# HETEROSIS AND INBREEDING DEPRESSION FOR FRUIT YIELD AND ITS COMPONENTS IN BRINJAL (*Solanum melongena* L.)

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**OILSEEDS RESEARCH SCHEME**
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## *ABSTRACT*

***Heterosis and inbreeding depression for fruit yield and its components in brinjal were studied in a set of 8 x 8 diallel cross (excluding reciprocal). Among the $F_1$s GBL 1 x BB 85, JBR 02-11 x K 331 and JBR 02- 11 x PB 69 and GBL 1 x DBL 02 had recorded significant standard heterosis for fruit yield and its important components. Therefore, for exploitation of such heterosis in future breeding programmes either recurrent selection or diallel selective mating system is to be examined in these crosses. Further, the cross which recorded high heterosis for fruit yield also recorded medium negative inbreeding depression in $F_2$ generation for fruit yield indicating importance of non-additive gene action.***

***KEY WORDS: Brinjal, Diallel, Heterobeltiosis, Inbreeding depression, Standard Heterosis***

## INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the major and principle vegetable crops widely grown in both temperate and tropical region of the globe. Brinjal has a huge genetic divergence in our country which offers much scope of improvement through heterosis breeding. The effort could enhance its quality and productivity without sacrificing the consumer's choice. The required goals of increasing productivity in the quickest possible time can be achieved only through heterosis breeding, which is feasible in this crop. The estimation of heterosis for fruit yield and its component characters would, therefore, be useful to judge the best hybrid combinations for exploitation of superior hybrids. Exploitation of hybrid vigour has become potential tool for improvement in egg plant. The present investigation was, therefore, under taken with an objective to study the magnitude of heterosis and inbreeding depression in different crosses and their utilization in future crop improvement programme. Moreover, the recent surge in widespread adaptation of hybrids by farmers also necessitates the development of new and higher yielding hybrids which are able for realize the degree of economic heterosis.

## MATERIALS AND METHODS

The experiment materials comprised of 28 $F_1$ and $F_2$ crosses, which were made using diallel mating design (excluding reciprocals) from eight parental genotype *viz.*, GBL 1, JBR 02-11, JBOB 03-04, Punjab Sadabahar, KS 331, PB 69, DBL 02 and BB 85. There were grown in randomized block design with three replication during *rab*i 2016 at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh. The $F_1$ hybrids were grown in plots consisting of single row of 4.8 m length having a spacing of 75 x 60 cm. The $F_2$ crosses had four rows, each of 4.8 m length. In parents and $F_1$ hybrids five plants per replication per genotype and in $F_2$ generation, 20 plants per replication per cross were sampled for recording observations.

Data were recorded on twelve characters *viz.*, days to first flowering, days to first picking, fruit length (cm), fruit girth (cm), single fruit weight (g), number of fruits per plant, plant height (cm), primary branches per plant, total phenol ( mg/ 100 mg), total sugar ( mg/ 100 mg), fruit borer infection (%) and fruit yield per plant (kg). Heterosis over better parent (BP) and standard parent (SP) (economic heterosis) in $F_1$ generation and inbreeding depression from $F_1$ to $F_2$ in each cross were estimated for twelve characters using standard formulae.

## RESULTS AND DISCUSSION

For days to first flowering most of the crosses exhibited significant negative heterosis coupled with negative inbreeding depression (Table 1). GBL 1 x Punjab Sadabahar and GBL 1 x BB 85 (-34.54 %) registered the highest negative heterosis over standard parent. JBOB 03-04 x Punjab Sadabahar (-15.09 %) and Punjab Sadabahar x K 331 (-13.21 %) showed high significant negative heterobeltiosis coupled with positive inbreeding depression indicating the expression non-additive geneaction in the expression of this character.

For days to first picking, one $F_1$ (GBL 1 x BB 85) registered significant negative heterobeltiosis (-12.33 %). Twenty six $F_1$s showed significant negative heterosis over standard parent. GBL 1 x Punjab Sadabahar and GBL 1 x BB 85 registered the highest significant negative standard heterosis (-35.35 %) coupled with positive inbreeding depression indicating the expression non-additive gene action in the inheritance of this character. Similar results were reported by Ansari *et al.* (2009), Das *et al*. (2009) and Biswas *et al*. (2013).

For fruit length and girth, six and twenty $F_1$s showed significant positive heterosis over best parent and standard parent. Majority of the crosses recorded positive inbreeding depression. Punjab Sadabahar x PB 69 exhibited the highest positive heterosis over best parent (33.24%) and GBL 1 x Punjab Sadabahar over standard parent (78.41 %) coupled with positive inbreeding depression indicating the importance of additive gene effects for inheritance of this character, while in case of fruit girth, the cross K 331 x PB 69 had the highest significant positive heterbeltiosis (133.88%) and economic heterosis (111.61%) coupled with negative inbreeding depression indicating the importance of non-additive gene action for expression this trait. These results are in agreement with those reported byAnsari *et al.* (2009), Das *et al*. (2009) and Biswas *et al*. (2013).

For single fruit weight as many as ten and twelve $F_1$s showed significant positive heterotic expression over better parent and standard parent, respectively. The crosses JBOB 03-04 x BB 85 (68.38%) and K 331 x BB 85 (64.62%) recorded the highest significant positive heterosis over better parent and standard parent coupled with positive inbreeding depression indicating the importance of additive gene effects for inheritance of single fruit weight. Similar result was reported by Biswas *et al*. (2013).

Out of twenty eight $F_1$s, six and two $F_1$s recorded significant positive heterbeltiosis and standard heterosis for number of fruits per plant. The GBL 1 x JBR 02-11 exhibited the highest significant positive heterobeltiosis (84.31%) and standard heterosis (27.03%) coupled with low positive inbreeding depression indicating the importance of additive gene action in expression this character. These findings are in agreement with results of Ansari *et al.* (2009) and Biswas *et al*. (2013).

Out of twenty eight $F_1$s, none of the cross showed significant positive heterobeltiosis for plant height. Only four crosses exhibited significant positive standard heterosis for this trait. GBL 1 x BB 85 (32.99%) registered the highest significant positive standard heterosis. The highest significant positive standard heterosis coupled with low negative inbreeding depression indicating the importance of non-additive gene action in expression this character. These results were confirmed with the finding of Das *et al*. (2009) and Biswas *et al*. (2013).

For number of primary branches, nine $F_1$s recorded significant positive heterosis over better parent and standard parent. Cross JBR 02-11 x DBL 02 expressed the highest significant positive heterobeltiosis (58.25%) and standard heterosis (58.38%) coupled with significant negative inbreeding depression indicating the importance of non-additive gene action in the expression of this character. These findings are similar with the results of Das *et al*. (2009) and Dubey *et al*. (2014).

For quality character total phenol, sixteen and eighteen $F_1$s expressed significant positive heterosis over better parent and standard parent. Cross K 331 x PB 69 recorded the highest significant positive heterosis over better parent (510.53%) and standard heterosis (205.26 %) with significant positive inbreeding depression indicating the importance of additive gene action in expression this character. For total sugar, eight and sixteen $F_1$s exhibited significant positive heterosis over better parent and standard parent, respectively. Cross Punjab Sadabahar x DBL 02 recorded the highest significant positive heterobeltiosis (103.64%) and GBL 1 x BB 85 had the highest standard heterosis (88.36 %) coupled with low positive inbreeding depression indicating the importance of additive gene action for total sugar. Chowdhury *et al*. (2010) and Sao and Mehta (2010) quoted similar results.

Three and four $F_1$s expressed significant negative heterosis over better parent and standard parent for fruit borer infestation. PB 69 x DBL 02 had exhibited significant negative heterobeltiosis (-27.96 %) and standard heterosis (-26.38 %) with positive inbreeding depression indicating the importance of non-additive gene action in expression of this character.

Out of twenty eight $F_1$s, six and eight $F_1$s showed significant positive heterosis for fruit yield per plant over better parent and standard parent, respectively. Cross GBL 1 x BB 85 (53.29 % and 73.26 %), JBR 02-11 x K 331 (53.33 % and47.59 %), JBR 02-11 x PB 69 (29.41 % and 41.18 %) and GBL 1 x DBL 02 (28.72 % and 37.33 %) registered the high significant positive heterobeltiosis and standard heterosis coupled with medium negative inbreeding depression indicating the importance of non-additive gene action in expression this character. These findings are in agreement with the results of Ansari *et al.* (2009) and Biswas *et al*. (2013).

## CONCLUSION

From the forgoing discussion, it canbe concluded that certain crosses recorded significant positive standard heterosis for fruit yield and its attributes *viz.*, GBL 1 x BB 85, JBR 02-11 x K 331 and JBR 02-11 x PB 69 and GBL 1 x DBL 02 had recorded the high positive heterosis. Therefore, for exploitation of heterosis in future breeding programmes either by recurrent selection or diallel selecting mating system is to be examined in these crosses. Further, the crosses which recorded high heterosis for fruit yield also recorded low inbreeding depression in $F_2$ generation indicating importance of non-additive gene action.

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**Table 1: Estimates of heterosis and inbreeding depression for fruit yield and yield traits in brinjal**

| Crosses | Days to First Flowering | | | Days to First Picking | | | Fruit Length (cm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) |
| | BP | SH | | BP | SH | | BP | SH | |
| GBL 1 x JBR 02-11 | -10.93 | -34.54** | 6.15 | -9.39 | -35.02** | -5.19 | 8.46 | 49.73** | 14.18** |
| GBL 1 x JBOB 03-04 | -5.82 | -28.51** | 1.69 | -5.02 | -29.97** | 6.25** | -5.13 | 30.97** | -8.11** |
| GBL 1 x Punjab Sadabahar | 1.89 | -34.94** | 2.46 | 1.59 | -35.35** | 2.08 | 29.23** | 78.41** | 3.75 |
| GBL 1 x K 331 | -6.88 | -29.32** | 1.14 | -5.94 | -30.64** | 0.98 | 2.31 | 41.24** | 5.04* |
| GBL 1 x PB 69 | 6.35 | -19.28** | 13.43** | 5.48 | -22.22** | 10.39 | -0.77 | 36.99** | 6.20* |
| GBL 1 x DBL 02 | 2.65 | -22.09** | -4.11 | 2.28 | -24.58** | -3.56 | -12.05 | 21.42 | -10.85** |
| GBL 1 x BB 85 | -14.29* | -34.94** | 2.46 | -12.33* | -35.35** | 10.94** | -8.97 | 25.66* | -5.41* |
| JBR 02-11 x JBOB 03-04 | 1.64 | -25.30** | -3.23 | 1.41 | -27.27** | -2.78 | -1.94 | 21.42 | 9.01** |
| JBR 02-11 x Punjab Sadabahar | 3.14 | -34.14** | -2.43 | 2.65 | -34.68** | -2.06 | 19.26* | 41.59** | 2.25 |
| JBR 02-11 x K 331 | -2.73 | -28.51** | -10.69** | -2.35 | -29.97** | -9.14 | 19.50* | 47.96** | -4.09 |
| JBR 02-11 x PB 69 | -3.28 | -28.92** | 0.56 | -2.82 | -30.30** | 0.48 | 9.22 | 32.04** | -7.80** |
| JBR 02-11 x DBL 02 | 7.10 | -21.29** | -14.30** | 6.10 | -23.91** | -12.40** | -1.28 | 14.69 | 5.83* |
| JBR 02-11 x BB 85 | -2.73 | -28.51** | -9.00** | -2.35 | -29.97** | -7.70** | 1.74 | 24.25* | -7.69** |
| JBOB 03-04 x Punjab Sadabahar | -15.09* | -26.51** | 2.74 | 12.70 | -28.28** | 2.35 | 1.39 | 29.20* | 11.01** |
| JBOB 03-04 x K 331 | 10.29 | -9.64 | 16.44** | 8.97 | -14.14 | 10.59** | 16.67 | 48.67** | 4.79* |
| JBOB 03-04 x PB 69 | 10.48 | -6.83 | -11.21** | 9.17 | -11.78 | -9.93** | 10.28 | 40.53** | -14.89** |
| JBOB 03-04 x DBL 02 | 4.90 | -14.06** | -0.94 | 4.27 | -17.85** | -0.82 | -16.39 | 6.55 | -10.37** |
| JBOB 03-04 x BB 85 | 9.23 | -14.46** | 3.76 | 8.00 | -18.18** | 3.30 | 11.39 | 41.95** | 4.04 |
| Punjab Sadabahar x K 331 | -13.21* | -27.71** | 3.88 | 11.11 | -29.29** | -3.33 | 26.36** | 56.46** | 3.39 |
| Punjab Sadabahar x PB 69 | 8.81 | -30.52** | 2.90 | 7.41 | -31.65** | 2.47 | 33.24** | 61.06** | 3.76 |
| Punjab Sadabahar x DBL 02 | 8.18 | -30.92** | 16.27** | 6.88 | -31.99** | 13.86** | 28.48** | 50.09** | -6.37** |
| Punjab Sadabahar x BB 85 | 10.69 | -29.32** | 9.10** | 8.99 | -30.64** | 7.78** | 17.97 | 44.07** | 6.19** |
| K 331 x PB 69 | -3.43 | -20.88** | -2.03 | -2.99 | -23.57** | -1.76 | 15.56 | 47.26** | -7.93** |
| K 331 x DBL 02 | 7.35 | -12.05** | 0.45 | 6.41 | -16.16** | 0.40 | -12.50 | 11.50 | -13.05** |
| K 331 x BB 85 | 7.69 | -15.66** | 1.43 | 6.67 | -19.19** | 1.25 | 15.83 | 47.61** | -3.60 |
| PB 69 x DBL 02 | -3.92 | -21.29** | -0.52 | -3.42 | -23.91** | -0.45 | 3.03 | 20.35 | -12.71** |
| PB 69 x BB 85 | -3.08 | -24.10** | 4.76 | -2.67 | -26.26** | 4.11 | -6.67 | 13.98 | 6.15* |
| DBL 02 x BB 85 | -11.79 | -30.92** | 11.62** | -10.22 | -31.99** | 9.89** | -1.45 | 20.35 | -8.83** |
| S.E. | 4.16 | 4.16 | 1.17 | 4.38 | 4.38 | 1.46 | 1.05 | 1.02 | 0.46 |

*Table 1: Contd…..*

| Crosses | Fruit Girth (cm) | | | Single Fruit Weight (g) | | | Number of Fruits per Plant | | |
|---|---|---|---|---|---|---|---|---|---|
| | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) |
| | BP | SH | | BP | SH | | BP | SH | |
| GBL 1 x JBR 02-11 | 5.10 | -5.88 | 3.33 | 20.50* | -14.87 | 1.64 | 84.31** | 27.03** | 4.25 |
| GBL 1 x JBOB 03-04 | 10.80 | -0.78 | -7.67 | -1.04 | 12.60 | -4.37** | -24.07 | -44.59** | -119.46** |
| GBL 1 x Punjab Sadabahar | 18.00 | 5.67 | -9.92 | 23.60** | 24.76** | -2.49** | 16.98 | -16.22 | -22.54** |
| GBL 1 x K 331 | -43.30** | -49.22** | 11.46 | 30.24** | -1.90 | 11.82** | 21.57 | -16.22 | 9.68** |
| GBL 1 x PB 69 | -1.22 | -10.63 | 6.21 | 54.52** | 27.44** | 1.89 | 13.73 | -21.62* | 10.35** |
| GBL 1 x DBL 02 | -6.40 | -16.18 | -16.88 | 26.67** | 17.99 | -5.13** | 30.91* | -2.70 | -13.88** |
| GBL 1 x BB 85 | 16.20 | 4.06 | -4.13 | 4.02 | 39.99** | -4.94** | 17.65 | -18.92* | -23.35** |
| JBR 02-11 x JBOB 03-04 | 24.00* | 11.04 | 7.98 | 11.10 | 34.43** | 2.14* | 11.11 | -18.92* | 16.65** |
| JBR 02-11 x Punjab Sadabahar | 15.70 | 3.61 | 7.52 | 38.21** | 10.40 | 2.56* | 3.40** | 2.70 | 23.69** |
| JBR 02-11 x K 331 | 5.40 | -5.61 | -20.49 | 4.59 | 17.90 | 2.70* | 74.51** | 20.27* | 11.26** |
| JBR 02-11 x PB 69 | 38.87** | 25.64** | -6.91 | 13.82 | 46.68** | -3.37** | 13.73 | -21.62* | -24.16** |
| JBR 02-11 x DBL 02 | -2.40 | -12.60 | -9.02 | -17.54 | 11.00 | -2.68* | 56.36** | 16.22 | 43.04** |
| JBR 02-11 x BB 85 | 29.70** | 16.15 | -15.96 | 6.09 | 20.79* | -7.09** | 45.10** | 0.00 | -16.21** |
| JBOB 03-04 x Punjab Sadabahar | 3.62 | -12.87 | 6.27 | 28.79** | -14.62 | 6.55** | 14.81 | -16.22 | 3.24 |
| JBOB 03-04 x K 331 | 16.67 | -5.97 | 2.86 | 17.79 | 5.18 | 6.10** | 18.52 | -13.51 | 12.47** |
| JBOB 03-04 x PB 69 | 17.19 | 6.03 | 0.51 | 68.38** | 32.79** | -2.73* | -14.81 | -37.84** | 8.68 |
| JBOB 03-04 x DBL 02 | 37.11** | 13.82 | 4.96 | -33.04** | 12.81 | -4.96** | -5.45 | -29.73** | -26.95** |
| JBOB 03-04 x BB 85 | 36.49** | 14.90 | 33.28** | 20.58* | 61.26** | 4.27** | -14.81 | -37.84** | -4.37 |
| Punjab Sadabahar x K 331 | 7.44 | -13.40 | -35.16** | -29.42** | -30.67** | -4.52** | -7.41 | -32.43** | -21.96** |
| Punjab Sadabahar x PB 69 | -5.67 | -14.66 | 14.69 | -18.33* | 24.85** | 2.28 | 0.00 | -27.03** | 0.00 |
| Punjab Sadabahar x DBL 02 | 131.28** | 92.00** | 6.25 | 43.39** | -26.92** | -8.40** | 5.45 | -21.62* | 10.35** |
| Punjab Sadabahar x BB 85 | 0.64 | -15.28 | 2.75 | 0.88 | -15.44 | 4.22* | 11.11 | -18.92* | -20.00** |
| K 331 x PB 69 | 133.88** | 111.61** | -1.69 | 67.37** | 47.84** | -2.94* | 8.33 | -29.73** | -11.54** |
| K 331 x DBL 02 | -7.44 | -23.16* | -96.50** | 4.17 | -0.78 | -5.69** | -27.27* | -45.95** | -5.03 |
| K 331 x BB 85 | 29.79* | 9.25 | -47.79** | 26.58** | 64.62** | 5.86** | -9.80 | -37.84** | -47.88** |
| PB 69 x DBL 02 | 12.90 | 1.10 | 39.15** | -27.31* | 7.85 | 2.88* | -30.91* | -48.65** | -68.35** |
| PB 69 x BB 85 | 23.60* | 10.69 | -4.37 | 20.50* | 31.06** | -3.91* | 1.96 | -29.73** | -46.16** |
| DBL 02 x BB 85 | -7.13 | -21.82 | -10.65 | -1.04 | -41.67** | -6.04** | -25.93* | -45.95** | -40.06** |
| S.E. | 1.07 | 1.07 | 0.86 | 3.54 | 3.52 | 0.37 | 2.32 | 2.32 | 0.73 |

*Table 1: Contd…..*

| Crosses | Plant Height (cm) | | | Number of Primary Branches / Plant | | | Total Phenol (mg/ 100 mg) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) |
| | BP | SH | | BP | SH | | BP | SH | |
| GBL 1 x JBR 02-11 | -23.94** | 0.58 | 3.04 | 33.25** | 33.36** | 0.00 | -42.86** | -12.20 | -5.56* |
| GBL 1 x JBOB 03-04 | -14.04* | 13.67 | -2.27 | -11.17 | -11.09 | 3.10 | -87.95** | -75.61** | -10.00** |
| GBL 1 x Punjab Sadabahar | -29.94** | -7.36 | 1.87 | -5.67 | -5.59 | 5.84 | -38.00** | 51.22** | 8.06* |
| GBL 1 x K 331 | -20.85** | 4.66 | -3.71* | -2.83 | -2.75 | -2.83 | 37.30** | 40.65** | 1.72 |
| GBL 1 x PB 69 | -16.68** | 10.18 | -3.02 | 19.42 | 19.52 | -4.60 | 222.81** | 49.59** | 3.28* |
| GBL 1 x DBL 02 | -13.10* | 14.91* | -2.13 | 8.25 | 8.34 | 0.00 | 24.29** | 112.20** | -2.30* |
| GBL 1 x BB 85 | 0.57 | 32.99** | -2.32 | 33.25** | 33.36** | 0.00 | 12.78* | 65.04** | -4.41* |
| JBR 02-11 x JBOB 03-04 | -13.88** | -14.60* | -4.51* | 16.58 | 16.68 | 14.16* | -48.19** | 4.88 | -6.98* |
| JBR 02-11 x Punjab Sadabahar | -12.17 | -12.89 | -4.99* | 33.33** | 33.44** | 6.19 | -53.33** | 13.82 | 4.26* |
| JBR 02-11 x K 331 | -2.94 | -3.75 | -4.17* | 49.92** | 50.04** | -9.17 | 95.24** | 100.00** | 3.66* |
| JBR 02-11 x PB 69 | -3.92 | -4.71 | -3.49 | 24.92** | 25.02* | 20.00** | 347.37** | 107.32** | 2.35* |
| JBR 02-11 x DBL 02 | 4.06 | 11.80 | -2.50 | 58.25** | 58.38** | -5.21 | -5.71 | 60.98** | 3.03 |
| JBR 02-11 x BB 85 | 7.31 | 24.17** | -2.50 | 33.33** | 33.44** | -12.57* | -50.00** | -26.83** | 3.33* |
| JBOB 03-04 x Punjab Sadabahar | -13.13** | -35.39** | -8.29** | -8.42 | -8.34 | 9.02 | -84.00** | -60.98** | 6.25* |
| JBOB 03-04 x K 331 | 3.37 | -14.95* | -4.94* | 24.92** | 25.02 | 0.00 | 159.52** | 165.85** | -2.75* |
| JBOB 03-04 x PB 69 | -1.78 | -26.94** | -7.08* | 0.00 | 0.08 | 8.50 | 184.21** | 31.71** | -5.56* |
| JBOB 03-04 x DBL 02 | -13.89 | -7.49 | -7.20** | 33.25** | 33.36** | 12.57* | -11.43* | 51.22** | -3.23* |
| JBOB 03-04 x BB 85 | -6.23 | 8.50 | -3.08 | -16.75 | -16.68 | 0.00 | 25.00** | 82.93** | 2.67* |
| Punjab Sadabahar x K 331 | -10.61 | -26.45** | -5.62* | -11.17 | -11.09 | -12.68 | 80.95** | 85.37** | -2.63* |
| Punjab Sadabahar x PB 69 | -6.84 | -30.71** | -5.75** | -13.92 | -13.84 | 0.00 | 189.47** | 34.15** | 1.82 |
| Punjab Sadabahar x DBL 02 | -12.22 | -5.69 | -5.15** | -16.68 | -16.68 | -30.03** | 47.14** | 151.22** | 0.97 |
| Punjab Sadabahar x BB 85 | -15.93** | -2.73 | -4.21* | -5.50 | -5.50 | -5.82 | 38.33** | 102.44** | 1.20 |
| K 331 x PB 69 | 4.30 | -13.80 | -5.47** | 8.25 | 8.34 | 0.00 | 510.53** | 205.26** | 3.45* |
| K 331 x DBL 02 | 1.58 | 9.14 | 4.09* | 13.83 | 13.93 | -2.42 | 137.14** | 18.57 | 2.41* |
| K 331 x BB 85 | -21.81** | -9.53 | -3.54 | 11.08 | 11.18 | -12.61 | 100.00** | -57.75** | 3.33* |
| PB 69 x DBL 02 | 0.88 | 8.38 | -3.71* | 13.83 | 13.93 | 4.84 | 265.71** | 82.86** | 2.34* |
| PB 69 x BB 85 | -16.57** | -3.47 | -13.58** | 8.25 | 8.34 | -7.62 | 86.67** | -6.67 | 3.57* |
| DBL 02 x BB 85 | 0.53 | 16.31* | 3.37 | 16.58 | 16.68 | -21.67** | -86.11** | -79.67** | -25.00** |
| S.E. | 4.29 | 4.29 | 0.46 | 0.45 | 0.45 | 0.51 | 0.03 | 0.03 | 0.08 |

*Table 1: Contd…..*

| Crosses | Total Sugar (mg/ 100 mg) | | | Fruit Borer Infestation (%) | | | Fruit Yield per Plant (kg) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) | Heterosis (%) | | IBD (%) |
| | BP | SH | | BP | SH | | BP | SH | |
| GBL 1 x JBR 02-11 | -60.64** | -23.94** | 0.00 | 11.11 | 8.19 | 1.12 | 19.70 | 27.38 | -19.65* |
| GBL 1 x JBOB 03-04 | -6.11 | 29.40** | -0.36 | 34.71** | 26.89 | 0.22 | 32.67 | 27.70 | 9.55 |
| GBL 1 x Punjab Sadabahar | -27.22** | 0.31 | 0.31 | 16.43 | -0.95 | 0.33 | 9.83 | 25.45 | 1.53 |
| GBL 1 x K 331 | -8.89 | 25.57** | 0.24 | -4.36 | -2.06 | 0.14 | 15.06 | 10.75 | -13.62 |
| GBL 1 x PB 69 | 11.37** | 53.50** | 0.50 | -1.12 | 1.26 | 2.34 | 5.88 | 15.51 | 15.28 |
| GBL 1 x DBL 02 | -28.89** | -1.99 | 0.47 | -16.58** | -14.74* | -2.78 | 28.72* | 37.33** | -7.48 |
| GBL 1 x BB 85 | 62.78** | 124.35** | 0.27 | 3.57 | -5.09 | -1.57 | 54.29** | 73.26** | -5.56 |
| JBR 02-11 x JBOB 03-04 | -11.15** | 76.88** | -0.26 | 16.03* | 9.29 | 2.21 | 30.00* | 25.13 | -2.31 |
| JBR 02-11 x Punjab Sadabahar | -55.13** | -10.67 | -6.52** | 18.29* | 0.64 | -8.51** | 17.98 | 34.76* | -3.57 |
| JBR 02-11 x K 331 | 2.31 | 103.68** | -0.30 | -5.05 | -7.18 | 2.41 | 53.33** | 47.59** | -10.65 |
| JBR 02-11 x PB 69 | -37.69** | 24.04** | 1.23* | -6.19 | -8.30 | 1.42 | 29.41* | 41.18** | -10.50 |
| JBR 02-11 x DBL 02 | -37.56** | 24.30** | -0.37 | -3.68 | -5.85 | -5.64** | -1.10 | 5.51 | -42.86** |
| JBR 02-11 x BB 85 | -68.69** | -37.67** | -0.74 | 33.03** | 21.91** | 32.46** | 9.95 | 23.48 | 19.48* |
| JBOB 03-04 x Punjab Sadabahar | -14.44** | 17.92** | -0.52 | 50.45** | 27.99** | -0.58 | -7.44 | 5.72 | -20.61* |
| JBOB 03-04 x K 331 | -16.56** | 15.01* | -0.53 | -9.77 | -16.00* | 7.04** | 12.33 | 8.13 | 3.56 |
| JBOB 03-04 x PB 69 | -37.22** | -13.48* | -0.53 | 12.62 | 4.84 | 1.33 | 5.88 | 15.51 | 13.61 |
| JBOB 03-04 x DBL 02 | -39.33** | -16.39** | -3.11** | -4.18 | -10.80 | -10.70** | 17.29 | 25.13 | 22.56* |
| JBOB 03-04 x BB 85 | -40.00** | -17.30** | 0.56 | 5.93 | -2.93 | 0.62 | 23.48 | 38.66** | 27.78** |
| Punjab Sadabahar x K 331 | -9.46 | 2.60 | 1.49 | 13.87 | -4.59 | 0.10 | 5.00 | 34.76** | 14.76 |
| Punjab Sadabahar x PB 69 | -33.33** | -20.88** | -0.19 | 13.80 | -4.65 | 1.42 | -8.75 | 17.11 | 17.81* |
| Punjab Sadabahar x DBL 02 | 103.64** | 88.36** | 0.24 | 0.22 | -16.03* | 0.39 | 6.25 | 36.36* | 3.76 |
| Punjab Sadabahar x BB 85 | 55.40** | 68.96** | 5.80 | 15.30** | -3.40 | 0.10 | -3.75 | 23.53 | -20.00* |
| K 331 x PB 69 | -33.55** | -21.13** | -0.78 | -15.92** | -6.07 | -4.01* | 4.41 | 13.90 | -1.41 |
| K 331 x DBL 02 | 26.43** | 35.53** | -0.23 | -10.37 | -8.39 | -3.91* | -15.04 | -9.36 | -36.75** |
| K 331 x BB 85 | 29.11** | 40.38** | -3.93** | 5.23 | -3.57 | 3.67* | 0.00 | 12.30 | 8.57 |
| PB 69 x DBL 02 | 23.54** | 51.35** | -0.20 | -27.96** | -26.38** | 2.47 | -23.76 | -18.66 | -33.46** |
| PB 69 x BB 85 | 2.50 | 25.57** | -0.37 | 11.80 | 2.45 | -0.95 | -18.00 | -7.91 | 24.04* |
| DBL 02 x BB 85 | 55.63** | 69.22** | -0.27 | 47.80** | 35.44** | 0.76 | 11.71 | 25.45 | 3.32 |
| S.E. | 0.37 | 0.37 | 0.32 | 1.30 | 1.30 | 0.50 | 0.48 | 0.48 | 0.45 |

***significant at 1% level, *significant at 5% level, BP= Better Parent Heterosis (Heterobeltiosis), SP= Standard Heterosis (Economic Heterosis)*

*[MS received : April 05, 2018]* *[MS accepted : April 11, 2018]*