HETEROSIS FOR FRUIT YIELD AND ITS COMPONENT TRAITS IN BRINJAL *(Solanum melongena* L.)

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ABSTRACT

A study was conducted to estimate the magnitude of heterosis for fruit yield and its components in brinjal. Twenty eight F_1 hybrids (generated by line x tester mating design using diverse seven lines and four testers) along with 11 parents and one check were evaluated in a randomized block design with three replication at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat (India). Appreciable heterosis was found over better and standard parent for all the traits studied in desirable direction. In order of merit, the highest heteroeltiosis was recorded by cross NSR 1 x Pant Rituraj (155.70 %) followed by JB 12-06 x Pant Rituraj (107.67 %) and JB 12-06 x GOB 1 (79.44%), while cross JBG 10-208 x GJB 2 ranked first by recording the highest standard heterosis (22.98 %) for fruit yield per plant followed by NSR 1 x Pant Rituraj (20.70 %) and NSR 1 x GBL 1 (16.63 %). The cross JBG 10-208 x GJB 2 also recorded significant standard heterosis for fruit length, fruit girth, fruit weight and total soluble solids. The present study revealed good scope for isolation of pure lines from the progenies of heterotic F_1s as well as commercial exploitation of heterosis breeding in brinjal.

KEY WORDS: Brinjal, fruit yield, heterobeltiosis, standard heterosis, total soluble solids

INTRODUCTION

Brinjal (*Solanum melongena* L) also known as eggplant is one of the important vegetable crops of India and is grown throughout the year. However, it is widely cultivated in both temperate and tropical regions of the globe mainly for its immature fruits as vegetables (Rai *et al.*, 1995), but in the temperate regions, it is cultivated mainly during warm season. India is regarded as the primary centre of origin/diversity of brinjal (Vavilov, 1931; Bhaduri, 1951; Genabus, 1963).

Recently, the exploitation of hybrid vigour in vegetable crops considered to be one of the outstanding achievements in vegetable breeding. To know the potentiality of hybrid in particular crop, the magnitude and direction of heterosis is of paramount important. Heterosis response largely depends upon genetic divergence among the parents involved in particular study. In India, wide genetic variability was reported by several workers in vegetables. Very meager work has been done especially in

Saurashtra region of Gujarat on brinjal, which is one of major vegetable crop of Gujarat state.For the first time, Bailey and Munson (1891) reported artificial hybridization in brinjal. However, none of the hybrids exhibited any heterosis. Nagai and Kida (1926) were probably the first to observe hybrid vigour in a cross combination of some Japanese varieties of brinjal. To obtain high yield per unit area, exploitation of hybrid vigour is one of the good way and particularly in crop like brinjal, where more seeds per fruit are obtained. Therefore, in the present study, an attempt has been made to gather information on the extent of heterosis in L x T crosses to produce promising hybrids/pure lines in brinjal.

MATERIALS AND METHODS

Seven diverse brinjal pure lines *viz.*, JBL 08-08, AB 09-1, JBG 10-208, JBL 10-04, NSR 1, JB 12-06 and ABR 2-23 and four testers *viz.*, GOB 1, GJB 2, GBL 1 and Pant Rituraj were chosen on the basis of their phenotypic performance and their diverse variation in fruit yield and its contributing traits, and were crossed in a line x tester mating design. The parents along with their F_1s and one check, (GBH 2) were grown in a randomized block design with three replications during *Kharif* 2014 at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh. The spacing 75 x 60 cm was adopted in rows of 6.00 m length. Recommended cultural practices and plant protection measures were followed to raise good crop. The observations were recorded on five randomly selected plants from each replications *viz*., days to 50 per cent flowering, days to first picking, fruit length (cm), fruit girth (cm), fruit weight (g), number of fruits per plant, number of primary branches per plant, plant height (cm), plant spread (cm), Total Soluble Solids and fruit yield per plant (kg). Line x tester analysis was carried out by the method suggested by Kempthorne (1957). Heterosis was worked out over better parent and standard check as per standard procedure.

RESULTS AND DISCUSSION

The analysis of variance showed highly significant differences among the genotypes for all the traits suggesting the presence of wide genetic variability in the material used. The differences among parents and hybrids were also found highly significant for all characters suggesting that parents as well as hybrids differed themselves for all the characters. The mean square due to parents *vs* hybrids contrast was also found highly significant for all the traits except fruit girth and fruit length indicating presence of mean heterosis for these characters (Table 1).

Wide range of variability exists among parents and their F_1 hybrids for different traits under study. Out of the 28 hybrids, the significant desirable heterotic effects over their respective better and standard parent were noticed in 24 and 4 crosses for days to 50 per cent flowering; 23 and 9 crosses for days to first picking; 2 and 19 crosses for fruit length; 4 and 6 crosses for fruit girth; 8 and 8 crosses for fruit weight; 9 and 7 crosses for number of fruits per plant; 5 and 3 for number of primary branches per plant; 9 and 1 crosses for plant height; 18 and 6 for plant spread; 9 and 24 for total soluble solids and 17 and 4 crosses, respectively for fruit yield per plant (Table 2). The heterobeltiosis and standard heterosis ranged from -25.53 to 155.70 per cent and -21.94 to 22.98 per cent for fruit yield per plant, respectively.

Top three hybrids for different traits with respect to heterosis over

better parent and standard check (GBH 2) are presented in Table 3. The highest heteroeltiosis was recorded by cross NSR 1 x Pant Rituraj (155.70 %) followed by JB 12-06 x Pant Rituraj (107.67 %) and JB 12-06 x GOB 1 (79.44%), while cross JBG 10-208 x GJB 2 ranked first by recording the highest standard heterosis (22.98 %) for fruit yield per plant followed by NSR 1 x Pant Rituraj (20.70 %) and NSR 1 x GBL 1 (16.63 %). The cross JBG 10-208 x GJB 2 also recorded significant standard heterosis for fruit length, fruit girth, fruit weight and total soluble solids. These results showed that the heterosis for fruit yield per plant was associated with heterosis for its component characters. The heterotic response over better parent and standard check in brinjal was also reported by Ashwini and Khandelwal (2003), Prabhu *et al.* (2005), Kamal *et al*. (2006), Vaddoria *et al.* (2007), Sao and Mehta (2010) and Reddy and Patel (2014).

The hybrids exhibited desirable heterobeltiosis and economic heterosis for fruit yield per plant and other characters could be further evaluated to exploit the heterosis or utilized in future breeding programme to obtain desirable segregants for the development of superior genotypes.

CONCLUSION

On the basis of above results and discussion, it can be concluded that highest heteroeltiosis was recorded by cross NSR 1 x Pant Rituraj followed by JB 12-06 x Pant Rituraj and JB 12-06 x GOB 1, while cross JBG 10-208 x GJB 2 ranked first by recording the highest standard heterosis (22.98 %) for fruit yield per plant followed by NSR 1 x Pant Rituraj (20.70 %) and NSR 1 x GBL 1 (16.63 %). The study revealed good scope for isolation of pure lines from the progenies of heterotic F_1s as well as commercial exploitation of heterosis breeding in brinjal.

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Table 1: Analysis of variance (mean squares) for experiment design for different characters in brinjal

Source	df	Days to 50 Per Cent Flowering	Days to First Picking	Fruit Length (cm)	Fruit Girth (cm)	Fruit Weight (g)	Number of Fruits Per Plant
Replications	2	15.95*	10.48	0.61	0.02	23.24	2.22
Genotypes	38	65.85**	72.20**	6.36**	1.87**	1364.48**	82.71**
Parents	10	82.49**	115.55**	12.77**	2.44**	1940.21**	153.27**
Hybrids	27	27.52**	25.60**	4.20**	1.72**	1191.72**	39.54**
P. vs H	1	934.47**	896.85**	0.49	0.32	271.58*	542.44**
Error	76	4.08	3.79	0.41	0.13	40.10	4.93

Source	df	Number of Primary Branches Per Plant	Plant Height (cm)	Plant Spread (cm)	Total Soluble Solids (°B)	Fruit Yield Per Plant (kg)
Replications	2	0.03	38.73*	3.98	0.004	0.004
Genotypes	38	1.52**	226.96**	412.86**	0.885**	0.491**
Parents	10	1.15**	215.31**	206.05**	0.692**	0.539**
Hybrids	27	1.66**	188.56**	252.81**	0.969**	0.201**
P. Vs H	1	1.45**	1380.17**	6802.11**	0.537**	7.856**
Error	76	0.16	11.75	27.95	0.050	0.023

***,** Significant at 5 % and 1 % levels of significance, respectively*

Table 2: Magnitude of heterobeltiosis (H_1) and standard heterosis (H_2) for various characters in brinjal

Sr. No.	Characters	Desirable Aspect	Number of Crosses with Significant Heterosis					
			Heterobeltiosis H_1 (%)	Standard Heterosis H_2 (%)	H_1		H_2	
					+Ve	-Ve	+Ve	-Ve
1	**Days to 50 Per Cent Flowering**	Early	-2.91 to -27.98	-11.49 to 12.84	0	24	4	4
2	**Days to First Picking**	Early	-0.99 to 25.86	-11.17 to 6.38	0	23	1	9
3	**Fruit Length (cm)**	High	-29.22 to 16.40	-7.43 to 48.00	2	20	19	0
4	**Fruit Girth(cm)**	High	-35.96 to 23.66	-28.88 to 22.34	4	10	6	6
5	**Fruit Weight (g)**	High	-45.54 to 33.34	-27.54 to 32.54	8	11	8	15
6	**Number of Fruits Per Plant**	More	-43.46 to 173.44	-20.57 to 41.84	9	8	7	2
7	**Number of Primary Branches Per Plant**	More	-33.50 to 66.28	-36.00 to 38.50	5	8	3	13
8	**Plant Height (cm)**	High	-17.94 to 34.82	-44.65 to 10.73	9	1	1	19
9	**Plant Spread (cm)**	High	-4.81 to 69.73	-19.58 to 25.92	18	0	6	3
10	**Total Soluble Solids (°B)**	High	-20.49 to 21.79	3.87 to 40.65	9	11	24	0
11	**Fruit Yield Per Plant (kg)**	High	-25.53 to 155.70	-21.94 to 22.98	17	3	4	7

Table 3: Top three hybrids selected separately on the basis of heterosis over better parent and standard hybrid GBH-2.

Characters	Rank	Most Heterotic Crosses Over			
		Better Parent	Value	Standard Parent	Value
Days to 50 Per Cent Flowering	**I**	JBL10-04 x Pant Rituraj	-27.98**	AB 09-1 x GBL 1	-11.49**
	II	JBL10-04 x GJB 2	-26.92**	JB 12-06 x GJB 2	-8.11*
	III	JBG 10-208 x GOB 1	-24.86**	ABR 2-23 x GOB 1	-8.11*
Days to First Picking	**I**	JBL10-04 x GJB 2	-25.86**	AB 09-1 x GBL 1	-11.17**
	II	JBL10-04 x Pant Rituraj	-21.98**	JBL 10-04 x GJB 2	-8.59**
	III	ABR 2-23 x GOB 1	-20.74**	NSR 1 x GJB 2	-8.55**
Fruit Length (cm)	**I**	NSR 1 x Pant Rituraj	16.40*	JBL08-8 x GJB 2	48.00**
	II	AB 09-1 x GOB 1	12.92*	AB 09-1 x GBL 1	42.11**
	III	JBG 10-208 x Pant Rituraj	7.02	JBG 10-208 x GBL 1	41.82**
Fruit Girth(cm)	**I**	NSR 1 x Pant Rituraj	23.66**	NSR 1 x Pant Rituraj	22.34**
	II	NSR 1 x GOB 1	15.60*	JBG 10-208 x GJB 2	20.26**
	III	ABR 2-23 x GOB 1	14.35*	JBG 10-208 x Pant Rituraj	18.72**
Fruit Weight (g)	**I**	AB 09-1 x GBL 1	33.34**	JBG 10-208 x Pant Rituraj	32.54**
	II	ABR 2-23 x GOB 1	27.03**	JBL10-04 x Pant Rituraj	22.71**
	III	NSR 1 x GJB 2	21.33**	NSR 1 x GJB 2	22.70**
Number of Fruits Per Plant	**I**	JB 12-06 x Pant Rituraj	173.44**	JB 12-06 x Pant Rituraj	41.84**
	II	JB 12-06 x GOB 1	90.84**	JBL 08-8 x GBL 1	34.38**
	III	NSR 1 x Pant Rituraj	82.70**	JBL 08-8 x GJB 2	33.46**
Number of Primary Branches Per Plant	**I**	NSR 1 x GBL 1	66.28**	NSR 1 x GBL 1	38.50**
	II	ABR 2-23 x GBL 1	57.95**	ABR 2-23 x GBL 1	31.56**
	III	JB 12-06 x Pant Rituraj	28.56**	JB 12-06 x Pant Rituraj	16.63*
Plant Height (cm)	**I**	JBL 10-04 x Pant Rituraj	34.82**	JB 12-06 x Pant Rituraj	10.73*
	II	JBL 10-04 x GBL 1	28.22**	JB 12-06 x GOB 1	1.62
	III	JBG 10-208 x GOB 1	20.18**	ABR 2-23 x GOB 1	-0.17
Plant Spread (cm)	**I**	JB 12-06 x Pant Rituraj	69.73**	NSR 1 x GJB 2	25.92**
	II	ABR 2-23 x GOB 1	41.83**	JB 12-06 x Pant Rituraj	22.53**
	III	JB 12-06 x GOB 1	34.59**	NSR 1 x GBL 1	16.53**
Total Soluble Solids (°B)	**I**	JBL10-04 x GOB 1	21.79**	JBL10-04 x GOB 1	40.65**
	II	JB 12-06 x GOB 1	19.64**	ABR 2-23 x GJB 2	39.35**
	III	JB 12-06 x GJB 2	17.78**	JBG 10-208 x GOB 1	38.06**
Fruit Yield Per Plant (kg)	**I**	NSR 1 x Pant Rituraj	155.70**	JBG 10-208 x GJB 2	22.98**
	II	JB 12-06 x Pant Rituraj	107.67**	NSR 1 x Pant Rituraj	20.70**
	III	JB 12-06 x GOB 1	79.44**	NSR 1 x GBL 1	16.63*

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