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Heterosis Studies for Yield and Yield Attributing Characters in Brinjal (*Solanum melongena* L.)

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ABSTRACT

Genetical studies on fruit yield per plant and its attributing traits were conducted following line x tester mating design comprising of 5 lines and 4 testers at Regional Horticulture Research Station, Navsari Agricultural University, Navsari. There was high heterosis response in most of the hybrids which supports the role of non-additive gene effects. The maximum heterosis for fruit yield per plant was observed in the cross AB-8/5 x GJB-2 (103.59%) followed by AB 8/5 x GBL 1 (41.52%) and JBR 6/7 x GJB 2 (35.17%). The hybrid AB 8/5 x GJB 2 also exhibited highly significant heterosis (245.26%) for number of fruits per cluster while the hybrid JBR 6/7 x GJB 2 showed significant heterosis (17.53 %) for average fruit weight. Some of the promising hybrids showed desirable heterosis for earliness, number of flowers per cluster, phenol content.

Key words *Brinjal, Heterosis, Commercial check.*

Brinjal is an important vegetable crop grown in almost all parts of the country. Being a centre of origin, brinjal has a huge genetic divergence in our country which offers much scope for improvement through heterosis breeding. The effort could enhance its quality and productivity without sacrificing the consumers' 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 (Kakikazi, 1931). The estimation of heterosis for yield and its component characters would therefore, useful to judge the best hybrid combination for exploitation of superior hybrids.

Exploitation of hybrid vigor has become a potential tool for improvement in eggplant (Bavage, *et al.,* 2005; Prabhu, *et al.,* 2005 and Dharwad, *et al.,* 2011). Hence, the present study was under taken with an objective of studying the extent of heterosis in different crosses and their utilization in future crop improvement programmes.

MATERIALS AND METHODS

The investigation was laid out in randomized block design (RBD) with three replication during *rabi* 2012 at Vegetable Research Scheme, R.H.R.S., Navsari Agricultural University, Navsari during late *rabi* of 2012-13. The experimental material for the present investigation was crossed in L x T fashion using 5 females (AB-7/2, AB-8/5, AB-9/1, JBR-6/7 and JBR-8/7) and 4 males (JDNB-19, GOB-1, GBL-1 and GJB-2). These 20 F_1s, 9 parents and a commercial check variety (*Surti Ravaiya*). In each replication, parents and hybrids were planted in single row of 10 plants per entry. Row to row and plant to plant distance was 90 and 60 cm, respectively. The recommended agronomic practices and plant protection measures were adopted for raising a good crop. Five competitive plants were randomly selected from the middle of each row in each replication to record the observations on fourteen plant characters *viz.,* seedling height (cm), plant height (cm), number of branches per plant, days to 1st flowering, days to 50 per cent flowering, number of flowers per inflorescence, number of fruits per inflorescence, fruit length (cm), fruit diameter (cm), fruit length : fruit diameter, average fruit weight (g), number of fruits per plant, fruit yield per plant (kg) and phenol content (mg/100g fresh weight).

RESULTS AND DISCUSSION

The results indicated that the mean sum of squares due to parents were highly significant for most of the characters in both the parents (Table 1). The variance due to parents x hybrids interaction was significant for all the characters except plant height and fruit weight. Parent vs. hybrids showed highly significant differences for all the characters except fruit length : fruit diameter ratio and fruit weight, which indicates that heterosis was reflected in hybrids. The *per se* performance and magnitude of heterosis over standard check variety are depicted in Table 2.

For seedling height 7 crosses exhibited significant heterosis in desirable direction over standard check. The maximum standard heterosis recorded by crosses *viz.,* AB 6/7 x GBL 1 (20.69 %) and AB 7/2 x GBL 1 (17.97 %). The results are in agreement with Bulgundi (2000) and Shafeeq, 2005.

Out of 20 crosses, 14 showed significantly positive standard heterosis for plant height. This suggests the importance of dominant gene action. The cross AB 7/2 x JDNB 19 showed highest standard heterosis for this character. Similar findings have also been reported by earlier workers, Prabhu, *et al.,* 2005 and Suneetha, *et al.,* 2008.

Table 1. Analysis of variance for parents and hybrids in respect of different characters in brinjal

Source of variation	d.f.	Seed-ling height (cm)	Plant height (cm)	Num-ber of branc-hes per plant	Days to first flower-ing	Days to 50 per cent flowe-ring	Number of flowers per inflore-scence	Number of fruits per inflore-scence	Fruit length (cm)	Fruit dia-meter (cm)	Fruit length : Fruit dia-meter ratio	Average fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)
Replications	2	0.37	24.77	2.07	1.18	24.46	0.04	0.03	0.14	0.045	0.016	15.49	1.36	0.006
Parents	8	6.75**	331.77**	28.24**	52.09**	67.78**	3.07**	3.96**	40.58**	4.46**	10.24**	645.37**	302.20**	0.41**
Females	4	7.68**	559.18**	39.97**	70.56**	115.43**	2.87**	5.77**	68.26**	7.32**	18.16**	1045.33**	466.94**	0.41**
Males	3	2.79	136.10*	17.42**	36.08**	13.33	0.32**	0.29**	10.43**	1.42**	0.85**	297.33**	57.18**	0.22**
Females vs Males	1	14.91**	9.17	13.72*	26.22*	40.56*	12.15**	7.77**	20.32**	1.96**	6.73**	89.63	378.34**	0.98**
Hybrids	19	7.61**	276.47**	14.40**	25.44**	35.32**	2.89**	3.73**	15.10**	2.07**	1.69**	587.32**	678.56**	1.12**
Parents vs Hybrids	1	38.83**	697.38**	41.46**	45.81**	38.45*	12.93**	3.39**	52.07**	4.61**	0.29	142.91	77.35**	0.78**
Error	56	1.31	33.32	2.00	6.30	8.05	0.06	0.05	0.61	0.16	0.10	67.67	7.74	0.04

* Significant at 5 % level ** Significant at 1 % level

Of the 20 crosses, four showed significant and positive standard heterosis for the trait indicating predominance of non-additivity. The cross AB-8/5 x GJB-2 (23.74 %) showed highest standard heterosis for this character followed by JBR-6/7 x GJB-2 (13.37 %), AB-8/5 x GBL-1 and AB-8/5 x GOB-1 (12.55 %). These results are in conformation with the results of earlier workers *viz.,* Shafeeq, 2005 and Nalini Dharwad, *et al.,* 2011.

Early flowering is generally an indication of early yield (Yordanor, 1983) and also early hybrids fit well in multiple cropping systems (Kamalakannan, *et al.,* 2007). For these traits, negative heterosis is considered to be desirable. 20 and 18 crosses exhibited significant negative (desirable) heterosis over the standard check for days to first flowering and days to 50 per cent flowering, respectively. This indicates the predominant non-additive gene action. Maximum negative heterosis over the commercial check (-22.51 %) was exhibited by the cross AB 7/2 x GJB 2. The results are in conformation with those of earlier workers *viz.,* Chowdhuery, *et al.,* 2010, Nalini Dharwad, *et al.,* 2011 and Reddy, *et al.,* 2011.

More number of flowers per inflorescence among crosses was evident from the recorded positive significant heterosis in all crosses. The cross AB 8/5 x GJB 2 showed maximum positive and significant heterosis of 111.11 per cent over the standard check. The findings are on line with Bavage, 2002, Shafeeq, 2005, Nalini Dharwad, *et al.,* 2011 and Reddy, *et al*., 2011.

Of 20 crosses, seventeen exhibited positively significant heterosis over the standard check. The data suggests that dominant gene action had its influence on number of fruits per inflorescence. The cross AB 8/5 x GJB 2 showed maximum positive and significant heterosis of 287.50 per cent over the standard check. All heterotic crosses had both or either of the parent's superior over standard check. Similar findings have also been reported by Bulgundi, 2000, Bavage, 2002, Nalini Dharwad, *et al.,* 2011 and Reddy, *et al.,* 2011.

Fruit length and Fruit diameter are important parameter for deciding consumer preference. In south Gujarat region, high fruit length is not preferred. Therefore, the crosses showing negative heterosis are useful. For fruit length none of the crosses exhibited negative heterosis over the standard check. Majority of the crosses showed negative heterosis over standard check. These are in conformity with the studies of Shafeeq, 2005, Timmapur, *et al.,* 2008 and Chowdhury, *et al.,* 2010.

Fruit length : fruit diameter ratio defines the fruit shape. In the South Gujarat region, round to oval fruit shape is preferred. This suggests, negative heterosis for fruit length : diameter ratio is useful. None of the crosses over the standard check showed negative and significant heterosis. But some of the crosses showed best fruit shape (F.L:F.D) which suits for south Gujarat region. Similar reports have been made by Nalini Dharwad, *et al.,* 2011.

For average fruit weight only one cross JBR 6/7 x GJB 2 showed positive and significant heterosis of 17.53 per cent over the standard check. Out of 20 crosses, nine were exhibited standard heterosis in positive direction. Similar views are putforth by Bulgundi, 2000, Bavage, 2002, Suneetha, *et al.,* 2008, Timmapur, *et al.,* 2008 Chowdhuary, *et al.,* 2010.

Nearly 50 per cent of crosses were significant for number of fruits per plant in either of direction, thus showing role of non-additivity and wide range of heterosis. Out of 20 crosses, 8 exhibited positive and significant heterosis over the standard check. The cross AB 8/5 x

Table 2. Estimates of heterosis over standard check (*Surti Ravaiya*) for different characters in Brinjal

Crosses	Seed-ling height (cm)	Plant height (cm)	Num-ber of bran-ches per plant	Days to first flowe-ring	Days to 50 per cent flowering	Number of flowers per inflore-scence	Number of fruits per inflore-scence	Fruit length (cm)	Fruit dia-meter (cm)	Fruit length : Fruit dia-meter ratio	Average fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)
AB 7/2 x JDNB 19	12.52*	61.66**	-0.82	-23.33**	-15.71**	11.11	62.50**	69.57**	-18.64**	109.02**	-3.25	28.99**	22.76**
AB 7/2 x GOB 1	13.43*	47.17**	-8.46	-27.22**	-18.32**	22.22**	75.00**	61.25**	-28.90**	127.96**	-7.14	7.85	0.55
AB-7/2 x GBL-1	17.97**	42.18**	-4.91	-26.67**	-18.85**	14.81*	37.50**	84.33**	-30.45**	164.38**	-5.19	22.61*	10.90
AB 7/2 x GJB 2	10.25	44.62**	-8.87	-29.44**	-22.51**	27.78**	87.50**	69.97**	-30.78**	145.14**	-12.66	39.63**	13.10
AB 8/5 x JDNB 19	2.54	27.12**	-1.36	-17.22**	-12.57**	59.26**	112.50**	13.25*	-6.52	21.53	-14.29*	33.24**	11.59
AB 8/5 x GOB 1	0.09	24.10**	12.55*	-19.44**	-15.18**	72.22**	141.67**	15.08*	-13.94*	33.39	-23.38**	55.05**	7.17
AB 8/5 x GBL 1	6.62	12.99	12.55*	-17.22**	-10.99**	83.33**	187.50**	28.33**	-24.76**	70.57**	-26.62**	111.97**	41.52**
AB 8/5 x GJB 2	-1.09	26.55**	23.74**	-23.33**	-18.32**	111.11**	287.50**	19.41**	-15.49**	41.31*	-36.69**	245.26**	103.59**
AB 9/1 x JDNB 19	2.54	35.69**	2.59	-20.00**	-15.18**	20.37**	25.00*	13.90*	-3.61	17.97	0.65	9.31	6.34
AB 9/1 x GOB 1	-0.18	20.78**	-4.64	-21.11**	-13.61**	16.67**	4.17	19.21**	-5.20	25.71	5.84	10.90	13.52*
AB 9/1 x GBL 1	28.40**	12.62	-8.19	-18.89**	-14.66**	18.52**	54.17**	31.80**	-9.83	47.61*	-5.52	9.57	-0.83
AB 9/1 x GJB 2	-2.90	12.31	3.55	-18.33**	-7.85*	22.22**	50.00**	4.66	-6.98	12.37	6.49	-21.68*	-11.72
JBR 6/7 x JDNB 19	7.53	26.75**	-3.55	-17.78**	-8.38*	14.81*	37.50**	27.21**	6.52	19.78	4.87	9.04	18.34**
JBR 6/7 x GOB 1	-5.63	4.36	-4.64	-7.22*	2.09	11.11	0.00	17.44**	5.30	11.26	-0.32	-15.69	-12.69
JBR 6/7 x GBL 1	20.69**	19.12*	-0.41	-15.00**	-5.76	20.37**	37.50**	37.90**	-1.39	39.87*	11.69	-0.27	8.00
JBR 6/7 x GJB 2	10.69*	28.88**	13.37**	-23.89**	-13.61**	33.33**	62.50**	33.25**	13.17*	17.56	17.53*	20.21*	35.17**
JBR 8/7 x JDNB 19	15.61**	41.66**	8.46	-19.44**	-10.47**	18.52**	37.50**	25.97**	8.28	15.98	2.60	4.52	3.86
JBR 8/7 x GOB 1	5.72	34.03**	-2.18	-17.78**	-9.95**	16.67**	0.00	19.02**	0.99	17.92	10.39	8.38	22.48**
JBR 8/7 x GBL 1	5.72	9.04	-9.00	-17.78**	-10.99**	20.37**	25.00*	44.79**	-10.16	61.06**	2.92	-7.58	-8.14
JBR 8/7 x GJB 2	1.09	12.94	5.05	-20.56**	-12.57**	33.33**	41.67**	20.52**	-9.67	33.86	-11.04	17.29	-0.83

* Significant at 5 % level ** Significant at 1 % level

GJB 2 showed maximum positive heterosis of 245.26 per cent over the commercial check. Similar findings also reported by Prabhu, *et al.,* 2005 and Chowdhury, *et al.,* 2010.

Fruit yield of a crop cannot be taken as a single entry; since it is associated with many yield attributing characters. For fruit yield per plant 7 crosses exhibited significant and positive heterosis over the standard check for fruit yield per plant. The hybrids with high *per se* performance also registered high heterotic effect. The maximum heterosis for fruit yield per plant was exhibited by the cross AB 8/5 x GJB 2 (103.59 %) followed by AB 8/5 x GBL 1 (41.52 %), JBR 6/7 x GJB 2 (35.17 %) and AB 7/2 x JDNB 19 (22.76 %). These hybrids could be considered for exploitation of heterosis. The high heterosis response observed in most of the hybrids further supported the predominant role of non-additive component in the characters studied. These results are in conformation of the results of earlier workers *viz.,* Prabhu, *et al.,* 2005, Shafeeq, 2005, Suneetha, *et al.,* 2008, Nalini Dharwad, *et al.,* 2011 and Reddy, *et al.* 2011.

Phenol content is the one of the most important character to reduce the shoot and fruit borer incidence. If the phenol content is high borer infestation will be less. Among 20 crosses, fourteen exhibited significant positive heterosis over standard check. The results are agreement with Suneetha, *et al.,* 2008.

The high heterosis response observed in most of the hybrids further supported the predominant role of non-additive component in the characters studied.

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