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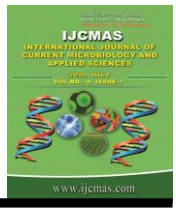

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# Evaluation of Parents and Hybrids for Yield and Marketable Quality Characters in Pumpkin (*Cucurbita moschata* L.)

**Devi Suresh[1]*, Randhir Kumar[1] and Anand Kumar[2]**

*[1]Department of Horticulture (Veg. & Flori.), [2]Department of Plant Breeding & Genetics, Bihar Agricultural University, Sabour, Bihar-813210, India*

**Corresponding author*

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**A B S T R A C T**

The experiment was conducted at Bihar Agricultural College, Sabour, India to study the performance of twenty one pumpkin hybrids along with seven diverse parents. The analysis of variance revealed the presence of significant differences among the parents, hybrids and parents v/s hybrids which suggested high variability among almost all the fourteen traits studied. Kashi Harit, Sabour Local and BRPK3/16 were most desirable parents for yield and its attributing traits and they could be utilized in future breeding programmes. The hybrids Kashi Harit x Sabour Local and BRPK2/16 x BRPK5/16 were identified as ideal cross combinations and can be assessed for yield stability over various locations and in different seasons.

## Introduction

Pumpkin (*Cucurbita moschata Duch. ex Poir*.) is a cucurbitaceous vegetable crop grown throughout the tropical and sub-tropical countries of the world, including India. The word pumpkin originates from the word Pepon which is in Greek for "large melon".

The crop is high valued due to its high productivity and nutritive value, good storability, long period of availability, better transport qualities and extensive cultivation both in tropical and subtropical parts of our country (Jahan *et al.*, 2012).

In India, the immature and mature fruits are extensively consumed as vegetable and the seeds are consumed as fried nuts/snack Yawalkar (1991). They are also used in the preparation of various Indian sweets like halwa. Tender tops of the shoots and leaves can also be cooked as vegetable. The flowers of pumpkin are more nutritive than fruits, sometimes used for 'Pakora' making.

Pumpkins are low in energy but have slightly sweet flavor and are moderately high in vitamin A (1600 IU). It has 4.65 per cent carbohydrate, 1.4 per cent protein, 0.1 per cent fat and 0.9 per cent fiber (Satkar *et al.*, 2013).

Pumpkin fruits rich in carotene and fiber promotes pro biotic bacteria which boost immunity and helps in regulating blood sugar level. The main nutrients are lutein and both alpha and β carotene, the latter of which generates Vitamin A in the body. It also has loads of cucurbitacin content that prevents arthritis and lower cholesterol. It is full of Omega-3 oil that improves heart health.

Pumpkin seeds are nutritional powerhouses wrapped up in a very small package with a variety of nutrients and appreciable quantities of minerals notably, magnesium, manganese, copper and zinc as well as good quantity of protein. They contain a wide array of beneficial plant compounds known as phytosterols and free-radical scavenging antioxidants, which can give our health an added boost. Pumpkin seeds may benefit our liver and help to fight diabetes and offer unique benefits for men's prostate health and women's relief of menopause symptoms as well.

China is the major producer of pumpkin in the world followed by India. In India, pumpkin occupies an area of 5.02 Lakh hectares and has production of 4.7 million ton Major producing states of India are Orissa,Uttar Pradesh and Bihar (NHB database, 2015-16). But in India the production of the crop is low and becomes static over the years.

So, researches should target at improving the yield and quality of the produce by development of superior varieties and hybrids keeping in mind the consumer preference. People prefer medium size fruits rather than cut pieces with increase in the concept of nuclear family in India. Further, the small fruits are easily packed and transported without any damage. Hence, development of pumpkin varieties and hybrids with small to medium sized fruits (2-3 kg) is essential. Even if attempts have been made to develop medium size high yield and better quality fruits by both public and private sector, it has not contributed to the requirement much.

Moreover, pumpkin has always remained as one of the least evaluated and exploited crop among the cucurbits until recent times. It is very helpful for a plant breeder in developing a commercial variety/hybrid with market preference by determining the component characters on which selection can be exercised based on the improvement in yield and quality. Collection and evaluation of germplasm is a pre-requisite in any improvement programme to select high yielding genotypes with desirable attributes *viz.*, earliness high yield and quality. Hence, in the present investigation, parents and hybrids were evaluated to identify the best performers based on yield and quality parameters.

## Materials and Methods

The present research work was at the Research farm area of the Department of Horticulture (Vegetable and Floriculture), Bihar Agricultural College, Bihar Agricultural University, Sabour, Bhagalpur. The experimental materials for the present study comprised of seven promising and diverse inbred lines/varieties of pumpkin selected on the basis of genetic variability from the germplasm stock maintained in the Department of Horticulture (Vegetable and Floriculture), Bihar Agricultural University, Sabour, Bhagalpur. The selected parental lines were BRPK-1/16, BRPK-2/16, BRPK-3/16, BRPK-4/16, BRPK-5/16, Kashi Harit,

and Sabour Local twenty one $F_1$ hybrids were obtained through half diallel mating among these selected parents. These plants were raised in randomized block design (RBD) with two replications and each replication consisted of seven plants following a spacing of 2.5 x $3m^2$. Recommended package of practices were followed to grow a successful crop of pumpkin.

Observations viz., node number at which first female flower appear, days to first female flower opening, fruit length (cm), fruit breadth(cm), fruit weight (kg), days to first fruit harvest, days to last fruit harvest, number of marketable fruits per plant, weight of marketable fruits per plant(kg), flesh thickness (cm) and 100 seed weight(g) of five plants of each treatment in each replication and means of these observations were subjected to statistical analysis.

The quality parameters *viz.*, TSS ($^o$Brix), ascorbic acid (mg/ 100 g) and carotinoids (mg/100g) were estimated on five fruits of each treatment per replication at harvestable maturity as per the procedure given by Hedge and Hofreiter (1962) and Roy (1973) respectively. Statistical analysis of data was carried out to estimate *per se* values as per the method suggested by Panse and Sukhatme (1978).

## Results and Discussion

The analysis of variance for yield, yield components and quality traits revealed the presence of significant differences among the parents, hybrids and parents v/s hybrids (Table 2) suggested that great variability exist in these sources of variations for almost all the fourteen traits *viz*., days to initiation of first female flower, node number at which first female flower appears, fruit length, fruit girth, average fruit weight, number of marketable fruits per plant, yield of marketable fruits per plant, days to first fruit harvest, days to last fruit harvest, flesh thickness, 100 seed weight, fruit flesh thickness, TSS content, ascorbic acid content and β carotene content. An efficient selection of parents is of prime importance for any successful breeding programme. The selection should be based on the genetic architecture that is evaluated based on *per se* performance and its ability to transmit its superior trait to offspring's.

Perusal of *per se* performance of the parental lines and $F_1$ hybrids (Table 2) for all the fourteen traits studied, revealed a wide range of mean values which indicated that the parental lines involved in this study were genetically diverse and had good breeding value, which confirmed the predictions of analysis of variance.

In the present study, parents BRPK5/16 (5.67), BRPK 2/16 (6.67) and BRPK3/16 (13.34) recorded the minimum number of nodes for first female flower appearance. Among the hybrids the cross BRPK5/16 x Sabour Local (7.50) had minimum node number to first female flower appearance followed by the cross BRPK3/16 x BRPK5/16 (9.84) and BRPK2/16 x BRPK5/16 (10.00) (Table 2). The parent BRPK5/16 showed earliest female flower initiation (29.84 days) among the parents which was followed by BRPK4/16 (31.34 days) and BRPK2/16 (34.00 days). Among the hybrids, BRPK2/16 x BRPK5/16 (31.34 days) ranked as the best hybrid in terms of minimum days taken for first female flower appearance which was followed by the cross BRPK1/16 x Sabour Local (32.67 days) and BRPK4/16 x Kashi Harit (33.37days) (Table 2).Thus BRPK5/16 and BRPK 2/16 (6.67) could be adjudged as the best parents for development of pumpkin hybrids with earliness. Similar results were also obtained by Akter *et al.*, (2011) in nine pumpkin genotypes.

In cucurbits, estimation of days to first fruit harvest and last fruit harvest are indicators for earliness. Among the seven parents, BRPK5/16 had taken minimum number of days for first fruit harvest (66.67 days) which was followed by BRPK4/16 (67.17 days) and BRPK3/16 (70.33 days).

Among the hybrids, BRPK1/16 x BRPK5/16 (68.67 days) had taken minimum days to first fruit harvest followed by BRPK2/16 x BRPK3/16 (69.67 days) and BRPK1/16 x Kashi Harit (69.83 days) while, the hybrid Kashi Harit x Sabour Local (76.65 days) had taken maximum number of days (Table 2).

Among the seven parents, Sabour Local had taken maximum number of days for last fruit harvest (125 days) which was followed by Kashi Harit (123.50 days) and BRPK3/16 (116 days) while the parent BRPK2/16 (103 days) had taken minimum days for this trait.

The hybrid Kashi Harit x Sabour Local (126.67 days) had taken maximum days to last fruit harvest followed BRP32/16 x BRP43/16 (125.50 days) and BRPK3/16 x Sabour Local (125 days) while, the hybrid BRPK3/16 x BRPK5/16 (102.5 days) had taken minimum number of days (Table 2).

Number of fruits produced by any kind of vegetable is a direct indicator of high yield. In this study, highest number of fruits per vine was observed in parent BRPK1/16 (2.34kg) followed by BRPK3/16 (2.17kg) and BRPK4/16 (2.00kg). Among the hybrids, the maximum number of fruits per vine were observed in BRPK3/16 x BRPK4/16 (2.34) which was followed by BRPK2/16 x BRPK5/16 (2.20) and BRPK4/16 x Kashi Harit (2.17).

The cross BRPK4/16 x Sabour Local (0.75) showed minimum number of fruits per vine (Table 2).Similar findings were reported by Maurya *et al.,* (2004) and Tamilselvi *et al.,* (2015) in bottlegourd gourd and pumpkin respectively. Fruit weight is another direct indicator of yield potential of pumpkin genotype. Among the parents, the highest fruit weight was recorded by in Sabour Local (6.90kg) followed by Kashi Harit (2.95kg) and BRPKK1/16 (2.80kg).

Among the twenty one hybrids, the highest fruit weight was exhibited by the cross Kashi Harit x Sabour Local (7.79 kg) followed by BRPK3/16 x Sabour Local (6.99 kg) and BRPK2/16 x Sabour Local (3.90kg). The lowest fruit weight was recorded in cross BRPK1/16 x BRPK5/16 (1.47 kg) (Table 2). Though the fruit number per vine is an important trait, in recent days, preference is more to small or medium sized fruits. In the present study Kashi Harit (2.95kg) and BRPKK1/16 (2.80kg) registered comparatively lesser fruit weight in favorable direction. Among the hybrids, the maximum number of fruits per vine were observed in BRPK3/16 x BRPK4/16 (2.34) which was followed by BRPK2/16 x BRPK5/16 (2.20) and BRPK4/16 x Kashi Harit (2.17). The cross BRPK4/16 x Sabour Local (0.75) showed minimum number of fruits per vine (Table 2). Similar results were reported by Jadhav *et al.,* (2009), Rani *et al.,* (2014) and Kumara *et al.,* (2017) in bitter gourd.

In pumpkin, to get higher fruit yield more flesh thickness is preferable as indirectly influencing trait. The parent BRPK3/16 (4.15cm cm) showed highest value for flesh thickness followed by BRPK2/16(3.30cm) and BRPK5/16 (3.25cm). Among the twenty one hybrids, the cross Kashi Harit x Sabour Local (4.45 cm) was ranked as the best one with maximum flesh thickness followed by BRPK2/16 x BRPK3/16 (4.35 cm) and BRPK3/16 x Kashi Harit (4.15 cm) while, the cross BRPK1/16 x Kashi Harit (2.85 cm) had minimum flesh thickness (Table 2).

Similar finding were made by Devi *et al.*, (1989) in pumpkin genotype CM23. For any hybrid seed production programme more seed number per fruit is desirable as it would reduce the cost of seed production.

Among the seven parents the maximum 100 seed weight was found in parent BRPK3/16 (14.12 g) which was followed by Kashi Harit (13.20 g) and Sabour Local (13.17 g) while, the parent BRPK2/16 (9.09 g) had minimum 100 seed weight.

Among the crosses, the cross BRP43/16 x Kashi Harit (15.08 g) showed the highest value of 100 seed weight followed by Kashi Harit x Sabour Local (13.96 g) and BRPK3/16 x BRPK5/16 (13.88 g) while, the cross BRPK1/16 x Kashi Harit (9.78 g) showed the lowest value for this trait (Table 2).

Among the parents BRPK3/16 showed lowest value fruit length (8.75cm) which was followed by BRPK1/16 and BRPK4/16 with length 10cm each while, the parent Sabour Local had shown maximum fruit length (15.00cm). BRPK1/16 x Kashi Harit showed largest fruit length (16.50cm) among the hybrids which was followed by Kashi Harit x Sabour Local and (15.5cm) and BRPK2/16 x Sabour Local (14.00cm) while, the hybrids BRPK5/16 x Sabour Local (7.75cm) had minimum length (Table 2).

Sabour Local showed highest value for fruit girth (70.50 cm) followed by Kashi Harit (64.00cm) and BRPK1/16 (194.55 cm) whereas, BRPK4/16 showed the lowest value (50.50 cm) of fruit girth (Table 2). Among the hybrids, Kashi Harit x Sabour Local showed highest value for fruit girth (96.50 cm) followed by BRPK 3/16 x Kashi Harit (70.00cm) and BRPK1/16 x Sabout Local (66.5 cm) whereas, the hybrids BRPK2/16 x BRPK4/16 (51.50 cm) showed the lowest value of fruit girth (Table 2). Pumpkin is rated as the second rich source of carotene content among the vegetables. The β carotene content in pumpkin fruit flesh of the parents varied from 1.92 to 3.67 mg per 100 g with the mean value of 2.90. Among the parents, BRPK4/16 (3.67mg/100g) showed highest value of β carotene content followed by Kashi Harit (3.51 mg) and BRPK1/16 (3.13 mg).

Among the cross combinations, the cross BRPK5/16 x Kashi Harit (3.58 mg) had maximum β carotene content followed by BRPK4/16 x Kashi Harit (3.15 mg) and BRPK1/16 x BRPK2/16 (3.04 mg) while, the cross BRPK2/16 x Sabour Local (1.05 mg) had minimum quantity of β carotene content (Table 2).

Kashi Harit (10.80 $_{o}$ Brix ) showed highest value of TSS followed by BRPK4/16 (10.20 $_{o}$ Brix) and Sabour Local (7.20 $_{o}$ Brix).Lowest TSS was found in BRPK3/16 (4.90 $_{o}$ Brix) (Table 4.2). BRPK1/16 x BRPK4/16 (10.10 $_{o}$ Brix ) showed highest value of TSS along with BRPK4/16 x Kashi Harit (10.10 $_{o}$ Brix) and BRPK2/16 x BRPK5/16 (8.35 $_{o}$ Brix).Lowest TSS was found in the hybrid BRPK5/16 x Sabour Local (4.25 $_{o}$ Brix) (Table 2).

In case of ascorbic acid BRPK2/16 (9.90mg/ 100 g) showed highest value followed by BRPK4/16 (9.11mg/100g) and BRPK5/16 (8.55mg/100g). Among twenty one hybrids, the hybrid BRPK2/16 x Kashi Harit (10.16mg/ 100 g) showed highest value of ascorbic acid content followed by BRPK3/16 x Kashi Harit (10.10mg/100g) and BRPK4/16 x Kashi Harit (9.77 mg/100g).

Lowest value of ascorbic acid was found in the hybrid BRPK1/16 x Sabour Local (7.41mg/100g) (Table 4.2). Similar findings have been obtained by Nisha (1999) and Tamilselvi *et al.,* (2015) for Kashi Harit.

**Table.1** Analysis of variance (Mean squares) in set of 7 x 7diallel cross for 14 characters in Pumpkin

| Source of variation | DF | Node At Which First Female Flower Appears | Days of Intiation of First Female Flower | Fruit Length(cm) | Fruit Girth(cm) | Average Fruit Weight(kg) | Days to First Fruit harvest |
|---|---|---|---|---|---|---|---|
| **Replicates** | 2.00 | 0.17 | 0.22 | 0.04 | 0.14 | 0.01 | 0.14 |
| **Treatments** | 27.00 | 59.26** | 20.07** | 11.97** | 243.02** | 8.06** | 18.01** |
| **Parents** | 6.00 | 125.77** | 25.99** | 12.75** | 159.68** | 9.61** | 32.87** |
| **Hybrids** | 20.00 | 42.26** | 16.17** | 11.69** | 273.09** | 7.98** | 13.69* |
| **Parent vs. Hybrids** | 1.00 | 0.29 | 62.44** | 12.89** | 141.75** | 0.35** | 15.38 |
| **Error** | 54.00 | 0.91 | 2.80 | 0.83 | 4.94 | 0.03 | 6.63 |
| **Total** | 83.00 | 19.87 | 8.35 | 4.43 | 82.27 | 2.64 | 10.18 |

*-Significant at 5 per cent probability level
** - Significant at 1 per cent probability level

**Table.1** (contd)

| Source of variation | DF | Days to Last Fruit harvest | Marketable Fruits Per Plant | Yield of Marketable Fruits Per Plant(kg) | Fruit Flesh Thickness (cm) | 100 Seed Weight (g) | TSS (°brix) | Ascorbic acid (mg/100g) | Beta carotene (mg/100g) |
|---|---|---|---|---|---|---|---|---|---|
| **Replicates** | 2.00 | 0.06 | 0.00 | 0.10 | 0.01 | 0.12 | 0.01 | 0.01 | 0.00 |
| **Treatments** | 27.00 | 176.94** | 0.71** | 21.22** | 0.80** | 6.29** | 10.70** | 1.74** | 1.73** |
| **Parents** | 6.00 | 231.48** | 0.90** | 16.20** | 1.07** | 10.16** | 17.29** | 1.51** | 1.31** |
| **Hybrids** | 20.00 | 169.24** | 0.68** | 23.71** | 0.67** | 5.45** | 8.59** | 1.87** | 1.41** |
| **Parent vs. Hybrids** | 1.00 | 3.55 | 0.25** | 1.61** | 1.71** | 0.06 | 13.36** | 0.40** | 10.76** |
| **Error** | 54.00 | 28.14 | 0.03 | 0.19 | 0.02 | 0.87 | 0.03 | 0.05 | 0.00 |
| **Total** | 83.00 | 75.87 | 0.25 | 7.03 | 0.27 | 2.61 | 3.50 | 0.60 | 0.54 |

*-Significant at 5 per cent probability level
** - Significant at 1 per cent probability level

**Table.2** Mean values for yield and yield attributing traits of parents and their $F_1$'s in Pumpkin

| Genotypes | Node At Which First Female Flower Appear | Days of Intiation of First Female Flower | Fruit Length (cm) | Fruit Girth (cm) | Average Fruit Weight (kg) | Days to First Fruit harvest | Days to Last Fruit harvest |
|---|---|---|---|---|---|---|---|
| **Parents** | | | | | | | |
| **BRPK 1/16** | 20.00 | 36.34 | 10.00 | 61.00 | 2.80 | 72.33 | 106.37 |
| **BRPK 2/16** | 6.67 | 34.00 | 11.75 | 59.50 | 2.67 | 71.15 | 103.00 |
| **BRPK 3/16** | 13.34 | 32.34 | 8.75 | 51.50 | 2.01 | 70.33 | 116.00 |
| **BRPK 4/16** | 19.67 | 31.34 | 10.00 | 50.50 | 1.85 | 67.17 | 109.67 |
| **BRPK 5/16** | 5.67 | 29.84 | 10.75 | 53.50 | 1.75 | 66.67 | 106.34 |
| **Kashi Harit** | 14.50 | 35.83 | 12.50 | 64.00 | 2.95 | 72.83 | 123.50 |
| **Sabour Local** | 21.84 | 38.00 | 15.00 | 70.50 | 6.90 | 76.17 | 125.00 |
| **F1 Hybrids** | | | | | | | |
| **BRPK 1/16*BRPK 2/16** | 21.50 | 35.50 | 10.25 | 53.00 | 1.54 | 71.83 | 117.50 |
| **BRPK 1/16*BRPK 3/16** | 18.17 | 39.00 | 11.00 | 61.00 | 1.95 | 74.17 | 106.50 |
| **BRPK 1/16*BRPK 4/16** | 16.00 | 36.67 | 12.00 | 55.50 | 1.77 | 72.84 | 112.50 |
| **BRPK 1/16*BRPK 5/16** | 18.00 | 34.83 | 11.50 | 63.50 | 1.47 | 68.67 | 106.33 |
| **BRPK 1/16*Kashi Hari** | 16.83 | 34.16 | 16.50 | 63.00 | 2.41 | 69.83 | 114.50 |
| **BRPK 1/16*BRPK 2/16** | 21.50 | 35.50 | 10.25 | 53.00 | 1.54 | 71.83 | 117.50 |
| **BRPK 1/16*Sabour Local** | 16.84 | 32.67 | 13.25 | 66.50 | 2.82 | 74.15 | 113.00 |
| **BRPK 2/16*BRPK 3/16** | 16.33 | 37.67 | 13.25 | 54.50 | 2.29 | 69.67 | 102.50 |
| **BRPK 2/16*BRPK 4/16** | 11.50 | 34.50 | 9.75 | 51.50 | 2.37 | 70.00 | 107.00 |
| **BRPK 2/16*BRPK 5/16** | 10.00 | 31.34 | 12.50 | 59.00 | 2.52 | 73.00 | 111.34 |
| **BRPK 2/16*Kashi Harit** | 12.50 | 36.84 | 13.75 | 63.50 | 2.02 | 71.17 | 116.12 |
| **BRPK 2/16*Sabour Local** | 13.34 | 37.17 | 14.00 | 64.50 | 3.90 | 71.00 | 107.50 |
| **BRPK 3/16*BRPK 4/16** | 16.50 | 34.50 | 11.75 | 55.00 | 2.84 | 70.67 | 125.50 |
| **BRPK 3/16*BRPK 5/16** | 9.84 | 35.83 | 11.50 | 53.00 | 2.20 | 71.17 | 102.50 |
| **BRPK 3/16*Kashi Harit** | 14.00 | 34.50 | 11.25 | 70.00 | 3.38 | 70.84 | 106.50 |
| **BRPK 3/16*Sabour Local** | 11.00 | 38.17 | 13.00 | 60.00 | 6.99 | 75.05 | 125.00 |
| **BRPK 4/16*BRPK 5/16** | 15.84 | 36.84 | 10.75 | 61.50 | 2.63 | 69.84 | 110.33 |
| **BRPK 4/16*Kashi Harit** | 12.34 | 33.34 | 10.25 | 62.50 | 2.02 | 71.17 | 124.50 |
| **BRPK 4/16*Sabour Local** | 11.67 | 33.83 | 13.00 | 65.50 | 2.93 | 70.65 | 119.50 |
| **BRPK 5/16*Kashi Harit** | 21.17 | 39.33 | 12.75 | 62.50 | 2.19 | 73.17 | 110.00 |
| **BRPK 5/16*Sabour Local** | 7.50 | 38.17 | 7.75 | 52.50 | 1.61 | 75.17 | 114.17 |
| **Kashi Harit*Sabour Local** | 11.34 | 40.00 | 15.50 | 96.50 | 7.79 | 76.65 | 126.67 |
| **Grand Mean** | **14.42** | **35.45** | **11.93** | **60.90** | **2.88** | **71.69** | **113.20** |
| **C.V. (%)** | 6.60 | 4.72 | 7.63 | 3.65 | 5.57 | 3.59 | 4.69 |
| **S.E. (±)** | 0.55 | 0.97 | 0.53 | 1.28 | 0.09 | 1.49 | 3.06 |
| **C.D. 5%** | 1.56 | 2.79 | 1.49 | 3.64 | 0.26 | 4.21 | 8.68 |
| **C.D. 1%** | 2.08 | 3.65 | 1.98 | 4.84 | 0.35 | 5.61 | 11.56 |

**Table.2** (contds)

| Genotypes | Marketable Fruits Per Plant | Yield of Marketable Fruits Per Plant(kg) | Fruit Flesh Thickness (cm) | 100 Seed Weight (g) | TSS (°brix) | Ascorbic acid (mg/100 g) | Beta carotene (mg/100g) |
|---|---|---|---|---|---|---|---|
| **Parents** | | | | | | | |
| **BRPK 1/16** | 2.34 | 6.50 | 3.10 | 10.27 | 6.90 | 8.13 | 3.13 |
| **BRPK 2/16** | 1.27 | 3.37 | 3.30 | 9.09 | 5.20 | 9.90 | 3.06 |
| **BRPK 3/16** | 2.17 | 4.35 | 4.15 | 14.12 | 4.90 | 8.09 | 1.92 |
| **BRPK 4/16** | 2.00 | 3.71 | 2.80 | 12.89 | 10.20 | 9.11 | 3.67 |
| **BRPK 5/16** | 1.67 | 2.93 | 3.25 | 13.10 | 5.40 | 8.55 | 2.12 |
| **Kashi Harit** | 0.84 | 2.47 | 2.29 | 13.20 | 10.80 | 8.43 | 3.51 |
| **Sabour Local** | 1.30 | 8.97 | 2.63 | 13.17 | 7.20 | 7.85 | 2.91 |
| **F1 Hybrids** | | | | | | | |
| **BRPK 1/16*BRPK 2/16** | 1.50 | 2.31 | 2.90 | 10.74 | 5.20 | 8.53 | 3.04 |
| **BRPK 1/16*BRPK 3/16** | 1.34 | 2.52 | 2.95 | 11.12 | 4.95 | 7.77 | 2.04 |
| **BRPK 1/16*BRPK 4/16** | 2.17 | 3.84 | 3.56 | 11.53 | 10.10 | 8.01 | 2.99 |
| **BRPK 1/16*BRPK 5/16** | 1.33 | 1.96 | 3.45 | 10.92 | 6.10 | 8.46 | 2.58 |
| **BRPK 1/16*Kashi Harit** | 1.34 | 3.16 | 2.85 | 9.78 | 6.10 | 8.56 | 2.13 |
| **BRPK 1/16*Sabour Local** | 1.00 | 2.82 | 3.10 | 12.02 | 5.45 | 7.41 | 2.02 |
| **BRPK 2/16*BRPK 3/16** | 1.17 | 2.67 | 4.35 | 12.20 | 6.25 | 8.83 | 1.61 |
| **BRPK 2/16*BRPK 4/16** | 1.50 | 3.54 | 2.70 | 10.91 | 8.35 | 9.26 | 1.13 |
| **BRPK 2/16*BRPK 5/16** | 2.17 | 5.47 | 3.75 | 11.07 | 8.10 | 8.40 | 2.32 |
| **BRPK 2/16*Kashi Harit** | 2.17 | 4.38 | 3.00 | 12.63 | 6.65 | 10.16 | 1.75 |
| **BRPK 2/16*Sabour Local** | 1.17 | 4.53 | 3.15 | 13.31 | 4.65 | 9.19 | 1.05 |
| **BRPK 3/16*BRPK 4/16** | 2.34 | 6.63 | 3.30 | 13.15 | 5.65 | 8.49 | 1.81 |
| **BRPK 3/16*BRPK 5/16** | 0.84 | 1.83 | 3.30 | 13.88 | 5.90 | 8.10 | 1.59 |
| **BRPK 3/16*Kashi Harit** | 1.34 | 4.50 | 4.15 | 11.91 | 4.80 | 10.10 | 2.12 |
| **BRPK 3/16*Sabour Local** | 1.50 | 10.51 | 3.25 | 13.86 | 4.30 | 8.10 | 1.27 |
| **BRPK 4/16*BRPK 5/16** | 1.84 | 4.81 | 3.60 | 13.17 | 6.35 | 9.12 | 2.34 |
| **BRPK 4/16*Kashi Harit** | 2.17 | 4.38 | 3.55 | 15.08 | 10.10 | 9.77 | 3.15 |
| **BRPK 4/16*Sabour Local** | 0.75 | 2.17 | 3.55 | 11.62 | 6.20 | 9.67 | 1.78 |
| **BRPK 5/16*Kashi Harit** | 1.00 | 2.19 | 3.10 | 11.01 | 5.25 | 7.71 | 3.58 |
| **BRPK 5/16*Sabour Local** | 1.83 | 2.93 | 3.45 | 12.38 | 4.25 | 8.30 | 1.83 |
| **KashiHarit*Sabour Local** | 1.67 | 13.01 | 4.45 | 13.96 | 7.75 | 9.48 | 1.42 |
| **Grand Mean** | **1.56** | **4.37** | **3.32** | **12.22** | **6.54** | **8.70** | **2.28** |
| **C.V.(%)** | 10.53 | 9.89 | 3.90 | 7.62 | 2.73 | 2.55 | 3.02 |
| **S.E. (±)** | 0.10 | 0.25 | 0.07 | 0.54 | 0.10 | 0.13 | 0.10 |
| **C.D. 5%** | 0.27 | 0.71 | 0.21 | 1.52 | 0.29 | 0.36 | 0.11 |
| **C.D. 1%** | 0.36 | 0.94 | 0.28 | 2.10 | 0.39 | 0.48 | 0.15 |

*-Significant at 5 per cent probability level
** - Significant at 1 per cent probability level

From the present investigation it is concluded that the mean sum of square due to parents and hybrids were significant for all the characters. The parent *vs* hybrids were significant for all the characters studied, except for node at which first female flower appeared, days to first fruit harvest, days to last fruit harvest and 100 seed weight which indicated the prevalence of heterosis for all the characters except node at which first female flower appeared, days to first fruit harvest, days to last fruit harvest and 100 seed weight.

It is also evident that from the study that among the seven parental lines, Sabour Local, BRPK3/16 and Kashi Harit were identified best for marketable fruit yield, its components and quality traits. The hybrids Kashi Harit x Sabour Local and BRPK2/16 x BRPK5/16 were identified as ideal cross combinations as they depicted higher *per se* performance for yield, yield contributing characters and quality parameters. Therefore, it has been suggested that hybrid breeding could be useful breeding approach for developing early and high yielding genotypes as they perform better than their parental genotypes.

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