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Evaluation of performance for the quantitative traits in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] under Eastern Uttar Pradesh, India

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Abstract
The present investigation was carried out to obtain information based on *per se* performances of parents and their combinations for genetic improvement in bottle gourd. Ten promising genotypes with three testers were crossed in Linex Tester manner. TheF_1'shybrid in bottle gourd was evaluated in Randomized Complete Block Design (RBD) with three replications for twenty four yield and yield attributing traits during *Zaid* 2020-21 (Y_1) and 2021-22 (Y_2) at the Main Experimental Station (MES), Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Ayodhya (U.P.) India. The study evident that highly significant differences were observed for most of the traits under study. Based on *per se* performance, parent Kashi Ganga (4.61 kg) exhibited the highest fruit yield per plant followed byNDBG-517 (4.45 kg) and NDBG-83-1 (4.06 kg). The *per se* performance of crosses *i.e.* Punjab Komal x Narendra Jyoti (7.78 kg) followed by HAU-22 x Narendra Jyoti (7.09 kg) and HAU-22 x Narendra Pooja (7.01 kg) produced significantly higher fruit yield per plant than the general mean. These hybrids may be exploited as a new variety after selection and subjected to multi-locational trials for their release as cultivation on a commercial scale.

Keywords: Bottle gourd, RBD, experiment, genetic improvement etc.

Introduction
Bottle gourd [*Lagenaria Siceraria* (Mol.) Standl.] 2n= 2x= 22 is an important cultivated annual cucurbitaceous crop grown throughout the country. According to Cutler and Whitaker (1961) [2], this plant is probably indigenous to Tropical Africa while, De Candolle reported its occurrence in wild form in South Africa and India. The fossils records its cultivation in India even before 2000 BC, which indicates it is native to India. In India, the total area covered under bottle gourd is 0.187 million ha with production of 3.16 million tones and productivity 16.89 t/ha (Anonymous, 2020-21) [1]. 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. Bottle gourd is the largest produced cucurbitaceous vegetables in the world preferred in both urban and rural population. The tender fruits of bottle gourd can be used as vegetable and for making sweets (e.g. Halva, kheer, petha and burfi etc.), kofta and pickles. The fruits contain 96.3 per cent moisture, 2.9 per cent carbohydrate, 0.2 per cent protein, 0.1 per cent fat, 0.5 per cent mineral matter (calcium, phosphorus, iron, potassium, sodium and iodine) and 11 mg of vitamin C (Ascorbic acid) per 100 g fresh weight (Thamburaj and Singh, 2005) [14]. Bottle gourd is a highly cross-pollinated crop with wide genetic variability present within the cultivated varieties throughout the country. The amount of cross pollination ranges from 60 to 80%. Being a cross pollinated crop, it exhibits high heterosis in its crosses (Tyagi 1973, Sirohi *et al.*1985 [13], Maurya *et al.*1993, Singh *et al.*1996 and Maurya *et al.* 2003) [15, 7, 8].

There are projections that demand for food grains would increase from 192 million tonnes in 2000 to 345 million tonnes in 2030. Hence in the next 20 years, production of food grains needs to be increased at the rate of 5.5 million tonnes annually.

The mean performance of 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 may also be used for transfering these traits. 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 highyielding and high quality bottle

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gourd genotypes even if they have moderate or low fruit yied. Keeping in view the above facts the present investigation was conducted to find out stable genotype of bottle gourd for improvement in future.

Materials and Methods

The present research work was conducted during *Zaid* seasons of 2021 (Y_1) and 2022 (Y_2) to study the mean performance, general mean and range for twenty four characters 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 observations were recorded on twenty-three characters. The experimental materials for the present investigation comprised of ten promising 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.*; Kashi Kirti (L_1), NDBG-63-1-1 (L_2), HAU-22 (L_3), Kashi Ganga (L_4), Punjab Komal (L_5), NDBG-17 (L_6), NDBG-65-2-1 (L_7), NDBG-83-1(L_8), FSC-5-1-1 (L_9) and NDBG-517 (L_{10}) were crossed with three testers *viz.* Narendra Rashmi (T_1), Narendra Pooja (T_2), Narendra Jyoti (T_3) to get 30 F_1hybrid seed. The crop was sown in rows spaced at 3 meters apart with a plant to plant spacing of 0.50 meter. 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, inter-nodal 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 (%), Ascorbic acid (mg/100 g) reducing sugars (%), non-reducing sugar (%), total sugars (%) and dry matter (g/100g). The analysis of variance was done as per the method suggested by (Panse and Sukhatme, 1987) [10].

Results and Discussion

A perusal of Table-1 revealed that days to first male flower anthesis varied from 41.48 to 51.00 for parents and F_1 hybrids with an overall mean of 48.17 for parents and 45.54 F_1 hybrids. Among the parents, FSC-5-1-1 (47.03) and Narendra Jyoti (47.12) exhibited minimum days to first male flower anthesis while NDBG-63-1-1 (51.00) took maximum days to first male flower anthesis. Out of 30 crosses, hybrids that exhibited minimum days to first male flower anthesis were Punjab komal x Narendra Jyoti (41.48) followed by cross HAU-22 X Narendra Jyoti (42.75). While cross FSC-5-1-1x Narendra Jyoti (48.95) took maximum days to first male flower anthesis. Days to first female flower anthesis varied from 43.67 to 56.50 for parents and F_1 hybrids with an overall mean of 53.58 for parents and 49.48 F_1 hybrids. Among the parents, Narendra Pooja (51.83) and Kashi Kirti (52.17) exhibited minimum days to first female flower anthesis while FSC-5-1-1 (56.50) took maximum days to first female flower anthesis. Out of 30 crosses, hybrids that exhibited minimum

days to first female flower anthesis were Punjab Komal x Narendra Jyoti (43.67) followed by HAU-22 X Narendra Jyoti (45.65) while cross FSC-5-1-1 x Narendra Jyoti (56.33) took maximum days to first female flower anthesis.

Node number to first male flower appearance varied from 9.96 to 14.38 for parents and for F_1 hybrids with an overall mean of 13.25 for parents and11.28 F_1 hybrids. Among the parents, Narendra Jyoti (11.22) and Narendra Pooja (12.03) exhibited minimum node number to first male flower appearance while Narendra Rashmi (14.38) took maximum node number to first male flower appearance. Out of 30 crosses, hybrids that exhibited minimum node number to first male flower appearance were Kashi Kirti x Narendra Pooja (9.96) followed by while cross Punjab Komal x Narendra Pooja (10.15) while cross NDBG-63-1-1 x Narendra Jyoti (12.66) took maximum node number to first male flower appearance. Node number to first female flower appearance varied from 13.07 to 19.41 for parents and F_1 hybrids with an overall mean of 17.63 for parents and 16.01 F_1 hybrids. Among the parents, Narendra Pooja (15.63) and Kashi Kirti (16.48) exhibited minimum node number to first female flower while FSC-5-1-1 (19.41) took maximum node number to first female flower appearance. Out of 30 crosses, hybrids that exhibited minimum node number to first female flower appearance were Kashi Kirti x Narendra Pooja (13.07) followed by Kashi Kirti x Narendra Rashmi (13.32) while cross NDBG-83-1 x Narendra Jyoti (18.44) took maximum node number to first female flower.

Length of pedicel of male flower (cm) varied from 15.17 to 23.23 for parents and F_1 hybrids with an overall mean of 19.55 for parents and 18.94 F_1 hybrids. Among the parents, Narendra Rashmi (15.17) and Narendra Pooja (17.59) exhibited minimum length of pedicel of male flower (cm) while HAU-22 (22.08) took maximum length of pedicel of male flower (cm). Out of 30 crosses, hybrids that exhibited minimum length of pedicel of male flower (cm) were Kashi Ganga x Narendra Jyoti (15.80) followed by NDBG-65-2-1x Narendra Rashmi (16.09) while cross NDBG -17x Narendra Pooja (23.23) took maximum length of pedicel of male flower (cm). Length of pedicel of female flower (cm) varied from 9.44 to 15.60 for parents and F_1 hybrids with an overall mean of 12.09 for parents andF_1 hybrids. Among the parents, Narendra Rashmi (19.44) and NDBG-517 (19.60) exhibited minimum length of pedicel of female flower (cm) while took Kashi Kirti (14.26) maximum length of pedicel of female flower (cm). Out of 30 crosses, hybrids that NDBG-517 x Narendra Rashmi (9.72) exhibited minimum length of pedicel of female flower (cm)were followed by HAU -22 X Narendra Rashmi (19.97) while cross took Kashi Ganga x Narendra Pooja (15.60) maximum length of pedicel of female flower (cm).

Days to first harvest varied from 51.97 to 66.15 for parents and F_1 hybrids with an overall mean of 62.47 for parents and 58.28F_1 hybrids. Among the parents, Kashi Kirti (58.72 and Narendra Rashmi (59.33) exhibited minimum days to first harvest while took NDBG-63-1-1 (66.15) maximum days to first harvest. Out of 30 crosses, hybrids that exhibited minimum days to first harvest were Punjab Komal x Narendra Jyoti (51.97) followed by NDBG-517 x Narendra Jyoti (53.71) while cross FSC-5-1-1 x Narendra Jyoti (64.01) took maximum days to first harvest. Primary branches per plant varied from 13.79 to 24.38 for parents and F_1 hybrids with an overall mean of 16.12 for parents and 18.45 F_1 hybrids.

Among the parents, Punjab Komal (13.79) and NBBG-17 (13.82) exhibited minimum primary branches per plant while FSC-5-1-1 (20.36) took maximum primary branches per plant. Out of 30 crosses, hybrids that exhibited minimum primary branches per plant were NDBG-517 x Narendra Jyoti (15.70) followed by NDBG -83-1x Narendra Jyoti (15.71) while cross NDBG-63-1-1 x Narendra Pooja (24.38) took maximum primary branches per plant.

Vine length (m) varied from 6.23 to 9.40 for parents and F_1 hybrids with an overall mean of 7.19for parents and 8.22 F_1 hybrids. Among the parents, NDBG-63-1-1 (6.23) andHAU-22 (6.61) exhibited minimum vine length (m) while NDBG-65-2-1 (8.02) took maximum vine length (m). Out of 30 crosses, hybrids that exhibited minimum vine length (m) per plant were FSC-511x Narendra Rashmi (6.74) followed by NDBG-83-1x Narendra Jyoti (6.79) while cross NDBG 517 x Narendra Rashmi (9.40) took maximum vine length (m). Number of node per vine varied from 63.47 to 93.72 for parents and F_1 hybrids with an overall mean of 75.06 for parents and84.07 F_1 hybrids. Among the parents, Punjab Komal (64.37) and NDBG-17 (66.26) exhibited minimum number of node per vine while NDBG-83-1 (87.28) took maximum number of node per vine. Out of 30 crosses, hybrids that exhibited minimum number of node per vine per plant were NDBG-63-1-1 x Narendra Rashmi (68.84) followed by NDBG-63-1-1 x Narendra Pooja (69.12). While cross NDBG-517 x Narendra Rashmi (93.72) took maximum number of node per vine. Inter-nodal length (cm) varied from 8.02 to 12.11 for parents and F_1 hybrids with an overall mean of 9.75 for parents and 9.88F_1 hybrids. Among the parents, NDBG -83-1 (8.09) and NDBG-63-1(8.25) exhibited minimum inter-nodal length (cm) while Narendra Jyoti (11.01) took maximum inter-nodal length (cm). Out of 30 crosses, hybrids that exhibited minimum inter-nodal length (cm) NDBG -17 x Narendra Rashmi (8.02) were followed by NDBG-83-1 x Narendra Jyoti (8.09) while cross (NDBG 63-1-1 x Narendra Rashmi (12.11) took maximum number of inter-nodal length (cm)

Picking duration varied from 30.75 to 47.28 for parents and for F_1 hybrids with an overall mean of 36.69 for parents and 42.27 F_1 hybrids. Among the parents, NDBG-63-1-1 (30.75) and NDBG-517 (32.08) exhibited minimum picking duration while NDBG-65-2-1 (43.632) took maximum picking duration. Out of 30 crosses, hybrids that exhibited minimum picking duration NDBG-65-2-1 x Narendra Jyoti (36.32) followed by NDBG-17 x Narendra Jyoti (36.58) while cross NDBG -63-1-1 x Narendra Pooja (47.28) took maximum days for picking duration. Peduncle length (cm) varied from 9.58 to 13.97 for parents and F_1 hybrids with an overall mean of 11.60 for parents and 11.22 F_1 hybrids. Among the parents, NDBG-83-1 (9.94) andFSC-5-1-1 (10.15) exhibited minimum peduncle length (cm), while Punjab Komal (13.19) took maximum peduncle length (cm). Out of 30 crosses, hybrids that exhibited minimum peduncle length (cm) appearance were NDBG-65-2-1x Narendra Jyoti (9.58) followed by NDBG-517 x Narendra Jyoti (9.80) while cross Kashi Kirti x Narendra Pooja (13.97) took maximum for peduncle length (cm).Fruit length (cm) varied from 32.17 to 44.66 for parents and F_1hybrids with an overall mean of 37.28 for parents and 38.03 F_1 hybrids. Among the parents, NDBG-517 (32.34) and Kashi Kirti (34.41) exhibited minimum fruit length (cm) while NDBG-83-1 (42.45) took maximum fruit length (cm). Out of 30 crosses, hybrids that exhibited minimum fruit

length (cm) appearance were Punjab Komal x Narendra Pooja (32.13) followed by NDBG-517 x Narendra Pooja (34.11) while cross NDBG-17 x Narendra Jyoti (44.66) took maximum for fruit length (cm).

Average fruit circumference (cm) varied from 21.93 to 35.25 for parent and F_1 hybrids with an overall mean of 26.42 for parents and 26.26 F_1 hybrids. Among the parents, NDBG-65-2-1 (22.41) and Narendra Jyoti (23.57) exhibited minimum average fruit circumference (cm) while Punjab Komal (32.31) took maximum average fruit circumference (cm). Out of 30 crosses, hybrids that exhibited minimum average fruit circumference (cm) were NDBG -63-1-1 x Narendra Rashmi (21.93) followed by FSC-5-5-1 x Narendra Jyoti (22.32) while cross Punjab Komal x Narendra Jyoti (32.25) took maximum for average fruit circumference (cm). Average fruit weight (kg) varied from 0.81 to 1.50 for parent and F_1 hybrids with an overall mean of 1.14 for parents and 1.18F_1 hybrids. Among the parents, HAU-22 (0.91) and NDBG-65-2-1 (0.92) exhibited minimum average fruit weight (kg) while Punjab Komal (1.31) took maximum average fruit weight (kg). Out of 30 crosses, hybrids that exhibited minimum average fruit weight (kg) were NDBG-17 x Narendra Pooja (0.81) followed by NDBG-17 x Narendra Jyoti (0.83) while cross Punjab Komal x Narendra Pooja (1.50) took maximum for average fruit weight (kg).Number of fruit per plantvaried from2.61 to5.97 for parent and F_1 hybrids with an overall mean of 3.31 for parents and 4.87 F_1 hybrids. Among the parents, Narendra Rashmi (2.61) and Punjab Komal (2.62) exhibited minimum number of fruit per plant whiletook NDBG-65-2-1(4.35) maximum number of fruit per plant. Out of 30 crosses, hybrids that exhibited minimum number of fruit per plant were FSC-511 x Narendra Jyoti (3.61) followed by NDBG-83-1 x Narendra Jyoti (3.69) while cross NDBG 17 x Narendra Rashmi (5.97) took maximum for number of fruit per plant.

Fruit yield per plant (kg) varied from 2.99 to 7.78 for parent and F_1 hybrids with an overall mean of 3.72 for parents and 5.70 F_1 hybrids. Among the parents, NDBG-63-1-1 (2.99) and HAU-22 (3.18) exhibited minimum fruit yield per plant (kg) while Kashi Ganga (4.61) took maximum fruit yield per plant (kg). Out of 30 crosses, hybrids that exhibited minimum fruit yield per plant (kg) were NDBG -17 x Narendra Jyoti followed by FSC-5-1-1x Narendra Jyoti (3.94) while cross Punjab Komal x Narendra Jyoti (7.78) took maximum for fruit yield per plant (kg). Total soluble solids (%) varied from2.17 to3.37 for parent and F_1 hybrids with an overall mean of 2.55 for parents and 2.79 F_1 hybrids. Among the parents, HAU-22 (2.29) and NDBG-17 (2.32) exhibited minimum total soluble solids (%) while Kashi Kirti (2.94) took maximum total soluble solids (%). Out of 30 crosses, hybrids that exhibited minimum total soluble solids (%) were Kashi Ganga x Narendra Pooja (2.17) followed by Kashi Kirti x Narendra Rashmi (2.35). While cross Punjab Komal x Narendra Rashmi (3.37) showed maximum value for total soluble solids (%).

Ascorbic acid (mg/100 g) varied from 7.14 to 9.51 for parent and F_1 hybrids with an overall mean of 8.70for parents and 8.94 F_1 hybrids. Among the parents, Punjab Komal (7.14) and NDBG-63-1-1 (7.82) exhibited minimum Ascorbic acid (mg/100 g) while Narendra Rashmi (9.51) took maximum Ascorbic acid (mg/100 g). Out of 30 crosses, hybrids that exhibited minimum Ascorbic acid (mg/100 g) were HAU-22 x Narendra Rashmi (8.05) followed by NDBG-63-1-1 x

Narendra Jyoti (8.08) while cross Kashi ganga x Narendra Pooja (9.47) showed maximum value for ascorbic acid (mg/100 g). Reducing sugars ranged from 1.29 to 2.51% for parents and F$_1$ hybrids with an overall mean of 1.94% for parents and 1.85% F$_1$ hybrids (Table-1). Among the parents exhibited maximum Kashi Ganga (2.51%) and NDBG-517 (1.49) recorded a minimum mean value for reducing sugars. In the case of F$_1$ hybrids, crosses NDBG-17 x Narendra Pooja (2.45%) followed by Kashi Kirti x Narendra Jyoti (2.42%) exhibited higher total sugars than the general mean and cross Punjab Komal x Narendra Rashmi (1.29%) recorded minimum reducing sugars.

Non-reducing sugars (%) ranged from 0.54 to 0.98% for parents and F$_1$ hybrids with an overall mean of 0.83% for parents and 0.80% F$_1$ hybrids (Table-1). Among the parents Kashi Kirti (0.92%) exhibited maximum non-reducing sugars (%) and FSC-5-1-1 (0.71%) recorded a minimum mean value for non-reducing sugars. In the case of F$_1$ hybrids, crosses NDBG-63-1-1 x Narendra Pooja (0.98%) followed by HAU-22 x Narendra Jyoti (0.92%) exhibited higher non-reducing sugars (%) than the general mean and cross Kashi Kirti x Narendra Pooja (0.54%) recorded minimum non- reducing sugars (%). Total sugars % ranged from 2.01 to 3.29% for

parents and F$_1$ hybrids with an overall mean of 2.77% for parents and 2.65% F$_1$ hybrids (Table-1). Among the parents, exhibited maximum total sugars Kashi Kirti (7.80%) and FSC-5-1-1 (7.43%). Kashi Ganga (2.40%) recorded a minimum mean value for total sugars. In the case of F$_1$ hybrids, crosses NDBG-17 x Narendra Pooja (3.29) followed by NDBG-63-1-1 x Narendra Pooja (3.17%) exhibited higher total sugar than the general mean and cross HAU-22 x Narendra Rashmi (2.10%) recorded minimum total sugars (%). Dry matter (g/100g) varied from 3.08 to 7.45 for parent and F$_1$ hybrids with an overall mean of 5.23 for parents and 5.50 F$_1$ hybrids Among the parents, Punjab Komal (3.08) and Kashi Ganga (3.55)exhibited minimum dry matter (g/100g) while took NDBG-63-1-1 (6.74) maximum dry matter (g/100g). Out of 30 crosses, hybrids that exhibited minimum dry matter (g/100g) Punjab Komal x Narendra Rashmi (3.73) followed by Punjab Komal x Narendra Pooja (4.07) while cross Kashi Ganga x Narendra Pooja (7.45) took maximum for dry matter (g/100g). Similar findings also reported by Similar results were also obtained by Ghuge *et al.* (2016) [5], Gautam *et al.* (2017) [3], Malviya *et al.* (2017) [6], Niva *et al.* (2018) [9], Quamruzzaman and Ahmad (2020) [11], and Geeta *et al.* (2021) [4].

Table 1: Mean performance, general mean, range, coefficient of variation, critical difference and standard error for twenty four characters of line × tester set of 30 F1's and their 13 parents over two years Y$_1$ (2021), Y$_2$ (2022) and pooled

S. No.	Genotype	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)
1	Kashi Kirti x N. Rashmi	45.83	48.83	10.98	13.32	20.90	13.35
2	Kashi Kirti x N. Pooja	46.91	51.46	9.96	13.07	19.53	13.18
3	Kashi Kirti x N. Jyoti	45.86	50.08	10.59	14.99	19.72	12.63
4	NDBG- 63-1-1 x N. Rashmi	45.25	50.78	10.81	17.29	20.08	12.60
5	NDBG- 63-1-1 x N. Pooja	45.55	51.55	11.12	17.09	22.32	13.06
6	NDBG- 63-1-1 x N. Jyoti	44.02	48.27	12.66	16.51	22.15	11.41
7	HAU -22 x N. Rashmi	43.28	47.40	12.39	13.56	19.72	9.97
8	HAU -22 x N. Pooja	43.34	48.12	12.09	14.90	17.45	12.42
9	HAU -22 x N. Jyoti	42.75	45.65	11.60	16.65	16.86	11.77
10	Kashi Ganga x N. Rashmi	43.01	47.42	11.48	15.90	18.97	12.95
11	Kashi Ganga x N. Pooja	46.39	49.50	10.65	15.22	17.60	15.60
12	Kashi Ganga x N. Jyoti	45.93	49.75	11.34	16.38	15.80	14.89
13	Punjab Komal x N. Rashmi	45.18	48.50	11.21	16.72	18.59	13.57
14	Punjab Komal x N. Pooja	44.23	47.40	10.15	15.27	21.65	12.03
15	Punjab Komal x N. Jyoti	41.48	43.67	11.74	16.21	20.79	13.13
16	NDBG – 17 x N. Rashmi	46.03	48.67	10.40	14.43	21.26	14.75
17	NDBG – 17 x N. Pooja	48.13	52.67	11.28	15.87	23.23	13.47
18	NDBG – 17 x N. Jyoti	46.03	50.83	11.91	17.42	20.03	12.78
19	NDBG – 65-2-1 x N. Rashmi	46.19	49.17	11.98	18.27	16.09	11.87
20	NDBG – 65-2-1 x N. Pooja	47.23	51.65	12.56	17.63	16.96	12.09
21	NDBG – 65-2-1 x N. Jyoti	44.89	48.19	11.42	15.27	18.97	12.57
22	NDBG – 83-1 x N. Rashmi	45.98	49.18	11.08	17.37	18.32	10.77
23	NDBG – 83-1 x N. Pooja	48.17	51.90	12.20	17.65	16.78	10.66
24	NDBG – 83-1 x N. Jyoti	47.30	51.06	12.18	18.44	17.80	12.42
25	FSC -5-1-1 x N. Rashmi	45.96	48.87	11.10	17.50	18.86	10.79
26	FSC -5-1-1 x N. Pooja	45.90	49.17	11.11	17.17	18.60	10.09
27	FSC -5-1-1 x N. Jyoti	48.95	56.33	11.04	16.60	19.03	10.78
28	NDBG -517 x N. Rashmi	46.06	53.36	10.58	15.15	17.33	9.72
29	NDBG -517 x N. Pooja	45.44	48.00	10.45	13.85	16.54	10.03
30	NDBG -517 x N. Jyoti	44.81	47.17	10.43	14.56	16.28	10.61
	F1 Hybrid Mean	45.54	49.48	11.28	16.01	18.94	12.20
Line							
31	Kashi Kirti	47.75	52.17	12.12	16.48	19.72	14.26
32	NDBG -63-1-1	51.00	54.83	13.41	16.73	21.72	13.70
33	HAU -22	48.54	53.17	13.41	15.85	22.08	13.38

34	Kashi Ganga	48.26	52.67	13.84	17.54	21.09	12.22
35	Punjab Komal	48.01	53.00	14.19	18.18	19.98	12.86
36	NDBG -17	47.92	54.00	13.37	19.28	21.13	12.50
37	NDBG -65-2-1	47.90	54.17	13.15	17.40	20.51	10.61
38	NDBG -83-1	47.18	53.33	13.61	17.54	18.75	12.68
39	FSC -5-1-1	47.03	56.50	13.93	19.41	18.23	12.24
40	NDBG -517	49.16	55.00	13.65	18.95	18.48	9.60
Tester							
41	Narendra Rashmi	48.45	53.17	14.38	18.63	15.17	9.44
42	Narendra Pooja	47.89	51.83	12.03	15.63	17.59	11.76
43	Narendra Jyoti	47.12	52.67	11.22	17.56	19.72	11.93
Parental Mean		48.17	53.58	13.25	17.63	19.55	12.09
Grand Mean		46.33	50.72	11.88	16.50	19.12	12.17
C.V.		6.44	6.31	11.23	10.67	11.95	15.52
S.E. m ±		1.22	1.31	0.54	0.72	0.93	0.77
C.D. at 5%		3.39	3.64	1.52	2.00	2.60	2.15
Range	Lowest	41.48	43.67	9.96	13.07	15.17	9.44
	Highest	51.00	56.50	14.38	19.41	23.23	15.60

S. No.	Genotype	Days to first harvest	Primary branches per plant	Vine length (m)	Number of node per vine	Inter-nodal length (cm)	Picking duration
1	Kashi Kirti x N. Rashmi	55.50	18.33	7.86	86.67	9.47	41.17
2	Kashi Kirti x N. Pooja	59.84	21.87	9.05	81.40	11.24	45.28
3	Kashi Kirti x N. Jyoti	59.30	22.22	8.87	77.63	11.47	43.42
4	NDBG- 63-1-1 x N. Rashmi	62.31	21.15	8.32	68.84	12.11	46.76
5	NDBG- 63-1-1 x N. Pooja	58.96	24.38	7.81	69.12	11.38	47.28
6	NDBG- 63-1-1 x N. Jyoti	60.48	23.10	8.24	81.40	10.16	43.43
7	HAU -22 x N. Rashmi	55.37	18.74	8.75	85.55	10.26	47.28
8	HAU -22 x N. Pooja	55.60	17.14	9.10	82.38	11.09	42.82
9	HAU -22 x N. Jyoti	57.26	20.23	8.69	87.98	9.96	40.52
10	Kashi Ganga x N. Rashmi	54.45	23.92	8.71	90.40	9.69	37.39
11	Kashi Ganga x N. Pooja	60.16	22.04	9.29	84.05	11.08	39.48
12	Kashi Ganga x N. Jyoti	57.02	17.46	8.18	87.29	9.36	42.50
13	Punjab Komal x N. Rashmi	59.94	17.73	8.15	93.52	8.69	43.05
14	Punjab Komal x N. Pooja	53.74	17.41	7.54	87.13	8.67	41.94
15	Punjab Komal x N. Jyoti	51.97	17.15	7.05	85.81	8.24	42.71
16	NDBG – 17 x N. Rashmi	55.98	18.07	7.42	92.63	8.02	45.12
17	NDBG – 17 x N. Pooja	63.18	15.78	7.82	84.51	9.35	38.06
18	NDBG – 17 x N. Jyoti	59.24	16.82	9.10	85.40	10.65	36.58
19	NDBG – 65-2-1 x N. Rashmi	62.14	17.31	8.82	91.10	9.71	39.25
20	NDBG – 65-2-1 x N. Pooja	56.65	18.20	8.10	90.15	8.99	38.51
21	NDBG – 65-2-1 x N. Jyoti	59.44	17.54	8.48	82.08	10.48	36.32
22	NDBG – 83-1 x N. Rashmi	55.47	16.44	7.70	76.22	10.24	42.87
23	NDBG – 83-1 x N. Pooja	59.96	15.78	7.08	86.25	8.26	46.25
24	NDBG – 83-1 x N. Jyoti	61.59	15.71	6.79	84.30	8.09	44.29
25	FSC -5-1-1 x N. Rashmi	54.39	16.03	6.74	74.47	9.06	42.74
26	FSC -5-1-1 x N. Pooja	57.18	16.48	7.77	79.20	9.80	44.94
27	FSC -5-1-1 x N. Jyoti	64.01	16.28	9.13	81.48	11.28	40.49
28	NDBG -517 x N. Rashmi	63.73	18.37	9.40	93.72	10.03	44.21
29	NDBG -517 x N. Pooja	59.88	16.00	8.38	87.37	9.61	43.55
30	NDBG -517 x N. Jyoti	53.71	15.70	8.29	83.93	9.89	40.08
F1 Hybrid Mean		58.28	18.45	8.22	84.07	9.88	42.27
Line							
31	Kashi Kirti	58.72	15.88	7.72	82.93	9.29	35.87
32	NDBG -63-1-1	66.15	14.93	6.23	75.86	8.25	30.75
33	HAU -22	63.06	14.91	6.61	74.39	8.96	35.98
34	Kashi Ganga	62.61	16.20	7.35	71.14	10.36	36.22
35	Punjab Komal	60.71	13.79	6.79	64.37	10.57	33.56
36	NDBG -17	64.05	13.82	7.67	66.26	11.63	35.26
37	NDBG -65-2-1	63.62	16.46	8.02	74.75	10.84	43.63
38	NDBG -83-1	64.62	18.90	6.96	87.28	8.09	39.91
39	FSC -5-1-1	64.52	20.36	7.39	78.32	9.55	36.95
40	NDBG -517	63.03	17.17	6.96	70.60	9.94	32.08
Tester							
41	Narendra Rashmi	59.33	15.78	6.95	75.12	9.28	36.46
42	Narendra Pooja	60.56	15.78	7.10	81.88	9.06	39.14
43	Narendra Jyoti	61.13	15.57	7.72	72.89	11.01	41.17

	Parental Mean	62.47	16.12	7.19	75.06	9.75	36.69
	Grand Mean	59.55	17.74	7.91	81.34	9.84	40.59
	C.V.	6.75	14.42	8.89	9.43	11.30	9.77
	S.E. m ±	1.64	1.04	0.29	3.13	0.45	1.62
	C.D. at 5%	4.57	2.91	0.80	8.73	1.27	4.51
Range	Lowest	51.97	13.79	6.23	64.37	8.02	30.75
	Highest	66.15	24.38	9.40	93.72	12.11	47.28

S. No.	Genotype	Peduncle length (cm)	Fruit length (cm)	Average fruit circumference (cm)	Average fruit weight (kg)	Number of fruit per plant	Fruit yield per plant (kg)
1	Kashi Kirti x N. Rashmi	12.30	37.61	26.25	1.28	4.13	5.40
2	Kashi Kirti x N. Pooja	13.97	37.34	29.27	1.13	4.59	5.27
3	Kashi Kirti x N. Jyoti	10.96	35.96	30.91	1.19	4.42	5.14
4	NDBG- 63-1-1 x N. Rashmi	10.97	38.37	26.97	1.09	3.84	4.10
5	NDBG- 63-1-1 x N. Pooja	11.93	37.97	21.93	1.03	4.73	4.84
6	NDBG- 63-1-1 x N. Jyoti	11.15	39.37	23.19	1.02	4.92	5.01
7	HAU -22 x N. Rashmi	11.30	39.72	24.75	1.07	4.67	5.03
8	HAU -22 x N. Pooja	13.37	41.34	27.77	1.32	5.30	7.01
9	HAU -22 x N. Jyoti	11.52	39.22	26.58	1.29	5.75	7.09
10	Kashi Ganga x N. Rashmi	10.48	36.88	23.22	1.11	5.51	6.13
11	Kashi Ganga x N. Pooja	10.95	39.11	23.46	1.17	4.45	5.16
12	Kashi Ganga x N. Jyoti	10.06	37.86	24.32	1.30	5.02	6.49
13	Punjab Komal x N. Rashmi	11.21	38.15	29.29	1.36	5.00	6.75
14	Punjab Komal x N. Pooja	12.17	32.13	34.44	1.50	4.25	6.40
15	Punjab Komal x N. Jyoti	9.68	34.25	35.25	1.45	5.38	7.78
16	NDBG – 17 x N. Rashmi	12.14	37.73	29.16	1.13	5.97	6.76
17	NDBG – 17 x N. Pooja	12.68	40.67	26.17	0.81	5.38	4.38
18	NDBG – 17 x N. Jyoti	11.53	44.66	26.36	0.83	4.78	3.92
19	NDBG – 65-2-1 x N. Rashmi	10.83	42.32	25.20	1.00	5.02	5.06
20	NDBG – 65-2-1 x N. Pooja	10.74	37.88	24.02	1.16	5.63	6.54
21	NDBG – 65-2-1 x N. Jyoti	9.58	40.91	24.36	1.26	4.69	5.90
22	NDBG – 83-1 x N. Rashmi	10.79	36.97	24.64	1.35	4.25	5.74
23	NDBG – 83-1 x N. Pooja	11.01	37.66	27.10	1.30	5.70	6.44
24	NDBG – 83-1 x N. Jyoti	10.02	41.30	26.16	1.21	3.69	5.63
25	FSC -5-1-1 x N. Rashmi	10.80	37.18	25.10	1.21	5.41	5.33
26	FSC -5-1-1 x N. Pooja	11.99	34.91	22.99	1.11	5.39	5.95
27	FSC -5-1-1 x N. Jyoti	11.30	36.26	22.32	1.09	3.61	3.94
28	NDBG -517 x N. Rashmi	10.95	36.16	25.60	1.20	4.54	5.45
29	NDBG -517 x N. Pooja	10.81	34.11	25.24	1.26	5.12	6.43
30	NDBG -517 x N. Jyoti	9.80	37.02	25.92	1.22	4.92	5.99
	F1 Hybrid Mean	11.23	38.03	26.26	1.18	4.87	5.70
Line							
31	Kashi Kirti	12.41	34.41	28.26	1.26	3.01	3.88
32	NDBG -63-1-1	12.18	36.97	28.63	1.12	2.74	2.99
33	HAU -22	11.70	35.26	24.74	0.91	3.50	3.18
34	Kashi Ganga	12.59	37.30	23.99	1.21	3.89	4.61
35	Punjab Komal	13.19	40.01	32.31	1.31	2.62	3.44
36	NDBG -17	12.80	36.56	30.86	1.12	3.24	3.60
37	NDBG -65-2-1	11.56	40.51	22.41	0.92	4.35	3.99
38	NDBG -83-1	9.94	42.45	25.92	1.12	3.68	4.06
39	FSC -5-1-1	10.15	40.07	25.48	1.02	3.26	3.27
40	NDBG -517	10.67	32.34	24.24	1.16	3.84	4.45
Tester							
41	Narendra Rashmi	12.22	34.65	27.72	1.30	2.61	3.40
42	Narendra Pooja	11.18	36.72	25.35	1.27	2.98	3.75
43	Narendra Jyoti	10.18	37.37	23.57	1.13	3.34	3.76
	Parental Mean	11.60	37.28	26.42	1.14	3.31	3.72
	Grand Mean	11.34	37.80	26.31	1.17	4.40	5.10
	C.V.	15.28	10.92	12.32	11.82	13.94	18.17
	S.E.m ±	0.71	1.68	1.32	0.06	0.25	0.38
	C.D. at 5%	1.97	4.70	3.69	0.16	0.70	1.06
Range	Lowest	9.58	32.13	21.93	0.81	2.61	2.99
	Highest	13.97	44.66	35.25	1.50	5.97	7.78

S. No.	Genotype	Total soluble solids (%)	Ascorbic acid(mg/100g fresh fruit)	Reducing sugars (%)	Non- reducing sugar (%)	Total sugars (%)	Dry matter (g/100g)
1	Kashi Kirti x N. Rashmi	2.35	8.85	1.76	0.82	2.58	6.12
2	Kashi Kirti x N. Pooja	2.67	8.41	2.04	0.54	2.57	6.35
3	Kashi Kirti x N. Jyoti	2.66	8.09	2.42	0.56	2.98	5.97
4	NDBG- 63-1-1 x N. Rashmi	2.53	8.31	2.17	0.88	3.06	4.98
5	NDBG- 63-1-1 x N. Pooja	2.81	8.93	2.19	0.98	3.17	5.21
6	NDBG- 63-1-1 x N. Jyoti	3.03	8.08	1.89	0.73	2.62	5.15
7	HAU -22 x N. Rashmi	3.20	8.05	1.36	0.65	2.01	4.61
8	HAU -22 x N. Pooja	3.09	8.90	2.05	0.91	2.96	6.76
9	HAU -22 x N. Jyoti	3.31	9.06	1.97	0.92	2.89	6.03
10	Kashi Ganga x N. Rashmi	2.92	9.18	1.95	0.87	2.83	6.31
11	Kashi Ganga x N. Pooja	2.17	9.47	2.32	0.81	3.13	7.45
12	Kashi Ganga x N. Jyoti	2.73	9.35	1.56	0.80	2.35	5.03
13	Punjab Komal x N. Rashmi	3.37	9.29	1.29	0.76	2.05	3.73
14	Punjab Komal x N. Pooja	2.99	8.82	1.89	0.70	2.73	4.07
15	Punjab Komal x N. Jyoti	2.90	9.35	2.07	0.75	2.82	5.52
16	NDBG – 17 x N. Rashmi	3.23	8.78	1.88	0.88	2.76	6.19
17	NDBG – 17 x N. Pooja	2.89	8.73	2.45	0.84	3.29	6.03
18	NDBG – 17 x N. Jyoti	2.54	9.36	1.92	0.77	2.69	5.62
19	NDBG – 65-2-1 x N. Rashmi	2.61	8.96	1.49	0.82	2.31	4.89
20	NDBG – 65-2-1 x N. Pooja	2.84	9.23	1.64	0.82	2.46	4.62
21	NDBG – 65-2-1 x N. Jyoti	2.85	9.04	1.66	0.85	2.51	5.07
22	NDBG – 83-1 x N. Rashmi	2.60	9.21	1.87	0.84	2.72	5.39
23	NDBG – 83-1 x N. Pooja	2.77	8.91	1.96	0.78	2.74	4.75
24	NDBG – 83-1 x N. Jyoti	2.73	8.65	1.97	0.81	2.78	5.88
25	FSC -5-1-1 x N. Rashmi	2.55	9.21	1.90	0.80	2.70	6.14
26	FSC -5-1-1 x N. Pooja	2.49	9.46	1.62	0.73	2.35	5.83
27	FSC -5-1-1 x N. Jyoti	2.54	9.14	1.58	0.77	2.35	6.54
28	NDBG -517 x N. Rashmi	2.57	9.31	1.64	0.84	2.48	5.94
29	NDBG -517 x N. Pooja	2.80	9.22	1.55	0.84	2.39	4.07
30	NDBG -517 x N. Jyoti	2.94	8.95	1.56	0.85	2.41	4.67
	F1 Hybrid Mean	2.79	8.94	1.85	0.80	2.65	5.50
Line							
31	Kashi Kirti	2.94	8.67	1.91	0.92	2.83	6.65
32	NDBG -63-1-1	2.70	7.82	2.05	0.90	2.95	6.74
33	HAU -22	2.29	8.46	2.40	0.79	3.19	5.20
34	Kashi Ganga	2.50	8.84	2.51	0.72	3.23	3.55
35	Punjab Komal	2.50	7.14	2.04	0.84	2.88	3.08
36	NDBG -17	2.32	8.04	1.90	0.92	2.82	5.16
37	NDBG -65-2-1	2.55	9.15	1.75	0.88	2.63	5.56
38	NDBG -83-1	2.60	8.85	1.92	0.80	2.72	4.53
39	FSC -5-1-1	2.40	9.22	1.89	0.71	2.60	5.94
40	NDBG -517	2.47	9.46	1.49	0.76	2.25	5.57
Tester							
41	Narendra Rashmi	2.53	9.51	1.61	0.86	2.47	4.38
42	Narendra Pooja	2.61	9.15	1.87	0.80	2.67	5.28
43	Narendra Jyoti	2.70	8.74	1.88	0.85	2.73	6.39
	Parental Mean	2.55	8.70	1.94	0.83	2.77	5.23
	Grand Mean	2.72	8.87	1.88	0.81	2.69	5.42
	C.V.	10.82	5.72	20.64	16.38	15.10	20.69
	S.E. m ±	0.12	0.21	0.16	0.05	0.17	0.46
	C.D. at 5%	0.33	0.58	0.44	0.15	0.46	1.28
Range	Lowest	2.17	7.14	1.29	0.54	2.01	3.08
	Highest	3.37	9.51	2.51	0.98	3.29	7.45

Conclusion

The main objective of this experiment was to evaluate the parents and their F_1 progenies based on *per se* performance for fruit yield per plant and other attributing traits which could be utilized in future breeding programs. Based on present study, it may be concluded that based on *per se* performance parents, Kashi Ganga, NDBG-517, NDBG-83-1, NDBG-65-2-1, Kashi Kirti were identified as superior parents while five crosses *viz.* Punjab Komal x Narendra Jyoti, HAU-22 x Narendra Jyoti, HAU-22 x Narendra Pooja, NDBG-17 x Narendra Rashmi and Punjab Komal x Narendra Rashmi were identified as superior crosses for fruit yield per plant as well as for earliness also. The best performing crosses may be utilized for multi-locational trials for selection and utilization as variety. Best performing parents may be used in future breeding programs for the improvement of fruit yield and its attributing traits.

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