Heterosis for fruit yield and its components in brinjal (*Solanum melongena* L.)

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ABSTRACT

An experiment was conducted with 14 parents and 40 F_1s to study heterosis in brinjal. Crosses showing significant heterosis over the better parent were: HE12 X Aruna for first fruit set; BR-112 X Aruna for fruit length and diameter; Pant Samrat X Punjab Neelam for number of fruits per plant; H-7 X Aruna for fruit weight; H-9 X S-16 for total yield per plant; Negative heterosis were recorded in KT-4 X Aruna for borer and Pant in Rituraj X Punjab Neelam for nematode infestation.

Key words: Brinjal, heterosis, yield, better parent

INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the major cultivated vegetable crops grown round the year. It has high nutritive and medicinal value. Exploitation of hybrid vigour in vegetable crops is an important breeding objective in countries like Japan, Netherlands, UK and USA. In India although some brinjal hybrids have been released for cultivation, there is a scope in this crop to strengthen hybrid-breeding programmes. Brinjal, often a self-pollinated crop that also shows some degree of crossing, has the advantages of easy crossing, production of large number of seeds per cross and low seed requirement per unit area for exploitation of heterosis . Hybrid breeding entails evaluation of elite parents and a number of crosses (along with the type of gene action involved required, to chalk out breeding strategies) to identify heterotic hybrids and desirable parents.

The present study was, therefore, undertaken to study extent of heterosis over the better parent in line X tester design for yield and yield-attributing traits in brinjal.

MATERIAL AND METHODS

The present study was conducted at Vegetable Research Farm, Punjab Agricultural University, Ludhiana, during 1998-99 on ten lines (Punjab Bahar, HE-12, Pant Rituraj, SM 17-4, Sada Bahar Baingan, Pant-Samrat, HR-112, H-7, H-9 and KT-4); four diverse testers (Punjab Neelam, Aruna, S-16 and Punjab Barsati) and 40 F_1 hybrids thereof. Hand-emasculation and pollination was done during autumn, while, seeds of F_1 hybrids and their parents were

sown in a nursery and transplanted during spring. Seedlings 8-10 cm tall were planted in the field at a spacing of 75cm between rows and 50cm between plants, in Randomized Block Design with three replications. Each treatment comprised seven plants in a row and data were recorded on five competitive plants. Recommended agronomical and cultural practices were followed. Observations were recorded on days to first fruit set, fruit length, fruit diameter, number of fruits per plant, average fruit weight, yield per plant, and, borer and nematode infestation. Heterosis over the better parent was calculated as superiority of the F_1 cross over the better parent.

$$\text{Per cent heterosis over the better parent (BP)} = \frac{\overline{F_1} - \overline{BP}}{\overline{BP}} \times 100$$

$\overline{F_1}$ = Mean performance of the hybrid

$\overline{BP}$ = Mean performance of the better parent

Standard Error of difference for heterotic effects was calculated using the formula:

$$SE_d = \sqrt{\frac{2EMS}{r}}$$

where,

EMS = Error mean square from analysis of variance

r = number of replications

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Critical difference was computed as SE x t value at error degrees of freedom, at 5% level of significance

RESULTS AND DISCUSSION

Analysis of Variance revealed highly significant differences among treatments for all the characters. Estimates of heterosis over the better parent for various traits are presented in Table 1. Results revealed that for days to first fruit set, only 14 crosses of 40 showed significant, negative, desirable heterosis over the respective better parent. Heterosis ranged from -0.32 to -12.05% for BR-112 x Aruna and HE12 x Aruna. Crosses showing desirable heterosis over the better parent were: HE-12 x Aruna, KT-4 x Aruna, SM17-4 x S-16, and Pant Samrat x Aruna. The earliest cross, HE-12 x Aruna, took 30 days from transplanting to first fruit set. Positive heterosis was observed for fruit length, fruit diameter, number of fruits per plant, fruit weight and total yield per plant. Four crosses

Table 1. Per cent heterosis over the better parent for various traits in brinjal

Parent / hybrid		Days to first fruit set	Fruit length (cm)	Fruit diameter (cm)	No. of fruits per plant	Average fruit weight (g)	Total yield (fruits/ plant) (g)	Borer infestation index (fruit wt. %)	Nematode infestation index
Pb. Bahar	x Aruna	-7.749**	-41.379**	25.893**	-52.611**	32.699**	-9.195*	31.425	12.081
	x S-16	1.676	-55.338**	-41.990**	-19.737**	-1.476	-20953**	16.931	0.079
	x Pb. Neelam	17.838**	-53.415**	-0.358	-21.709**	-5.536**	-17.155**	76.109**	8.567
	x Pb. Barsati	37.376**	-57.828**	09.551	-60.748**	12.997**	-46.052**	19.552	-22.538**
HE-12	x Aruna	-12.050**	3.797	-19.040**	-37.976**	7.147**	-1.916	54.855**	-9.108
	x S-16	-4.234*	-2.551	-14.499**	-6.773**	-1.784	-5.078	-3.569	8.896
	x Pb Neelam	9.450**	27.067**	-3.806	3.648	-28.892**	14.844**	59.830**	-19.070**
	x Pb Barsati	-1.302	4.489	17.582**	-41.434**	4.792*	-23.919**	48.498**	16.178
Sada Bahar	x Aruna	10.735**	-31.434**	-0.670	-49.474**	10.600**	-37.353**	94.351**	24.161**
	x S-16	47.508**	-32.329**	-33.059**	-53.518**	5.131*	-54.118**	19.716	29.468**
	x Pb Neelam	14.943**	-45.023**	-39.615**	-53.905**	-9.088**	-34.412**	58.481+**	19.974**
	x Pb Barsati	25.289**	-36.270**	-3.842**	-50.78**	-6.190*	-43.228**	61.325**	6.390
Pant Samrat	x Aruna	-10.732**	-4.511	-16.675**	-36.236**	-22.937**	-6.513	20.412	27.270**
	x S-16	6.135**	-5.707	-3.195	-2.625	-23.858	-7.143	0.994	23.484**
	x Pb Neelam	0.937	-5.954	-21.923**	19.995**	-27.400**	-12.970**	32.886*	-26.227**
	x Pb Barsati	-1.242	-3.423**	0.764	-63.884**	-35.243**	-62.536**	59.710**	6.506
BR-112	x Aruna	-0.321	56.671**	44.827**	-64.809**	-21.611**	-40.996**	25.302	-6.108
	x S-16	2.256	5.495	-10.345*	-24.336**	-5.535**	-12.857	-12.871	5.825
	x Pb Neelam	-1.885	-11.336*	-15.385**	-16.525*	-14.323**	-25.105**	38.292**	4.971
	x Pb Barsati	13.890**	-16.145**	24.770**	-67.290	25.886**	-35.591**	40.594**	22.656**
H-7	x Aruna	23.796	13.728**	16.964**	-41.251**	61.908	-4.902	87.295**	-12.108
	x S-16	0.000	-14.544**	-17.389**	-36.872**	-17.548**	-24.771**	66.643+**	2.992
	x Pb Neelam	-6.217**	-14.235**	-30.239**	-43.749**	35.997**	-21.797**	45.632	-16.290**
	x Pb Barsati	-5.866+	-42.018**	10.853	-25.855**	-26.366**	-45.718**	52.478**	-22.538**
H-9	x Aruna	-6.521**	-29.104**	-5.960	-45.994**	20668**	-5.900	6.273	9.080
	x S-16	4.565*	-20523**	-34.931**	14.477*	21.861**	39.524**	17.775	0.079
	x Pb Neelam	-6.198**	-17.340	-42.347**	17.391**	-28.413**	0.795	12.599	0.250**
	x Pb Barsati	0.985	-15052**	-7.163	-42.991**	-24.049**	-47.320**	18.733	25.848**
KT-4	x Aruna	-11.789**	-5.141*	2.232	-41.812**	0.360	-35.249**	-9.549**	-5.146
	x S-16	2.018	-18.665**	-27.582**	-23.077**	-13.067	-14.191**	-16.889	-5.146
	x Pb Neelam	-5.052*	-35.539**	-29.615**	-33.846**	-39.492**	-32.217**	-16.264	0.000
	x Pb Barsati	-0.679	-15.378**	-4.558	-54.206**	26.284**	-42.219**	41.992*	15.393+**
PTR	x Aruna	-7.395**	1.110	-7.864	-25.783**	-42.278	4.214	-1.752	0.000
	x S-16	-0.339	-3.797	-7.363	3.296	-27.729**	-0.517	-28.392	0.000
	x Pb Neelam	7.756**	-18.699**	-23.873**	-6.091	-18.683**	-23.012**	-6.775	-28.584**
	x Pb Barsati	-2.144	-20.948**	-3.878	-44.598**	-19.443**	29.870**	-2.996	12.896**
SM 17-4	x Aruna	-2.527	-9.165*	2.522	-34.145**	0.788	-27.586**	16.618+*	24.270**
	x S-16	-11.605**	22.125	-12.262	-34.220	11.467**	0.529	-8.851**	-20.572
	x Pb Neelam	-6.315**	-8.171	-9.721**	-40.887**	-30.526**	-19.665**	72.093*	-23.870
	x Pb Barsati	5.556**	-5.518	-15.281	-47.663**	15.053**	-39.827**	34.064*	3.311
CD at *(P=0.05)*		1.435	0.776	0.544	1.110	3.164	20.027	3.887	0.578
CD at *(P=0.01)*		1.899	1.027	0.720	1.469	4.187	93.661	5.143	0.765

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

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out of 40 showed significant, positive heterosis over the better parent for fruit length, and it ranged from 1.11% to 55.67%. Crosses showing significant positive-heterosis were: BR-112 x Aruna and Pant Rituraj x Aruna.

Range of positive heterosis over the better parent for fruit diameter was 2.33% to 44.83%. Only five crosses out of 40 showed significant positive-heterosis over the respective parent. The best cross was BR-112 x Aruna. Maximum positive-heterosis for number of fruits per plant ranged from 3.30% to 19.99%. Only three crosses out of 40 showed significant positive-heterosis over the better parent (Pant Samrat x Punjab Neelam, H-9 x Punjab Neelam, and H-9 x S-16). Maximum desirable heterosis for average fruit weight ranged from 0.36% to 61.91%. Only 13 crosses out of 40 showed significant positive-heterosis over their respective better parent (H-7 x Aruna, Punjab Bahar x Aruna, KT-4 x Punjab Barsati, BR112 x Punjab Barsati, and H-9 x S-16). These results are in agreement with those of Dixit *et al* (1987), Balmohan *et al* (1983), Dixit and Gautam (1987), Singh and Parsad (1995) and Prasath *et al* (2000).

Maximum desirable heterosis over the better parent for yield per plant was 0.53 to 39.52%. The best heterotic cross was H-9 x S-16, with fruit yield of 976.67g/plant, followed by HE-12 x Punjab Neelam (803.9g/plant). Significant positive heterosis for yield per plant was earlier reported by Salehuzzaman (1981), Singh *et al* (1982), Patil and Shinda (1984), Singh and Kumar (1988), Prasath *et al* (2000), Das and Barua (2001) and Ashwani and Khandewal (2003).

Negative heterosis is desirable for borer and nematode infestation. Most desirable heterosis for borer infestation ranged from -1.75% to -28.39%. Only two hybrids of the 40 studied showed significant negative, desirable heterosis: KT-4x Aruna and SM 17-4 x S-16. These results are in agreement with findings of Dahiya *et al* (1985). Range of negative desirable heterosis for nematode infestation was from -5.15% to -28.58%. Crosses showing significant desirable heterosis were Pant Rituraj x Punjab Neelam, Pant Smrat x Punjab Neelam, Punjab Bahar x Punjab Barsati, HE-12 x Punjab Neelam and H-7 x Punjab Neelam. These brinjal hybrids may be commercially exploited.

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