**	74.15**	80.79**	73.58**	80.68**	63.42**	61.65**	84.17**	81.84**	73.82**	71.78**
22	NDBG-21 x Pusa Naveen	133.82**	124.93**	237.56**	223.73**	185.54**	174.26**	98.73**	38.15**	70.54**	20.41*	84.48**	29.25**
23	NDBG-21 x Narendra Prabha	52.11**	52.11**	49.72**	49.72**	50.92**	50.92**	40.81**	40.81**	37.50**	37.50**	39.15**	39.15**
24	NDBG-21 x Narendra Rashmi	77.87**	85.63**	68.98**	75.42**	73.44**	80.54**	38.57**	37.07**	41.94**	40.14**	40.26**	38.61**
25	NDBG-22 x Pusa Naveen	115.23**	107.04**	147.28**	137.15**	131.20**	122.07**	71.91**	24.58*	54.32**	13.48	63.02**	19.01*
26	NDBG-22 x Narendra Prabha	121.69**	121.69**	133.05**	133.05**	127.36**	127.36**	34.12**	34.12**	6.05	6.05	20.04**	20.04**
27	NDBG-22 x Narendra Rashmi	94.20**	102.68**	57.41**	63.42**	75.88**	83.07**	27.63*	26.25*	31.75**	30.08**	29.70**	28.17**
No. of crosses with significant positive heterosis		25	27	25	27	26	27	24	21	20	19	25	24
No. of crosses with significant negative heterosis		0	0	0	0	0	0	0	0	1	0	0	0
Range of heterosis		-0 to 133.82	-0 to 171.55	-0 to 237.56	-0 to 239.41	-0 to 185.54	-0 to 205.43	-2.54 to 117.59	-2.95 to 115.24	-16.76 to 121.17	-8.79 to 118.36	-9.71 to 119.93	-1.57 to 116.18

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. No.	Crosses	Total soluble solids						Reducing sugars					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 x Pusa Naveen	-6.76	-1.43	-3.16	1.29	-4.98	-0.07	0.18	8.07	0.91	7.53	0.55	7.80*
2	NDBG-28 x Narendra Prabha	-7.14	-7.14	-3.6	-3.6	-5.38	-5.38	9.84*	9.84*	7.72	7.72	8.77*	8.77*
3	NDBG-28 x Narendra Rashmi	-1.47	-4.29	0.86	1.29	0.66	-1.51	13.07*	2.17	14.29**	1.93	13.68**	2.05
4	NDBG-13 x Pusa Naveen	-9.46*	-4.29	-7.57	-3.31	-8.52*	-3.8	-13.38**	-0.59	-14.48**	-1.93	-13.93**	-1.27
5	NDBG-13 x Narendra Prabha	9.72*	12.86*	7.88	10.36	8.81*	11.61**	-3.95	10.24*	-5.05	8.88*	-4.5	9.55*
6	NDBG-13 x Narendra Rashmi	-8.33	-5.71	1.27	3.6	-3.56	-1.08	-1.72	12.80**	-3.54	10.62*	-2.63	11.70**
7	NDBG-15 x Pusa Naveen	1.35	7.14	0.28	4.89	0.82	6.02	2.92	11.02*	2.54	9.27*	2.73	10.14**
8	NDBG-15 x Narendra Prabha	-5.71	-5.71	-4.75	-4.75	-5.23	-5.23	-6.3	-6.3	-7.72	-7.72	-7.02	-7.02
9	NDBG-15 x Narendra Rashmi	1.54	-5.71	-6.3	-5.9	-2.52	-5.81	30.69**	29.92**	30.39**	28.38**	30.54**	29.14**
10	Narendra Pooja x Pusa Naveen	-12.16*	-7.14	-2.34	2.16	-7.29	-2.51	0	7.87	-0.36	6.18	-0.18	7.02
11	Narendra Pooja x Narendra Prabha	-10.00*	-10.00*	-8.57	-7.91	-8.96*	-8.96*	0.2	0.2	-1.74	-1.74	-0.78	-0.78
12	Narendra Pooja x Narendra Rashmi	-5.97	-10.00*	-2.86	-2.16	-4.38	-6.09	-0.21	-4.72	-3.57	-6.18	-1.92	-5.46
13	NDBG-104 x Pusa Naveen	-8.11	-2.86	-3.3	1.15	-5.73	-0.86	-10.31**	9.65*	-12.40**	7.72	-11.37**	8.67*
14	NDBG-104 x Narendra Prabha	-7.14	-7.14	9.35	9.35	1.08	1.08	-2.42	19.29**	-4.71	17.18**	-3.58	18.23**
15	NDBG-104 x Narendra Rashmi	-1.49	-5.71	-7.59	-7.19	-4.11	-6.45	-25.93**	-9.45*	-28.41**	-11.97**	-27.19**	-10.72**
16	NDBG-Sel-1 x Pusa Naveen	-6.76	-1.43	-1.1	3.45	-3.95	1	-0.18	7.68	0	6.56	-0.09	7.12
17	NDBG-Sel-1 x Narendra Prabha	-4.29	-4.29	0.86	1.44	-1.72	-1.43	9.25*	9.25*	7.66	8.49	8.45*	8.87*
18	NDBG-Sel-1 x Narendra Rashmi	-5.71	-5.71	-4.43	-3.88	-5.08	-4.8	-10.83*	-10.83*	-12.07**	-11.39*	-11.46**	-11.11**
19	Narendra Kamna x Pusa Naveen	-6.76	-1.43	-2.89	1.58	-4.84	0.07	7.3	24.41**	7.61	22.78**	7.46*	23.59**
20	Narendra Kamna x Narendra Prabha	-5.71	-5.71	-0.58	-0.58	-3.15	-3.15	-19.86**	-7.09	-19.29**	-7.92	-19.58**	-7.5
21	Narendra Kamna x Narendra Rashmi	6.06	0	7.59	8.06	7.64	4.01	-1.87	13.78**	-1.86	11.97**	-1.86	12.87**
22	NDBG-21 x Pusa Naveen	0	5.71	4.4	9.21	2.18	7.46	6.72	15.75**	4.78	14.29**	5.73	15.01**
23	NDBG-21 x Narendra Prabha	-5.71	-5.71	-7.19	-7.19	-6.45	-6.45	-16.52**	-9.45*	-18.23**	-10.81*	-17.38**	-10.14**
24	NDBG-21 x Narendra Rashmi	-4.41	-7.14	-4.87	-4.46	-3.38	-5.81	-16.15**	-9.06	-17.70**	-10.23*	-16.94**	-9.65*
25	NDBG-22 x Pusa Naveen	-6.76	-1.43	-6.09	-0.14	-5.66	-0.79	7.66	16.14**	7.07	14.09**	7.36*	15.11**
26	NDBG-22 x Narendra Prabha	0	0	-0.81	5.47	-0.42	2.72	25.98**	25.98**	24.71**	24.71**	25.34**	25.34**
27	NDBG-22 x Narendra Rashmi	7.14	7.14	3.65	10.22	5.35	8.67*	33.56**	18.31**	33.41**	16.41**	33.48**	17.35**
No. of crosses with significant positive heterosis		1	1	0	0	1	1	6	14	4	11	8	15
No. of crosses with significant negative heterosis		3	2	0	0	1	1	7	3	7	4	7	4
Range of heterosis		-12.16 to 9.72	-10.00 to 12.86	-8.57 to 9.35	-7.91 to 10.36	-8.96 to 8.81	-8.96 to 11.61	-25.93 to 33.56	-10.83 to 29.92	-28.41 to 33.41	-11.97 to 28.38	-27.19 to 33.48	-11.11 to 29.14

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. No.	Crosses	Non- reducing sugar						Total sugars					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	NDBG-28 x Pusa Naveen	-12.98**	1.22	-14.58**	0	-13.79**	0.61	-6.04	3.64	0.25	5.36**	0.27	4.56
2	NDBG-28 x Narendra Prabha	-18.95**	-5.71**	-19.10**	-5.28**	-19.02**	-5.50**	-10.71	-1.52	3.66**	3.66**	-2.37	1.26
3	NDBG-28 x Narendra Rashmi	-10.18**	4.49*	-10.76**	4.47*	-10.47**	4.48**	-5.36	4.39	4.40**	2.35**	-0.41	3.3
4	NDBG-13 x Pusa Naveen	11.24**	13.06**	9.52**	12.20**	10.38**	12.63**	5.57	9.09	-2.36**	2.61**	1.28	5.61
5	NDBG-13 x Narendra Prabha	-2.45	-2.45	-2.03	-2.03	-2.24	-2.24	3.94	3.94	-0.25	3.66**	3.79	3.79
6	NDBG-13 x Narendra Rashmi	-7.66**	-1.63	-8.33**	-1.63	-8.00**	-1.63	1.2	2.12	2.39**	6.41**	7.51	4.42
7	NDBG-15 x Pusa Naveen	-37.36**	-30.20**	-37.87**	-31.30**	-37.61**	-30.75**	-35.99**	-30.76**	3.98**	9.28**	-13.22**	-9.26*
8	NDBG-15 x Narendra Prabha	4.76**	16.73**	4.78**	15.85**	4.77**	16.29**	1.82	10.15	-1.42*	0	0.13	4.7
9	NDBG-15 x Narendra Rashmi	-41.76**	-35.10**	-42.65**	-36.59**	-42.20**	-35.85**	-23.25**	-16.97*	5.80**	7.32**	-8.12*	-3.93
10	Narendra Pooja x Pusa Naveen	-3.73*	5.31**	-4.41**	5.69**	-4.07**	5.50**	-0.29	5.61	0.62	5.75**	1.35	5.68
11	Narendra Pooja x Narendra Prabha	-4.48*	4.49*	-6.25**	3.66*	-5.37**	4.07**	-2.29	3.48	-2.43**	-0.26	-2.36	1.47
12	Narendra Pooja x Narendra Rashmi	4.10*	13.88**	3.68*	14.63**	3.89**	14.26**	3	9.09	-1.79**	0.39	0.47	4.42
13	NDBG-104 x Pusa Naveen	-9.64**	-8.16**	-9.52**	-7.32**	-9.58**	-7.74**	-6.16	-3.03	-5.08**	2.48**	-4.17	-0.07
14	NDBG-104 x Narendra Prabha	-11.84**	-11.84**	-10.98**	-10.98**	-11.41**	-11.41**	-3.94	-3.94	0	7.97**	2.46	2.46
15	NDBG-104 x Narendra Rashmi	8.81**	15.92**	8.33**	16.26**	8.57**	16.09**	7.36	8.33	-9.81**	-2.61**	3.33	2.46
16	NDBG-Sel-1 x Pusa Naveen	-3.89*	0.82	-2.35	1.22	-3.12*	1.02	1.97	1.97	0.37	5.49**	-0.4	3.86
17	NDBG-Sel-1 x Narendra Prabha	-0.78	4.08*	1.18	4.88**	0.2	4.48**	3.12	5.15	5.15**	6.80**	4.21	6.04
18	NDBG-Sel-1 x Narendra Rashmi	8.81**	15.92**	7.58**	15.45**	8.19**	15.68**	6.84	8.94	-4.38**	-2.88**	0.83	2.6
19	Narendra Kamna x Pusa Naveen	-20.48**	-19.18**	-21.83**	-19.92**	-21.16**	-19.55**	-11	-8.03	3.22**	8.89**	-3.1	1.05
20	Narendra Kamna x Narendra Prabha	15.10**	15.10**	15.45**	15.4**	15.27**	15.27**	9.55	9.55	-6.07**	-0.92	2.92	3.93
21	Narendra Kamna x Narendra Rashmi	-14.56**	-8.98**	-14.77**	-8.54**	-14.67**	-8.76**	-3.75	-2.88	-0.25	5.23**	0.49	1.47
22	NDBG-21 x Pusa Naveen	-21.69**	-20.41**	-22.62**	-20.73**	-22.16**	-20.57**	-15.1	-12.27	-2.35**	3.40**	-7.81*	-3.86
23	NDBG-21 x Narendra Prabha	16.73**	16.73**	15.85**	15.85**	16.29**	16.29**	9.7	9.7	-7.90**	-2.48**	0.34	3.16
24	NDBG-21 x Narendra Rashmi	10.34**	17.55**	9.09**	17.07**	9.71**	17.31**	8.71	9.7	-6.54**	-1.05	1.09	3.93
25	NDBG-22 x Pusa Naveen	-19.10**	-11.84**	-19.49**	-10.98**	-19.29**	-11.41**	-7.77	-4.7	0.75	5.88**	-3.16	0.98
26	NDBG-22 x Narendra Prabha	-26.22**	-19.59**	-27.21**	-19.51**	-26.72**	-19.55**	-10.47	-8.03	10.98**	10.98**	2.18	2.18
27	NDBG-22 x Narendra Rashmi	-20.60**	-13.47**	-20.59**	-12.20**	-20.59**	-12.83**	-8.26	-5.76	13.69**	7.45**	3.07	1.33
No. of crosses with significant positive heterosis		8	12	8	12	8	12	0	0	9	19	0	0
No. of crosses with significant negative heterosis		17	11	16	11	17	11	2	2	10	3	3	1
Range of heterosis		-41.76 to 16.73	-35.10 to 17.55	-42.65 to 15.85	-36.59 to 17.07	-42.20 to 16.29	-35.85 to 17.31	-35.99 to 9.70	-30.76 to 10.15	-9.81 to 13.69	-2.88 to 10.98	-13.22 to 7.51	-9.26 to 6.04

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

Table 1. Contd....

S. No.	Crosses	Dry matter					
		Y <sub>1</sub>		Y <sub>2</sub>		Pooled	
		BP	SV	BP	SV	BP	SV
1	NDBG-28 × Pusa Naveen	-11.16**	-10.67*	-12.14**	-12.14**	-11.65**	-11.41**
2	NDBG-28 × Narendra Prabha	11.81**	12.43**	10.42**	10.42**	11.11**	11.41**
3	NDBG-28 × Narendra Rashmi	-22.45**	-15.40**	-22.14**	-17.48**	-22.29**	-16.45**
4	NDBG-13 × Pusa Naveen	-17.53**	-13.17**	-17.68**	-14.40**	-17.61**	-13.79**
5	NDBG-13 × Narendra Prabha	-10.04*	-5.29	-4.53	-0.72	-7.27*	-2.98
6	NDBG-13 × Narendra Rashmi	7.91*	17.72**	8.46*	14.95**	8.18**	16.32**
7	NDBG-15 × Pusa Naveen	1.4	1.11	0.56	-2.08	0.98	-0.5
8	NDBG-15 × Narendra Prabha	-15.03**	-15.03**	-16.12**	-16.12**	-15.58**	-15.58**
9	NDBG-15 × Narendra Rashmi	0.68	9.83*	-0.85	5.07	-0.09	7.42*
10	Narendra Pooja × Pusa Naveen	-26.43**	-23.56**	-26.37**	-24.64**	-26.40**	-24.11**
11	Narendra Pooja × Narendra Prabha	-13.57**	-10.20*	-13.45**	-11.41**	-13.51**	-10.82**
12	Narendra Pooja × Narendra Rashmi	-28.32**	-21.80**	-27.44**	-23.10**	-27.88**	-22.46**
13	NDBG-104 × Pusa Naveen	-4.19	-4.45	-4.47	-6.97	-4.33	-5.73
14	NDBG-104 × Narendra Prabha	21.24**	21.24**	17.12**	17.12**	19.16**	19.16**
15	NDBG-104 × Narendra Rashmi	-9.27*	-1.02	-8.55*	-3.08	-8.91**	-2.06
16	NDBG-Sel-1 × Pusa Naveen	5.58	5.29	6.05	3.26	5.81	4.26
17	NDBG-Sel-1 × Narendra Prabha	3.34	3.34	1.36	1.36	2.34	2.34
18	NDBG-Sel-1 × Narendra Rashmi	2.81	12.15**	2.14	8.24*	2.47	10.17**
19	Narendra Kamna × Pusa Naveen	-19.72**	-19.94**	-18.23**	-20.38**	-18.98**	-20.16**
20	Narendra Kamna × Narendra Prabha	-15.31**	-15.31**	-16.58**	-16.58**	-15.9**	-15.95**
21	Narendra Kamna × Narendra Rashmi	-20.07**	-12.80**	-14.19**	-9.06*	-17.14**	-10.91**
22	NDBG-21 × Pusa Naveen	-29.58**	-26.25**	-29.61**	-27.45**	-29.60**	-26.86**
23	NDBG-21 × Narendra Prabha	-26.48**	-23.01**	-26.89**	-24.64**	-26.69**	-23.83**
24	NDBG-21 × Narendra Rashmi	-23.21**	-16.23**	-21.11**	-16.39**	-22.17**	-16.32**
25	NDBG-22 × Pusa Naveen	-20.74**	-20.96**	-21.40**	-23.46**	-21.07**	-22.23**
26	NDBG-22 × Narendra Prabha	-20.41**	-20.41**	-21.38**	-21.38**	-20.90**	-20.90**
27	NDBG-22 × Narendra Rashmi	-24.32**	-17.44**	-23.93**	-19.38**	-24.13**	-18.42**
No. of crosses with significant positive heterosis		3	4	3	4	3	5
No. of crosses with significant negative heterosis		14	17	17	16	17	16
Range of heterosis		-29.58 to 21.24	-26.25 to 21.24	-29.61 to 17.12	-27.45 to 17.12	-29.60 to 19.60	-26.86 to 19.16

\*, \*\* Significant at 5 per cent and 1 per cent probability levels, respectively

well as in pooled for node number to first female flower anthesis and NDBG-13 × Narendra Rashmi in  $Y_1$  showed negative and significant heterosis over standard variety and one hybrid NDBG-15 × Pusa Naveen in  $Y_1$  showed negative and significant heterosis over better parent for days to first harvest. The present observations are in agreement with the findings of Niva et al. [8], Sanjivani et al. [12] and Chandramouli et al. [13].

Out of significant crosses for total fruit yield per plant, only one hybrid (NDBG-Sel-1 × Narendra Rashmi) showed positive and significant heterosis over standard parent for length of pedicel of female flower in both the years and pooled while, cross NDBG-21 × Pusa Naveen in  $Y_1$  and pooled. None of crosses showed positive and significant heterosis over standard parent for length of pedicel of male flower, internodal length and average fruit weight in both the years and pooled, while, two hybrids (NDBG-13 × Narendra Rashmi and NDBG-22 × Pusa Naveen) showed positive and significant heterosis over standard parent for primary branches per plant in both the years and pooled and one hybrid (NDBG-13 × Narendra Rashmi) showed positive and significant heterosis over better parent and standard variety for vine length in both the years and pooled, while, two crosses (NDBG-13 × Narendra Prabha and NDBG-13 × Narendra Rashmi) showed positive and significant heterosis over better parent and standard variety for number of node per vine in both the years and pooled, only one hybrid (NDBG-21 × Narendra Rashmi) showed positive and significant heterosis over better parent and standard variety for longer picking duration in both the years and pooled, only two hybrids (NDBG-13 × Narendra Rashmi and NDBG-105 × Narendra Prabha) showed positive and significant heterosis over better parent and standard variety for peduncle length in both the years and pooled and (NDBG-13 × Narendra Prabha) in  $Y_1$ , only two crosses (NDBG-13 × Narendra Prabha and NDBG-15 × Narendra Prabha) showed positive and significant heterosis over better parent and standard variety for fruit length in  $Y_2$  and pooled, NDBG-21 × Pusa Naveen showed positive and significant heterosis over better parent in  $Y_1, Y_2$  and pooled except standard variety in  $Y_2$  and NDBG-22 × Pusa Naveen in  $Y_1$  and pooled over standard variety showed positive and significant heterosis over better parent and standard variety for average fruit circumference in  $Y_1$  and NDBG-22 × Pusa Naveen showed positive and significant

heterosis over better parent and standard variety for number of fruit per plant in both the years and pooled while, NDBG-13 × Pusa Naveen in  $Y_1$ . The present observations are in agreement with the findings of Parmar et al. [14] and Chandramouli et al. [13].

Out of significant crosses for fruit yield per plant, only one hybrid (NDBG-13 × Narendra Prabha) showed positive and significant heterosis over standard parent for total soluble solids in  $Y_1$  and pooled while, one hybrid (NDBG-13 × Narendra Rashmi) in  $Y_1$  and pooled and NDBG-Sel-1 × Narendra Rashmi showed positive and significant heterosis over better parent and standard variety for non reducing sugar in both the years and pooled and NDBG-22 × Pusa Naveen in  $Y_1$  over better parents and one hybrid (NDBG-13 × Narendra Rashmi) showed positive and significant heterosis over better parent and standard variety for dry matter in both the years and pooled while, NDBG-Sel-1 × Narendra Rashmi showed positive and significant heterosis over standard variety for dry matter in both the years and pooled. None of the crosses showed positive and significant heterosis over better parent and standard variety for reducing sugars and total sugars in both the years and pooled. The number of crosses which showed significant standard heterosis for quality traits along with fruit yield were generally more in number than the crosses for significant better parent heterosis. This showed negative association for heterosis between fruit yield and quality traits. Similar results were also proposed by Sanjivani et al. [12].

#### 4. CONCLUSION

A wide range of variation in the estimates of heterobeltiosis and standard heterosis in positive and negative direction were observed for all the traits studied. The five top most promising heterotic crosses which showed significant and desirable heterosis over standard variety around both the seasons (pooled) were NDBG-13 × Narendra Rashmi (116.8%), NDBG-13 × Narendra Prabha (90.64%), NDBG-Sel-1 × Narendra Rashmi (81.38%), Narendra Kamna × Narendra Rashmi (71.78%) and NDBG-Sel-1 × Pusa Naveen (63.81) for fruit yield per plant and some other traits. Hence these top heterotic  $F_1$  may exploit in future as commercial hybrid of bottle gourd in salt affected soil as well as normal soil among the vegetable farming community as hybrid seed production in this crop is very simple.



## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Anoj Yadav, GC Yadav. Studies on heritability and genetic advance for the quantitative traits in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] over seasons under salt affected soil. The Pharma Innovation Journal. 2022;11(2):1630-1632.
2. Anonymous; 2018. Available:<http://www.agriculturalproductsindia.com/vegetables/vegetables-bottle-gourd.html>
3. Hayes JD, Footer CA. Heterosis in self-pollinated crop with particular reference to barley. In: Heterosis in Plant Breeding. F.G.H. (Eds.), Elsevier Scientific, New York. 1976;239-256.
4. Ghuge MB, Syamal MM, Karcho S. Heterosis in bottle gourd (*Lagenaria siceraria* (Mol.) Standl). Indian J. Agric. Res. 2016;50(5):466-470.
5. Gautam DK, Yadav GC. Gene action for growth, yield and quality traits in bottle gourd (*Lagenaria siceraria* (Mol.) Standl). J. Pharmaco. Phytochem. 2017;6(4):84-88.
6. Malviya AV, Bhandari DR, Patel AI, Jadavand NK, Patel UV. Heterosis for Fruit Yield and its Components in Bottle Gourd [*Lagenaria siceraria* (Mol.) Standl.] Trend. Biosci. 2017;10(2):783-787.
7. Padmakshi T. Heterosis and combining ability for yield attributing traits in bottle gourd (*Lagenaria siceraria* (Mol.) Standl). Ph. D. (Horti) Thesis, Indira Gandhi Vishwavidyalaya, Raipur; 2017. Available:<http://krishikosh.egranthac.in>
8. Niva D, Patel JN, Acharya RR. Heterosis studies in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). A Sci. Technol J. 2018; 31(1).
9. Quamruzzaman A, Ahmad S. Genetic analysis of some yield components of bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. SAARC J. Agric. 2020;8(1):1-9.
10. Quamruzzaman A, Salim M, Akhter L, Rahman M, Chowdhury M. Heterosis, combining ability and gene action for yield in bottle gourd. American Journal of Plant Sciences. 2020;11:642-652.
11. Geeta ON, Patel JB, Jyoti GJ. Studies on heterosis and inbreeding depression in bottle gourd (*Lagenaria siceraria* (Mol.) Standl). Ind. J. Pure App. Biosci. 2021;9(1):132-139.
12. Sanjivani P, Gondane MN, Bhalekar, Kshirsagar DB. Exploitation of heterosis in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) for earliness, yield and yield contributing traits. Int. J. Pharmacogn. Phytochem. Res. 2020;9(2):777-783.
13. Chandramouli B, Reddy RVSK, Rao MP, Babu MR, Jyothi KU, Umakrishna K. Studies on heterosis and inbreeding depression in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). J. Pharm. Innov. 2021;10(5):1501-1506.
14. Parmar, Shipra Singh, Pathak, Mamta. Heterosis and combining ability studies for yield and quality traits in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). Environment and Ecology. 2018;36(3):798-807.

© 2023 Yadav et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:  
<https://www.sdiarticle5.com/review-history/103704>