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Shivam Kumar Singh
Research Scholar, Department of Horticulture, Post Graduate College, Ghazipur, Uttar Pradesh, India

Vashistha Yati
Associate Professor, Department of Horticulture, Post Graduate College, Ghazipur, Uttar Pradesh, India

Dhram Raj Singh
Associate Professor and Head, Department of Horticulture, Post Graduate College, Ghazipur, Uttar Pradesh, India

Vineet Singh
Senior Research Fallow, Central Institute of Subtropical Horticulture, Lucknow, Uttar Pradesh, India

Abhishek Kumar Singh
Senior Research Fallow, Department of Vegetable Science, Indian Agricultural Research Institute, New Delhi, India

Corresponding Author:
Shivam Kumar Singh
Research Scholar, Department of Horticulture, Post Graduate College, Ghazipur, Uttar Pradesh, India

Estimation of imbreeding depression for yield attributes and yield of okra (*Abelmoschus esculentus* (L.) Moench)

Shivam Kumar Singh, Vashistha Yati, Dhram Raj Singh, Vineet Singh and Abhishek Kumar Singh

Abstract
The experiment comprised the study of inbreeding depression for yield attributes and yield of okra. The experimental material consisting parents were comprised ten diverse genotypes of okra namely, Arka Abhay, Parbhani Kranti, VRO-3, Sel-4, Pusa-A4, Pusa Makhmali, SB -8, IC- 282272, IC-43733 and IC-43750 obtained by way of diallel mating system without reciprocals along with check Arka Anamika. Material was evaluated during summer season of 2019 in a randomized block design with randomization of generation replicated thrice. The characters studied were plant height (cm), number of branches per plant, node at which first flower appear, number of nodes on main stem, intermodal length (cm), days to first flower, days to 50 per cent flowering, fruit length (cm), fruit width (cm), fruit weight (g), number of ridges on fruit, number of fruits per plant, days to edible fruit maturity, fruit yield per plant (g), fruit yield per ha (q), number of seeds per fruit, seed yield per plant (g), crude fiber content (%) and iodine content (mg/ 100 g). Inbreeding depression showed significantly positive values for plant height, node at which first flower appears, number of nodes on main stem, intermodal length, days to 50 per cent flowering, fruit length, fruit weight, days to edible maturity, fruit yield per hectare, number of seeds per fruit, seed yield per plant, crude fiber content and iodine. However rest of the characters showed negative values of imbreeding depression.

Keywords: *Abelmoschus esculentus* (L.) Moench, Inbreeding depression, diallel analysis, fruit yield

Introduction
Okra (*Abelmoschus esculentus* L. Moench), is an economically important vegetable crop commonly known as lady's finger in India, is native to tropical Africa grown in tropical and sub-tropical parts of the world. One of the major problem in okra cultivation in India is lack of location specific high yielding varieties. In often cross-pollinated crops like okra, improvement in the past was based on selection in locally adapted populations. Inbreeding depression defines to decrease infitness and vigour due to inbreeding effect. It increases homozygosity in the genotype by continuous selfing. It results due to fixation of undesirable recessive genes in F_2. Application of biometrical techniques like diallel analysis has appeared to be the best and vastly useful breeding tool, which gives generalized picture of genetics of the characters under study. Understanding the nature of gene action could be helpful in predicting the effectiveness for selection in a population. Clear- cut knowledge of the type of gene action and magnitude and composition of genetic variance is of fundamental importance to a plant breeder. Furthermore, the imbreeding depression studies are useful for the evaluation of newly developed lines for their parental usefulness and to know the gene actions involved in the inheritance of various characters. Hence, the present investigation was undertaken to study the imbreeding depression for yield and its components in okra.

Material and Methods
The materials for the present investigation comprised ten diverse genotypes of okra namely, Arka Abhay, Parbhani Kranti, VRO-3, Sel-4, Pusa-A4, Pusa Makhmali, SB -8, IC- 282272, IC-43733 and IC-43750 obtained by way of diallel mating system without reciprocals. The parents and their F_1s along with standard check were evaluated during summer seasons of 2019, 2020 and rainy season of 2019. Ten parents and total of 45 genotypes were evaluated in a Randomized Block Design (RBD) with three replications at at the Research Farm, Department of Horticulture, Post Graduate College, Ghazipur, Uttar Pradesh.

All the recommended package of practices was adopted to raise a good crop. The observations were recorded for 19 quantitative traits *viz.*, plant height (cm), number of branches per plant, node at which first flower appear, number of nodes on main stem, intermodal length (cm), days to first flower, days to 50 per cent flowering, fruit length (cm), fruit width (cm), fruit weight (g), number of ridges on fruit, number of fruits per plant, days to edible fruit maturity, fruit yield per plant (g), fruit yield per ha (q), number of seeds per fruit, seed yield per plant (g), crude fiber content (%) and iodine content (mg/ 100 g).

Results and Discussions

Plant height (cm): Among 45 cross combinations all crosses had shown positive significant inbreeding depression (Table 1) ranging from 7.24 (Prabhani Kranti x Pusa-A4) to 15.16 (IC-282272 x SB-8) i.e., these crosses were in desired (positive) direction which exhibited higher mean values than their F_1's indicating the existence of transgreesive segregants for dwarfness in respective crosses. Similar reports have been also reported by Srivastava *et al.* (2008) [6]; Weerasekara *et al*. (2008) [8] and Parmar *et al.* (2012) [2].

Number of branches per plant

Only one cross out of 45 crosses, showed negative significant inbreeding depression (Table 1) ranging from -11.11 (Sel-4 x VRO-3) to -45.46 (IC-282272 x Prabhani Kranti). Therefore, this cross was in desired way with lower mean values than their F_1's indicating low inbreeding depression for number of branches in respectively crosses. Thirty nine crosses had shown positive significant inbreeding depression raging from VRO-3 x SB-8 and VRO-3 x SB-8 (10.00) and IC-282272 x Prabhani Kranti (45.46). Similar reports have been also reported by Wammanda *et al*. (2010) [7] and Parmar *et al.* (2012).

Node at which first flower appears

Among 45 cross combinations, forty three crosses in desired (positive) direction showed (Table 1) lower mean values than their F_1's indicating existence of transgressive segregants for earliness of first node bear the flower in respective crosses. These crosses ranged from 0.00 (IC-282272 x IC-43733) to Sel-4 x Prabhani Kranti (38.46). While, two cross combinations expressed negative significant inbreeding depression i.e., in undesired direction. The negative significant inbreeds VRO-3 x SB-8 (-10.00) and VRO-3 x SB-8 (-10.00). Similar reports have been also reported by Srivastava *et al.* (2008) [6] and Weerasekara *et al*. (2008) [8].

Number of nodes on main stem

Among all (45) crosses, all crosses were in desired (positive) direction which showed (Table 1) lower mean values than their F_1's, indicating the effect of superior gene for number of nodes on main stem in respective crosses. The positive significant inbreeding depression value ranged from 10.87 (IC-43733 x Prabhani Kranti) to 34.09 (IC-43733 x VRO-3). While, no negative significant cross was obtained from inbreeding depression. Similar reports have been also reported by Singh *et al.* (2012) [5]; Reddy *et al*. (2012) [3] and Parmar *et al.* (2012).

Internodal length (cm)

No any cross had shown negative significant inbreeding depression (Table 1). This cross exhibited higher mean value than their F_1's indicating the higher inbreeding depression for taller intermodal length (cm) in respective crosses. Therefore, this is an undesirable cross in respect of intermodal length. Whereas, all crosses exhibited positive significant inbreeding depression ranging from Arka Abhay x VRO-3 (10.79) to IC-43733 x Pusa Makhmali (22.45) i.e., these are in desired (positive) direction showed lower mean value than their F_1's indicating the low or nil inbreeding depression for short the intermodal length (cm) in respective crosses. Similar reports have been also reported by Srivastava *et al.* (2008) [6] and Weerasekara *et al*. (2008) [8].

Days to 50 per cent flowering

No negative significant crosses were obtained for inbreeding depression in case of days to 50 per cent flowering (Table 1). This is indicating that there is no existence of continuous segregation for lateness in the crosses. While, all crosses had shown positive significant inbreeding the effect of dominating genes from earliness of 50% flowering in respective crosses. Similar reports have been also reported by Reddy *et al*. (2012) [3] and Parmar *et al.* (2012) [2].

Fruit length (cm)

None of the crosses expressed negative significant inbreeding depression(Table 1). While, all crosses had shown positive significant inbreeding ranged from 6.59 (Prabhani Kranti x SB-8) to 17.15 (IC-282272 x Pusa Makhmali) the effect of dominating genes their F_1's indicating the existence of transgressive segregants for fruit length (cm) in respective crosses. Similar reports have been also reported by Srivastava *et al.* (2008) [6]; Weerasekara *et al*. (2008) [8] and Balakrishnan *et al.* (2009) [1].

Fruit width (cm)

Twenty-nine crosses had shown negative significant inbreeding depression (Table 1) ranging from -4.76 (IC-282272 x Pusa Makhmali) to -39.00 (VRO-3 x IC-43750 and VRO-3 x IC-43750), i.e., these crosses were in desired (negative) direction with lower mean values than their F_1's indicating the existence of low or nil inbreeding depression for fruit width (cm) in respective crosses. Whereas, nineteen crosses had shown positive significant inbreeding depression ranging from Prabhani Kranti x Pusa-A4 (9.84) to Prabhani Kranti x IC-43750 (27.50), i.e., these crosses are undesirable in respect of fruit width (cm) with higher mean values than their F_1's indicating the presence of medium or high inbreeding depression for fruit width (cm) in respective crosses. Similar reports have been also reported by Wammanda *et al*. (2010) [7]; Singh *et al.* (2012) [5]; Reddy *et al*. (2012) [3] and Parmar *et al.* (2012) [2].

Fruit weight (g)

Among 45 crosses, none of the cross had shown negative (desired) significant inbreeding depression(Table 1), i.e., these crosses had lower mean values than their F_1's indicating the presence of transgressive segregants from fruit weight (g). While, all crosses showed positive significant ranged from 7.31(IC-282272 x Pusa-A4) to 31.32 (Pusa Makhmali x Prabhani kranti) obtained for inbreeding depression for this trait. Similar reports have been also reported by Srivastava *et al.* (2008) [6] and Wammanda *et al*. (2010) [7].

Number of ridges on fruit

Twelve crosses shown negative (Table 2) significant

inbreeding depression ranged from -7.14 (IC-282272 x IC-43733, Pusa Makhmali x Prabhani kranti, Prabhani Kranti x IC-43750 and Prabhani Kranti x SB-8). This cross exhibited higher mean value than their F_1's indicating the higher inbreeding depression for number of ridge on fruit in respective crosses. Whereas, twenty two crosses exhibited positive significant inbreeding depression ranging from Arka Abhay x SB-8 (0.00) to Arka Abhay x IC-282272 and Prabhani Kranti x VRO-3 (12.50) i.e., these are in desired (positive) direction showed lower mean value than their F_1's indicating the low or nil inbreeding depression for short the number of ridge on fruit in respective crosses. Similar reports have been also reported by Singh *et al.* (2012) [5]; Reddy *et al.* (2012) [3] and Parmar *et al.* (2012) [2].

Number of fruits per plant

Only one cross had shown desired (negative) significant inbreeding depression(Table 2), with lower mean values than their F_1's indicating the existence of transgressive segregants for number of fruits per plant in respective cross. The inbreeding depression for this trait above said was Pusa-A4 x SB-8 (-4.54). While, nine crosses were in undesired (positive) direction showed higher mean values than their F_1's indicating the high inbreeding depression for number of fruits per plant in respective crosses. Similar reports have been also reported by Srivastava *et al.* (2008) [6]; Singh and Kumar (2010) [4] and Wammanda *et al*. (2010) [7].

Days to edible fruit maturity

No negative significant crosses were obtained for days to edible fruit maturity inbreeding depression (Table 2). Whereas, all crosses showed positive significant inbreeding depression ranging from VRO-3 x Pusa-A4 (6.47) to Arka Abhay x IC-282272 (11.76) for this trait. This is indicating that the presence of recessive gene for late maturing crop in respective crosses. Similar reports have been also reported by Wammanda *et al*. (2010) [7]; Singh *et al.* (2012) [5]; Reddy *et al*. (2012) [3] and Parmar *et al.* (2012) [2].

Fruit yield per plant (g)

Among all (45) cross combinations, the inbreeding depression (Table 2) had ranged between Prabhani Kranti x SB-8 (-39.00) to IC-43733 x Pusa Makhmali (61.33). Out of this eight crosses had shown negative (desired) inbreeding depression showing lower mean values than their F_1's indicating the existence of transgressive segregants for fruit yield per plant (g) in respective crosses. While thirty five crosses had shown positive (undesired) significant inbreeding depression for fruit yield per plant (g) in respective crosses. Similar reports have been also reported by Balakrishnan *et al.* (2009) [1]; Singh and Kumar (2010) [4] and Singh *et al.* (2012) [5].

Fruit yield per hectare (q)

From the perusal of data it is clear that the inbreeding depression (Table 2) ranging from Sel-4 x Prabhani Kranti (1.18) to Prabhani Kranti x SB-8 (5.87). None of the crosses had shown negative (desired) significant inbreeding depression showing lower mean values than their F_1's indicating the existence of transgressive segregants for fruit yield per hectare in respective crosses. While, all the crosses had shown positive (undesired) significant inbreeding depression for fruit yield per hectare (q) in respective crosses.

Number of seeds per fruit

The inbreeding depression for number of seeds per fruit (Table 2) had been ranged between IC-43733 x Prabhani Kranti (9.09) to Sel-4 x SB-8 (11.11). None of the crosses were in desired (negative) direction with higher mean value than their F_1's indicating the existence of dominating gene effects for the trait of number of seeds per fruit in respective crosses. Similar reports have been also reported by Singh and Kumar (2010) [4] and Reddy *et al*. (2012) [3].

Seed yield per plant (g)

Among all (45) cross combinations, the inbreeding depression (Table 2) had ranged between Pusa-A4 x SB-8 (1.44) to Sel-4 x SB-8 (23.53). None of these crosses had shown negative (desired) inbreeding depression showing lower mean values than their F_1's indicating the existence of transgressive segregants for seed yield per plant (g) in respective crosses. While all crosses had shown positive (undesired) significant inbreeding depression for seed yield per plant (g) in respective crosses. Similar reports have been also reported by Wammanda *et al*. (2010) [7] and Singh *et al.* (2012) [5].

Crude fiber content (%)

The inbreeding depression for crude fiber content (Table 2) had been ranged between Sel-4 x IC-43750 (7.43) to IC-282272 x IC-43750 (15.17). None of the crosses were in desired (negative) direction with higher mean value than their F_1's indicating the existence of dominating gene effects for the trait of crude fiber content in respective crosses. Similar reports have been also reported by Parmar *et al.* (2012) [2].

Iodine (mg/100 g)

The inbreeding depression for iodine (Table 2) ranged between Arka Abhay x Prabhani Kranti (12.00) and Pusa Makhmali x Pusa-A4 (3.33). None of the crosses had shown negative significant inbreeding depression i.e., in desired direction with higher mean values than their F_1's indicating lower inbreeding depression for iodine in respective crosses. Similar reports have been also reported by Srivastava *et al.* (2008) [6] and Wammanda *et al*. (2010) [7].

Table 1: Estimation of inbreeding depression of 45 F_2 hybrids of okra

Hybrid	PH (cm)	NBPP	NFF	NNMS	INL (cm)	DFF	DF 50%	Fruit length (cm)	Fruit width (cm)	Fruit weight (g)
Arka Abhay X IC-282272	13.23**	28.57**	20.00**	19.30**	13.56**	2.44*	12.66**	7.17**	10.34**	24.45**
Arka Abhay x IC-43733	14.00**	35.71**	9.09**	24.53**	15.79**	7.03**	9.74**	8.29**	15.67**	24.11**
Arka Abhay x Sel-4	12.38**	25.00**	28.57**	24.53**	14.76**	6.15**	9.62**	10.07**	-36.00**	8.35**
Arka Abhay x Pusa Makhmali	10.37**	30.00**	8.33**	25.93**	14.30**	6.62**	10.12**	8.33**	24.17**	11.39**
Arka Abhay x Prabhani Kranti	12.38**	0.00	23.08**	26.92**	17.04**	6.62**	10.06**	10.29**	14.60**	16.49**
Arka Abhay x VRO-3	11.62**	41.67**	18.18**	31.03**	10.79**	6.62**	9.20**	10.06**	20.17**	10.67**
Arka Abhay x IC-43750	11.93**	33.33**	16.67**	29.17**	14.54**	6.72**	12.05**	10.96**	-32.67**	18.01**
Arka Abhay x Pusa-A4	12.78**	33.33**	8.33**	23.64**	14.05**	6.47**	11.56**	7.72**	27.34**	11.57**
Arka Abhay x SB-8	14.13**	33.33**	25.00**	26.00**	13.71**	5.84**	9.70**	10.07**	-30.67**	12.43**

IC-282272 x IC-43733	10.23**	31.25**	0.00	20.34**	13.63**	6.25**	9.74**	10.28**	-38.67**	18.59**
IC-282272 x Sel-4	11.80**	33.33**	23.08**	29.17**	16.45**	6.67**	11.25**	12.32**	-26.67**	11.29**
IC-282272 x Pusa Makhmali	14.60**	22.22**	21.43**	26.67**	16.45**	6.43**	10.40**	17.15**	-4.76**	12.03**
IC-282272 x Prabhani Kranti	9.09**	45.46**	27.27**	30.43**	15.28**	6.15**	9.62**	10.07**	-25.33**	14.43**
IC-282272 x VRO-3	13.65**	16.67**	7.14**	25.45**	15.41**	6.87**	10.32**	8.51**	20.67**	21.08**
IC-282272 x IC-43750	13.66**	20.00**	27.27**	26.67**	16.95**	6.47**	9.64**	8.07**	-34.00**	12.24**
IC-282272 x Pusa-A4	10.60**	27.27**	25.00**	20.93**	15.45**	7.25**	9.70**	15.42**	-37.67**	7.31**
IC-282272 x SB-8	15.16**	18.18**	20.00**	26.67**	19.42**	6.57**	10.00**	11.62**	-24.67**	16.17**
IC-43733 x Sel-4	12.11**	27.27**	28.57**	17.24**	17.57**	6.62**	9.82**	8.71**	20.00**	12.64**
IC-43733 x Pusa Makhmali	14.47**	30.00**	16.67**	18.75**	22.45**	6.38**	8.75**	9.47**	20.34**	12.84**
IC-43733 x Prabhani Kranti	11.08**	11.11**	15.38**	10.87**	14.50**	6.72**	10.39**	7.04**	10.67**	21.50**
IC-43733 x VRO-3	10.54**	41.67**	9.09**	34.09**	17.57**	6.47**	8.38**	7.35**	15.84**	12.64**
IC-43733 x IC-43750	13.39**	30.00**	16.67**	26.92**	13.76**	6.34**	9.15**	9.04**	19.67**	16.96**
IC-43733 x Pusa-A4	11.65**	30.00**	9.09**	25.58**	18.05**	7.30**	8.81**	8.22**	26.17**	12.30**
IC-43733 x SB-8	9.46**	30.00**	9.09**	22.73**	19.95**	6.82**	10.19**	9.86**	-38.67**	12.05**
Sel-4 x Pusa Makhmali	12.98**	30.77**	33.33**	22.64**	13.76**	6.34**	8.88**	11.23**	-35.00**	14.21**
Sel-4 x Prabhani Kranti	11.33**	10.00**	38.46**	28.26**	20.43**	7.30**	9.32**	8.70**	-27.33**	12.45**
Sel-4 x VRO-3	13.18**	-11.11**	9.09**	15.69**	15.41**	6.92**	10.39**	9.86**	25.50**	24.41**
Sel-4 x IC-43750	11.36**	27.27**	0.00	30.00**	18.52**	7.30**	9.20**	10.32**	-19.67**	12.37**
Sel-4 x Pusa-A4	11.41**	20.00**	20.00**	21.43**	19.35**	5.11**	8.98**	8.44**	-26.67**	11.99**
Sel-4 x SB-8	11.11**	25.00**	9.09**	24.44**	17.84**	6.72**	9.43**	10.82**	-23.33**	19.45**
Pusa Makhmali x Prabhani Kranti	12.13**	0.00	11.11**	23.33**	13.76**	6.67**	8.86**	9.85**	-29.33**	31.32**
Pusa Makhmali x VRO-3	12.30**	41.67**	16.67**	30.95**	16.62**	7.48**	9.55**	11.43**	-23.67**	11.58**
Pusa Makhmali x IC-43750	10.67**	0.00	15.38**	20.00**	17.45**	6.12**	8.88**	10.82**	-19.67**	11.95**
Pusa Makhmali x Pusa-A4	9.74**	0.00	18.18**	25.00**	19.48**	6.21**	9.89**	8.21**	-25.33**	13.91**
Pusa Makhmali x SB-8	11.49**	30.00**	23.08**	23.53**	16.91**	6.34**	9.26**	9.37**	-30.67**	12.14**
Prabhani Kranti x VRO-3	10.68**	41.67**	21.43**	23.53**	15.45**	6.47**	8.12**	8.88**	-30.33**	9.81**
Prabhani Kranti x IC-43750	14.09**	36.37**	8.33**	28.89**	21.53**	6.12**	8.72**	8.63**	27.50**	16.49**
Prabhani Kranti x Pusa-A4	7.24*	16.67*	20.00**	20.00**	15.38**	6.08**	9.20**	8.78**	9.84**	23.89**
Prabhani Kranti x SB-8	11.60**	38.46**	30.77**	26.32**	17.88**	5.96**	9.60**	6.59**	14.67**	10.90**
VRO-3 x IC-43750	10.59**	0.00	26.67**	24.49**	17.68**	6.57**	10.37**	8.79**	-39.00**	12.46**
VRO-3 x Pusa-A4	10.74**	30.00**	27.27**	24.39**	14.96**	6.57**	6.96**	8.02**	-30.00**	12.14**
VRO-3 x SB-8	11.51**	10.00**	-10.00**	22.45**	16.63**	6.77**	8.97**	8.71**	16.00**	21.92**
VRO-3 x IC-43750	10.59**	0.00	26.67**	24.49**	17.68**	6.57**	10.37**	8.79**	-39.00**	12.46**
VRO-3 x Pusa-A4	10.74**	30.00**	27.27**	24.39**	14.96**	6.57**	6.96**	8.02**	-30.00**	12.14**
VRO-3 x SB-8	11.51**	10.00**	-10.00**	22.45**	16.63**	6.77**	8.97**	8.71**	16.00**	21.92**
IC-43750 x Pusa-A4	13.30**	38.46**	8.33**	22.50**	16.06**	6.16**	8.88**	10.07**	-31.67**	11.13**
IC-43750 x SB-8	13.03**	0.00	35.71**	18.18**	16.06**	6.29**	9.64**	10.07**	-26.33**	13.40**
Pusa-A4 x SB-8	12.89**	30.00**	30.77**	26.67**	17.45**	6.57**	8.54**	9.14**	-23.00**	12.37**
S.E.	2.44	0.47	0.41	1.11	0.21	0.77	0.81	0.31	0.06	0.70
C.D. 5%	6.80	1.32	1.13	3.09	0.58	2.14	2.25	0.86	0.16	1.96
C.D. 1%	8.96	1.74	1.49	4.07	0.76	2.82	2.97	1.14	0.21	2.59

PH= Plant height, NBPP= Number of branches per plant, NFF= Node at which 1st flower appears, NNMS= Number of nodes on main stem, INL= Internodal length, DFF= Days to first flowering, DF50%= Days to 50 per cent flowering

Table 2: Estimation of inbreeding depression of 45 F_2 hybrids of okra

Hybrid	NRF	NFPP	DEM	SYPP (g)	FYPP (Kg)	FYPH (q)	NSPF	CFC (%)	Iodine (mg/100 g)
Arka Abhay X IC-282272	12.50**	5.88**	11.76**	11.67*	31.67	3.00**	9.52**	8.06**	2.12
Arka Abhay x IC-43733	6.67**	4.92**	9.04**	10.10	41.00	3.12**	9.27**	7.81**	2.39
Arka Abhay x Sel-4	6.25**	11.86**	8.93**	18.59**	25.50	3.21**	10.22**	10.42**	2.28
Arka Abhay x Pusa Makhmali	6.67**	15.09**	9.44**	19.75**	32.50	3.34**	10.22**	9.50**	2.23
Arka Abhay x Prabhani Kranti	6.25**	14.29**	9.39**	19.83**	53.67	3.28**	9.72**	9.64**	2.00
Arka Abhay x VRO-3	6.25**	7.55**	8.57**	13.01*	27.51	3.41**	10.15**	10.97**	2.21
Arka Abhay x IC-43750	6.67**	9.30**	11.24**	16.22**	60.33	3.66**	9.79**	10.71**	2.19
Arka Abhay x Pusa-A4	6.67**	14.00**	10.81**	18.22**	38.50	3.37**	9.93**	9.69**	2.05
Arka Abhay x SB-8	0.00**	9.09**	9.04**	15.03*	-20.01	3.51**	9.66**	10.69**	2.36
IC-282272 x IC-43733	-7.14**	3.23	9.04**	9.42	36.67	3.88**	9.66**	12.19**	2.47
IC-282272 x Sel-4	7.69**	17.31**	10.47**	22.64**	57.33	3.81**	10.45**	13.00**	2.77
IC-282272 x Pusa Makhmali	-8.33**	6.25**	9.73**	12.53*	33.51	4.05**	10.37**	12.86**	2.90
IC-282272 x Prabhani Kranti	0.00	4.88**	8.93**	11.51	-18.00	3.82**	10.07**	11.54**	3.20
IC-282272 x VRO-3	0.00	5.17**	9.58**	11.58*	42.00	3.87**	9.79**	12.26**	2.92
IC-282272 x IC-43750	0.00	2.56	8.99**	10.86	-14.01	3.79**	9.93**	15.17**	2.81
IC-282272 x Pusa-A4	0.00	6.25**	9.04**	13.20*	35.01	4.13**	10.53**	13.70**	2.48
IC-282272 x SB-8	0.00	0.00	9.30**	8.67	-19.02	3.98**	10.53**	8.97**	2.89
IC-43733 x Sel-4	0.00	13.04**	9.14**	18.34**	40.50	4.29**	9.66**	11.52**	2.58
IC-43733 x Pusa Makhmali	0.00	17.02**	8.14**	21.58**	61.33	4.15**	9.72**	10.97**	3.00
IC-43733 x Prabhani Kranti	0.00	3.51	9.64**	9.40	42.33	4.05**	9.09**	10.30**	2.66

IC-43733 x VRO-3	0.00	8.70**	7.82**	14.57*	37.50	4.29**	9.27**	11.29**	2.94
IC-43733 x IC-43750	7.69**	8.89**	8.52**	15.17	39.00	4.03**	9.66**	11.25**	2.65
IC-43733 x Pusa-A4	-8.33**	15.56**	8.19**	20.49**	42.00	4.40**	9.46**	13.45**	2.70
IC-43733 x SB-8	7.69**	12.77*	9.47**	19.44**	40.00	4.43**	9.79**	11.00**	2.66
Sel-4 x Pusa Makhmali	0.00	4.08*	8.29**	11.50	30.51	4.48**	10.69**	8.57**	2.34
Sel-4 x Prabhani Kranti	6.25**	14.63**	8.67**	21.99**	-2.01	1.18**	10.77**	9.44**	2.42
Sel-4 x VRO-3	0.00	5.17*	9.64**	11.44	45.00	4.41**	9.86**	8.42**	2.60
Sel-4 x IC-43750	7.14**	2.22	8.57**	9.17	35.50	4.29**	10.77**	7.43**	2.89
Sel-4 x Pusa-A4	6.67**	2.50	8.38**	8.50	44.01	4.42**	10.22**	10.29**	2.16
Sel-4 x SB-8	-7.14**	16.67**	8.77**	23.53**	0.00	4.71**	11.11**	10.86**	2.74
Pusa Makhmali x Prabhani Kranti	-7.14**	8.00**	8.24**	13.13*	56.00	5.20**	9.72**	8.57**	2.46
Pusa Makhmali x VRO-3	6.67**	6.98**	8.95**	13.78*	39.00	5.29**	10.53**	11.82**	2.62
Pusa Makhmali x IC-43750	6.25**	15.22**	8.29**	22.28**	40.00	5.10**	10.15**	10.88**	2.69
Pusa Makhmali x Pusa-A4	-14.28**	9.76**	9.28**	17.05**	44.50	4.91**	10.37**	11.11**	3.33
Pusa Makhmali x SB-8	6.67**	12.77**	8.62**	19.31**	39.00	5.36**	10.29**	9.43**	2.95
Prabhani Kranti x VRO-3	12.50**	9.52**	7.56**	16.68**	-12.00	5.83**	10.85**	7.78**	2.60
Prabhani Kranti x IC-43750	-7.14**	13.33**	8.15**	21.04**	42.00	5.44**	10.77**	8.61**	2.69
Prabhani Kranti x Pusa-A4	6.67**	3.39	8.60**	9.87	42.67	4.35**	10.00**	11.00**	2.49
Prabhani Kranti x SB-8	-7.14**	2.04	8.99**	9.55	-39.00	5.87**	10.45**	12.00**	2.78
VRO-3 x IC-43750	7.69**	5.56**	9.66**	12.56*	0.00	4.19**	9.79**	10.83**	2.17
VRO-3 x Pusa-A4	-8.33**	4.26**	6.47**	9.95	-32.01	4.04**	9.79**	10.29**	2.06
VRO-3 x SB-8	7.69**	-1.82	8.33**	3.71	41.00	4.12**	9.46**	9.17**	2.45
IC-43750 x Pusa-A4	-8.33**	0.00	8.29**	8.12	49.00	3.67**	11.02**	11.18**	2.83
IC-43750 x SB-8	-7.69**	7.14**	8.99**	12.98**	48.67	3.68**	10.85**	10.00**	2.91
Pusa-A4 x SB-8	-8.33**	-4.54**	7.95**	1.44	32.50	4.30**	9.40**	10.83**	2.49
S.E.	0.27	1.44	0.81	4.15	44.39	0.18	1.51	0.27	1.22
C.D. 5%	0.75	4.03	2.26	11.58	123.72	0.50	4.22	0.76	3.40
C.D. 1%	0.99	5.31	2.97	15.27	163.10	0.66	5.56	1.00	4.48

NRF=Number of ridges on fruit, NFPP= Number of fruits per plant, DEM= Days to edible maturity, SYPP= Seed yield per plant, FYPP= Fruit yield per plant, NSPF= Number of seeds per fruit and CFC= Crude fiber content.

Conclusion

On the basis of this research it can be concluded that the inbreeding depression showed significantly positive values for plant height, node at which first flower appears, number of nodes on main stem, intermodal length, days to 50 per cent flowering, fruit length, fruit weight, days to edible maturity, fruit yield per hectare, number of seeds per fruit, seed yield per plant, crude fiber content and iodine.

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