

## **LINE x TESTER ANALYSIS OF HETEROSIS AND COMBINE ABILITY IN BHINDI**

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The results of the line x tester analysis in bhindi (*Abelmoschus esculentus* L. Moench) are presented in this paper.

### **Materials and Methods**

Seven tester varieties were crossed each with two female lines. The hybrids, seven testers and two lines were grown in randomised block design with two replications at the College of Agriculture, Dharwar during kharif 1974 with a spacing of 45 x 30 cms. The data on three quantitative characters were collected on five random plants heterosis and combining ability were estimated (Turner 1953; Kempthorne, 1957).

### **Results and discussion**

On the basis of mean performance, parents revealed no significant difference among themselves for days to flower (Tables 1 and 2). Whereas 2 x 5 cross showed earliness compared to others. White velvet, Emerald, 2 x 4 and 2 x 2 entries showed increased plant height among males, females and hybrids respectively, White velvet, A. E. 107, 1 x 6 and 2 x 7 amongst females, males and hybrids respectively indicated higher number of pods per plant. Variance for number of pods per plant alone were highly significant. The variance due to parents vs. hybrids were highly significant for all the characters and indicated heterosis. Significant differences within females and hybrids for number of pods per plant indicated high degree of genetic variation for number of pods compared to other characters.

The heterosis and potence ratio are given in table 3. Six crosses showed the significant additive gene effects and 2 x 5 hybrid gave the maximum heterosis for earliness. It is worthwhile to concentrate on this hybrid for further exploitation for earliness. Six crosses showed significant deviations over both better and best parents. There was no significant heterosis for plant height. The deviations for number of pods per plant were significant in ten crosses showing non-additive gene action. The cross 1 x 6 gave maximum heterosis for higher number of pods per plant which needs attention for commercial exploitation. The data have indicated that white velvet as a female parent gives out hybrids with more heterotic effect than Pusa sawani. The

**Table 1**  
**Mean performance of parents and hybrids of three characters**

<b>Treatments</b>	<b>Days to flower</b>	<b>Plant height (cms )</b>	<b>No. of pods per plant.</b>
<b>Females</b>			
1. Pusa sawani	49.70	68.20	<b>10.30</b>
2. White velvet	49.70	79.50	14.10
<b>Males</b>			
1. Red wonder	<b>50.10</b>	69.60	7.70
2. I C 9223	50.00	67.00	10.10
3. Dwarf green	51.20	72.50	9.60
4. Rajas septilatus	52.40	<b>81.80</b>	10.50
5. Sevendhari	50.70	75.80	9.50
Emerald	53.50	83.50	13.80
7. A E J07	51.80	80.30	
<b>Hybrids</b>			
1 X 1	47.00	76.60	7.50
1 X 2	50.40	73.20	10.00
1 X	54.30	86.80	8.40
1 X 4	47.10	85.50	9.00
1 X 5	49.00	72.40	11.40
1 6	49.20	79.90	<b>16.80</b>
1 X 7	46.70	82.50	14.30
2 X 1	49.40	84.50	11.40
2 X 2	54.00	88.20	12.50
2 X 3	47.50	83.70	15.60
2 x	52.20	88.20	11.40
2 X 5	<b>44.60</b>	75.80	10.30
2 x 6	52.70	82.60	10.20
2 X	<b>47.60</b>	85.70	16.80

potence ratio also indicated overdominance in majority of the crosses and partial and complete dominance in a few crosses for all the three characters under study.

Table 2  
ANOVA of three characters

Source	D. F.	Days to flower	M. S. S.	
			Plant height cms	No. of pods per plant
Replications	1	13.48	99.34	1.19
<b>Treatments</b>	22	12.26	83.45	14.54
Males	6	3.21	80.46	6.73
<b>Females</b>	1	0.00	128.82	14.44 *
Hybrids	<b>13</b>	16.82	57.82	17.95 *
Males vs. Females	3	8.90	65.53	13.35
Parents vs. Hybrids	1	<b>22.89**</b>	<b>461.28**</b>	17.43
Error	22	6.99	158.63	6.49
<b>Significant at</b>		<b>Significant at</b>		

The combining ability variances and effects are presented in tables 4 and 5 respectively. The variances of combining ability were not significant for any of the characters (Table 5). The g. c. a. variance was more than s. c. a. variance for days to flower. It was reversed for plant height and both are of equal magnitude for number of pods per plant. With respect to g. c. a. effects of females, there does not seem to offer much choice between them as there is no significant differences between females (Table 4). A. E. 107 and Red wonder amongst males are good and poor general combiners respectively for number of pods per plant. Sevendhari is a good general combiner for earliness where as I C 9223 is poor combiner for the same character. None of the males showed good g. c. a. effect for height. Hence much stress should be laid on A. E. 107 and Sevendhari for future breeding programmes. No cross is good specific combiner for days to flowering. Hybrids 2 x 2 and 1 x 3 showed significant s. c. a. effects for plant height. While crosses 1 x 2 and 2 x 3 showed poor s. c. a. effects for the same character. Cross 1 x 6 is

**Table 3**

**Heterosis over mid, better and best parents and potence ratio**

Hybrids	M. P.	Days to flower B. P.	to flower B. P.	Potence ratio	M. P.	Plant height B. P.	B. P.	Potence ratio	M. P.	No. of pods B. P.	per plant B. P.	Potence ratio
1 X 1	— 5.81*	— 5.43	— 5.43	1.45	108	100	— 8.2	—11.0	<sup>f</sup> 16.6 **	—27.1	—46.8	—1.15
1 X 2	1.61	1.41	1.41	— 3.66	8.6	7.3	—12.3	— 9.3	— 1.96	— 2.9	—29.0	—2.00
1 X 3	7.74**	9.25**	9.25**	— 5.13	23.4	19.7	3.9	— 7.6	—14.1 **	—18.0**	—40.4	—3.75
r <sup>4</sup>	— 7.83**	— 5.63	— 5.63	2.92	14.0	4.5	2.3	— 1.5	— 9.09	— 12.6	—36.1	—2.25
1X5	— 2.40	• - 1.40	— 1.40	2.40	0.4	—4.4	—13.2	— 0.1	9.6*	8.5	—14.8	10.0
1X6	— 1.40	— 1.00	1.00	1.26	10.5	—6.5	— 4.3	— 0.5	69.69**	63.1	19.1	17.50
1 X7	2.16	— 6.03*	— 6.03*	3.86	11.1	3.1	— 1.1	— 0.8	19.1**	3.6	14	1.28
2X i	— 1.00	— 0.60	— 0.60	2.50	13.4	6.2	1.1	— 2.0	4.5	—19.1	—14.8	0.16
2 X 2	8.87**	8.65**	8.65**	—27.60	20.3	10.9	5.6	— 2.3	3.3	— 11.3	—11.3	0.2
2 X 3	5.75*	— 4.43	— 4.43	3.93	11.0	5.2	0.2	2.2	32.2	10.6	106	1.65
2X4	2.15	5.03	5.03	0.85	9.4	7.8	5.6	— 6.5	— 3.3	—19.1	—19.1	0.17
2X5	- 11.11**	—10.26**	—10.26**	11.20	2.3	4.6	—10.1	—11.0	—18.2**	—26.9	—26.9	—1.53
2X6	2.13	6.03*	6.03	—0.58	1.3	— 1.0	— 1.0	— 0.5	—13.5**	—27.6	—27.6	6.95
2X7	2.17	0.20	0.20	1.09	7.2	6.7	2.6	— 2.0	20.8**	19.1	19.1	14.5

Significant at

\*\* Significant at

Table 4

## G. C. A. and S. C. A. effects of parents and hybrids

Parents	Days to flower	Plant height cms.	No. of pods per plant
<b>Females</b>			
1. Pusa sawani	-0.45	-2.20	-0.76
2. White velvet	0.45	+2.30	+0.76
<b>Males</b>			
1. Red wonder	-1.37	-1.20	-2.38**
2. Ic 9223	2.63**	-1.00	-0.50
3. Dwarf green	1.36	3.50	0.22
4. Rajas septilatus	0.10	5.10	-1.60
5. Sevendhari	-2.77**	-7.70	-0.90
6. Emerald	1.43	-0.50	1.70
7. AE 107	-1.37	2.30	3.80**
<b>Hybrids</b>			
1 X 1	-0.75	-1.80	-1.21
1 X 2	-1.35	-5.40*	-0.54
1 X 3	3.82	3.70*	-2.80*
1 X 4	-2.07	0.80	-0.40
i X 5	2.45	0.50	1.30
1 X 6	-1.30	0.80	4.10**
1 X 7	-2.00	0.60	-0.50
2 X 1	0.75	1.60	1.20
2 X 2	1.35	5.10*	0.40
2 X 3	-3.83	-3.90*	2.80
2 X 4	2.08	-1.00	0.40
2 X 5	-3.65	-0.60	-1.40
2 X 6	1.30	-1.00	-4.10
2 X 7	1.00	-0.70	0.40

Significant at 5

Significant at 1 %

good specific combiner for number of pods per plant. Hybrids  $2 \times 6$  and  $1 \times 3$  are poor specific combiners for the above character.

**Table 5**  
**Analysis of combining ability**

Source	D. F.	Days of flower	Plant height	No. of pods per plant
C. C. A.	8	1.944	3.11	7.44
S. C. A.	13	0.38	19.89	7.88
Error	13	10.85	166.40	7.94

The *per se* performance of parents and hybrids have agreed very well with heterotic performance and g. c. a. effects thus indicating the facts that the *per se* performance is a good indication of g. c. a. effects of parents. Similar reports have been made in other crop plants (Miller and Marani, 1953; Singh, Gupta and Phul, 1971 and Singh, Murthy and Butany, 1971). Observations indicated that parents with good general combining ability need not necessarily produce promising hybrids. These findings are in conformity with earlier reports (Bains, Athwal and Gupta, 1967; Singh, Gupta and Phul, 1971, and Singh, Murthy and Butany, 1971).

**Summary**

Line X tester analysis of heterosis and combining ability in bhindi have indicated that parents with good g. c. a. effect need not produce superior crosses with good s. c. a. effects. But the parental *per se* performance is a good indication of g. c. a. effect of parents.

**സംഗ്രഹം**

വെണ്ടയിൽ സങ്കരവീര്യത്തിന്റെയും സംയോജനക്ഷമതയുടെയും 'നിര  $\times$  പരീക്ഷകം' വിശ്ലേഷണത്തിൽനിന്നും പൊതുസംയോജനക്ഷീവുള്ള ജനകങ്ങൾ നല്ല സവിശേഷസംയോജനക്ഷീവുള്ള സങ്കരങ്ങളെ ഉല്പാദിപ്പിക്കണമെന്നില്ല എന്നു കണ്ടു. പക്ഷെ ജനകങ്ങൾ തമ്മിലുള്ള പ്രകടനം അവയുടെ പൊതുസംയോജനക്ഷീവിനെ സൂചിപ്പിക്കുന്നു.

## REFERENCES

- BAINS, K. A. **ATHWAL**, D. A. and GUPTA, V. P. 1967. Combining ability of inbreds of bajra in relation to genetic diversity of male sterile lines. *3. Res Punjab. Agric. Univ.* 4, 192—196.
- Kempthorne**, O. 1957. *An introduction to Genetic Statistics* John Wiley and Sons, New York.
- Miller, P. A. and **Marani**, A. 1963. Heterosis and combining ability in diallel crosses of upland cotton. *Crop Sci.*, 3, 441—444.
- Singh, T. H., **Gupta**., and **Pbul**, P. A. 1971. Line x tests analysis of combining ability in cotton *Indian J. Genet.*, 31, 316—321.
- Singh, B. B., **Murthy**, B. R. and **Butany**, W. T. 1971. Line X tester analysis of combining ability and heterosis for some yield and quality components in upland cotton. *Indian J. Genet.* 31, 8—15.
- Turner, J. H. 1953. A study of heterosis in upland cotton yield of hybrids compared with varieties. *Agri. J.*, 45, 484—486.

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