HETEROSIS IN GREENGRAM

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Exploitation of heterosis or hybrid vigour has proved to be a potential tool for increasing the yield in many crops. Heterosis in greengram has been reported earlier by Bhatnagar and Singh (1964), Misra *et al.* (1970) and Singh and Jain (1970). But attempts for the exploitation of this phenomenon seems to be scanty till date.

The present study explores the possibility to increasing the yiled of greengram through heterosis by comparing the magnitude of heterotic effect in intervarietal Hybrids.

Materials and Methods

Five distinctly different improved strains of greengram viz. P. S. 7, Madira, PLMB 9, Pusa Baisakhi, and E. C. 1653 were grown during November 1976 to January 1977. A 5x5 diallel set of crosses without reciprocals was dene by adopting the methodology developed and standardised by Narasimhan (1972).

During May to July 1977 a comparative performance trial of 5 parents and 10 F_1's was made in a randomised block design with 3 replications. In each plot (2.5m x 2. 5m) there were 25 plants spaced 45 cm. From each plot 5 plants selected at random were used for recording observations on (1) Height of the plants (2) Number of leaves per plant (3) Number of branches per plant (4) Number of clusters per plant (5) Number of pods per plant (6) Length of pod (7) Number of seeds per pod (8) 100 seed weight (9) grain yield per plant and (10) Number of days taken for the first flower to bloom.

The magnitude of heterosis was calculated by comparing the better parental as well as the mid parental value and the significance of the heterosis was tested by the critical difference calculated as to over better parental value CD1 = t $0.05 \sqrt{2}$ MSe/r To test mid parental value CD2 = t 0.05 $\sqrt{\ }$ MSe/r Similarly CD1 (0.01) and CD2 (0.01) were also computed.

Heterosis was calculated and expressed as percentage increase over better parental as well as mid parental values using the formula $(F, -\bar{x}/\bar{x})100$ where x is the mean of better parental or mid parental values as the case may be and F_1 is the mean of F_1.

Table 1

Heterosis in F over mid parent and better parent expressed as percentage

Characters	p1Xp2	p1Xp3	p1Xp4	p1Xp5	p2Xp3	p2Xp4	p2Xp5	p3Xp4	p3Xp5	p4Xp5
Plant height		*				*				
HPO - MP	—0.23	20.36	fi.OS	5.16	7.31	21.46	—21.24	—3.97	— 1.91	— 18.18
HX) - BP	-5.01	8.74	1.89	-4.88	1.6l	20.30	—31.00	—9.91	— 18.89	—28.57
No. of leaves	*	**								
HPO - MP	32.05	54.85	69.16	15.24	1.87	43.64	— 15.83	—30.43	— 14.99	—6.38
HPO - BP	29.73	47.69*	64.60*	1.38	—4.46	42.50**	—24.79	—35.33	—2.87	— 15.64
No. of branches		**		**	**	**				
HPO - MP	44.44	103.25	112.10	65.99	47.90	104.12	10.95	25.00	63.04	49.73
HPO - BP	34.72	87.43**	99.40"	44.0*5	29.98	7979*	2.64	22.45	32.16	23.35
No. of clusters			**							
HPO •• MP	54.26	105.13	93.68	73.46	41.07	81.09	—5.50	— 13.40	35.85	22.53
HPO - B?	48.75	85.71	91.61	66.89	32.12	76.78	—12.19	-20.84	18.62	16.47
No. of pods/plant		**								
HPO - MP	—0.92	52.05	16.56	9.05	-2.10	51.54	—15.56	— 16.10	8.14	—31.75
HPO - BP	—5.41	42.94*#	14.46	13.64	—3.65	42.17	—22.90	—22.47	—2.67	—33.69
Length of pod		*								
HPO - MP	—0.79	23.15	—6.97	8.97	-2.92	16.68	—28.11	4.72	3.42	—0.92
HPO - B;	—9.67	25.09	— 10.63	—7.21	—14.79	0.95	—32.21	3.01	—13.67	— 18.46

Table 1 (Contd.)

Characters	p1Xp2	p1Xp3	p1Xp4	p1Xp5	p2Xp3	p2Xp4	p2Xp5	p3Xp4	p3Xp5	p4Xp5
No. of seeds/pod										
HPO - MP	−7.65	12 57	4 8	1.83	−11.05		−20 80	14 02	−7 71	1 5
HPO - BP	−18.08	7. 3	37	−5.81	−2.80	−10.7	−20. 7	−10.91	−3. 5	−8. 2
100 seed weight										
HPO - MP	−18 03	−15 8	−.19	−9.24		−13.73	−11 65	−3	−8 2
HPO - BP	−12 41	−9 74	−2 82	−6.0 49	−16.92	7. 2	−27.45	−18.24	−1 4	−1. 8
Yield plant										
HPO MP	34	47 35	67 86	22.0* 2	−45.61	7 2	−9 8	4.48	−1 3. 2	−8 5 3
HPO BP	3.2	2 2	64·14	−.0 1	−53.79	7 0 1	−25. 8	0 27	−16.54	−33.9
Days o flowering										
HPO MP	6 69	−8.0	17.43	03	2.06	−1.8	7.00	12 49	5	16 77
HPO BP	8.49	−5 92	19.37	11 04	3.64	..44	13.74	25.48	4.00	.7.59

P1 = P. S 7 P2 = S adi P3 = PLMB P4 = Pusa Bisaki P5 = E. C.

HPO - MP = Heterosis per cent over mid parent. HPO - BP = Heterosis per cent over better parent.

* = Significance 5 per cent probability level. ** = Significance a 1 per cent probability level.

Results and Discussion

Heterosis in F_1 over mid parent and better parent expressed as percentage are given in the Table 1.

Plant **height** : Plant height of parents ranged from 29.43 cm to 45.04 cm while that of hybrids ranged from 30.26cm to 42.84cm. Heterosis ranges from 31.00 to 20.30%. Two hybrids P. S. 7 x PLMB 9 and Madira x Pusa Baisakhi exhibited significant positive heterotic vigour over mid parent. None of the hybrids exhibited significant positive heterotic vigour over the better parent.

Number of leaves per **plant** : Parents gave a range of 6.47 to 9.40 and hybrids showed a range of 4.87 to 12.40. Four hybrids (P. S. 7 Madira, P. S. 7 x PLMB 9, P. S. 7 x Pusa Baisakhi, Madira x Pusa Baisakhi) exhibited significantly positive vigour over mid parental and better parental values. The heterosis ranges from 35.33 to 64.60%. The hybrid P. S. 7 x Pusa Baisakhi exhibited maximum heterosis (64.6%).

Number of branches per **plant** : The mean number of branches in parents ranged from 1.40 to 2.27 while the hybrids showed a range of 1.80 to 3.47. The hybrids P.S.7 x PLMB 9, PS.7 x Pusa Baisakhi, P. S. 7 x E.C. 1653 and Madira x Pusa Baisakhi exhibited positive and significant heterosis vigour over better parent. Heterosis ranges from 2.64 to 99.40%. *P. S. 7 x* Pusa Baisakhi exhibited maximum heterosis over better parent (99.40%)

Number of clusters per plant : Number of clusters in parents ranged from 4. 13 to 6.07 and that of hybrids from 4.33 to 10.73. Significant positive heterotic vigour over better parent was exhibited by the hybrids P. S. 7 x PLMB 9, P. S. 7 x Pus Baisakhi, P.S. 7 x E.C. 1653, and Madira x Pusa Baisakhi. The heterosis ranges from 20.84 to 91.60%. The hybrids P. S. 7 x Pusa Baisakhi exhibited maximum heterosis (91.61%).

Number of pods per **plant** : Parents gave a range of 14.07 to 17.60 and the hybrids showed a wider range of 11.67 to 23.60. Significant positive heterosis over better parent was exhibited by hybrids P. S. 7 x PLMB 9 and Madira x Pusa Baisakhi. Heterosis ranges from-33.69 to 42.94%. The maximum heterosis was exhibited by P. S. 7 x PLMB 9 (42.94%).

Length of pod : Parents showed a range of 7.70 cm to 11.92 cm and the hybrids gave a range of 7.48 cm to 11.06 cm. Heterosis ranges from 32.21 to 25.09%. Singnificant positive heterotic vigour over better parent was noticed in P. S. 7 x PLMB 9 (25.09%).

Number of seeds per **pod** : Parents gave a range of 10.40 to 14.73 and the hybrids ranged from 10.93 to 13.00. The heterosis ranges from 25.80 to 10.91%. None of the hybrids exhibited significant positive heterotic vigour for this character.

Hundred seed weight: The seed weight of parent ranged 5.01 g to 7.36g and that of hybrids from 4.40 to 6.48g. Heterosis ranges from 27.45 to 7.98. None of the hybrids exhibited heterotic vigour over the better parent.

Grain yield per plant: Yield of parents ranged from 11.21 to 17.77 g and that of hybrids from 7.56 to 20.32g. Significant positive heterotic vigour was noticed in the hybrids P.S. 7 x Madira, P. S. 7 x PLMB9, P.S. 7 x Pusa Baisakhi, P. S. 7 x E C. 1653 and Madira x Pusa Baisakhi. The heterosis ranges from 53.79 to 72.06%. The maximum heterosis (72.06%) was exhibited by Madira x Pusa Baisakhi.

Days to **flowering:** Flowering duration of parents ranged from 32.73 to 39.33 days and that of hybrids from 31.8 to 41.07 days. The heterosis ranges from 5.92 to 25.48%. The hybrids did not differ from the parents for this character. The presence of relatively high cross compatibility exhibited in artificial cross pollination suggest that there is considerable scope for improving the crop through hybridization. Significant positive heterotic vigour over better parent exhibited in respect of the number of leaves, number of branches number of clusters, number of pods, length of pod and grain yield is in conformity with the results of Bhatnagar and Singh (1964), Singh and Jain (1970) and Misra et al. (1790) in greengram.

Graffius (1959) has suggested that there cannot be any gene system for yield perse and the yield in an end product is due to the interaction between the different yield components. This indicates that the heterosis in yield is through heterosis in . individual yield component. The study shows that increase jn yield is always associated with increase in yield components. The differences in magnitude of heterosis exhibited in different parental combinations may be due to the differences in combining ability. A major reason for heterosis in is the genetic diversity in parents. The heterosis exhibited in yield and its components may be exploited for increased productivity.

Summary

Five elite strains (P. S. 7 X Madira, PLMB 9, Pusa Baisakhi, E.C 1653) and their 10 cross combinations were compared in an experiment adopting a randomised block design with 3 replications. The study revealed that parents showed good cross compatibility. Significant positive heterotic vigour over better parent was exhibited for the number of leaves, number of pods, length of pod and grain yield. Negative heterosis was noticed in the case of 100 seed weight. The magnitude of heterosis varied in different parental combinations. The heterosis in yield noticed is through heterosis in yeild components viz. number of branches per plant, number of pods per plant and number of clusters per plant.

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