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Exploitation of heterosis for yield and yield components in pigeonpea

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Abstract

The commercial application of heterosis is considered to be an outstanding application of the principles of the genetics in the field of plant breeding. Pigeonpea is often cross-pollinated crop, therefore, it can be also improved genetically following breeding methods suitable for cross-pollinated crops. Therefore, an attempt has been made to study the extent of heterosis involving 3 medium duration females and 15 males of pigeonpea. Positive and negative heterosis over better parent and standard heterosis over check Asha was studied. The high heterosis was observed for seed yield and pods per plant, medium level of heterosis observed for plant height, 100-seed weight, reproductive period and branches per plant. Low amount of heterosis was recorded for days to flowering, days to maturity, pod length, seeds per pod and protein content. The highest heterosis was recorded by hybrid MS 3783 x BSMR 853 (35.36%) followed by MS 3783 x ICPL 84060 (28.08%) and MSCo 5 x P 185 (25.01%) for seed yield per plant. These hybrids also exhibited high standard heterosis for one or more yield attributing traits.

Keywords : Genetic male sterility, heterobeltiosis, pigeonpea

Introduction

In pigeonpea cajanus cajan (L) Millsp., the commercial exploitation of heterosis was feasible due to the availability of various male sterility systems viz., genetic male sterility and cytoplasmic genic male sterility and high degree of natural cross-pollination(0.09 to 94.5%). In the present study an attempt has been made to study the extent of heterosis over three locations in Gujarat for seed yield and its related components using genetic male sterile lines.

Materials and methods

Three genetic male sterile medium duration lines viz., MSCo 5, MSC 11 and MS 3783 and 15 testers were crossed in Line x Tester design. Resulting 45 hybrids along with parents and standard check, Asha were evaluated in randomized block design with three replications during *kharif* 2002-03 at three locations viz., Sardarkrushinagar, Khedbrahma and Bharuch. The row length was 3 mt with a spacing of 60 x 10 cm. Observations were recorded on five randomaly selected plants from each plot.The per cent heterosis was estimates as deviation of F_1 mean from better parent and standard check (Asha) based on pooled data.

Results and discussion

Heterosis ranged from –13.85 to 6.65 per cent and –14.98 to 5.47 per cent over better parent and standard check respectively for days to flowering. Heterosis for days to maturity ranged from –11.93 to 1.91 per cent and –11.88 to 5.81 per cent over better and standard check, respectively (Table 1). Majority of early and dwarf hybrids involved MSCo 5 and MSC 11 as female parents. Hybrids MSCo 5 x GT 1, MSCo 5 x WRG 9701 and MSCo 5 x BT 20 were earlier to flower while, MSCo 5 x BT 20 was the earliest in maturity. Similar finding were reported by Pandey (1) and Khorde *et al.* (2).

Heterosis for branches per plant ranged form –23.90 to 19.76 per cent and –14.18 to 28.99 per cent over better and standard check, respectively. In case of pods per plant, 10 and 20 hybrids recorded significant positive heterosis over better parent and standard check, respectively. Eight hybrids recorded superiority over better parent with respect to seeds per pod.

Table 1. Range of heterosis and three top ranking crosses with respect to heterosis over better parent and standard check

Characters	Heterosis over better parent		Heterosis over standard check	
	Best Crosses	Heterosis %	Best Crosses	Heterosis %
Days to flowering	MS 3783 X IPCL 84060	-13.85**	MSCO 5 X GT 1	-14.98**
	MSC 11 X WRG 9701	-11.97**	MSCO 5 X WRG 9701	-13.88**
	MS 3783 X BSMR 853	-11.86**	MSCO 5 X ICPL 84060	-12.33**
Days to maturity	MSC 11 X ICPL 84060	-11.93**	MSCO 5 X BT 20	-11.88**
	MSC 11 X WRG 9701	-11.81**	MSCO 5 X GT 1	-11.11**
	MS 3783 X KM 34	-11.55**	MSCO 5 X ICPL 84060	-9.26**
Plant height	MS 3783 X BSR 1	-19.02**	MSC 11 X BSMR 736	-13.34**
	MSC 11 X BSMR 736	-14.44**	MSC 11 X BT 20	-12.10**
	MSCO 5 X BSR 1	-13.31**	MSC 11 X P 135	-11.09**
Branches per plant	MS 3783 X P 3760	19.76**	MS3783 X P 3760	28.99**
	MS 3783 X KM 34	17.01**	MS3783 X KM 34	27.84**
	MSC 11 X P 175	15.78**	MS3783 X BSMR 853	24.01**
Pods per plant	MS 3783 X BSMR 853	33.88**	MS3783 X BSMR 853	66.26**
	MS 3783 X P 175	24.51**	MS3783 X P 185	62.75**
	MS 3783 X P 185	16.03**	MS3783 X P 175	54.63**
Seeds per pod	MSC 11 X BT 20	9.82*	MSC 11 X BT 20	19.52**
	MSCO 5 X ICPL 84060	8.39	MSCO 5 X ICPL 84060	16.52**
	MS 3783 X BSMR 853	5.57	MSC 11 X BSR 1	13.81*
Pod length	MS 3783 X P 185	12.14**	MSC 11 X GT 1	17.07**
	MSC 11X BSR 1	10.06**	MSC 11 X BSR 1	9.98**
	MSCO 5 X ICPL 87119	8.63*	MSCO 5 X GT 1	8.65**
100-seed weight	MS 3783 X BT 20	15.41**	MSCO 5 X ICPL 87119	23.81**
	MSCO 5 X ICPL 87119	13.08**	MSC 11 X BT 20	15.80**
	MS 3783 X WRG 9701	12.54**	MSC 11 X P 175	15.53**
Seed yield per plant	MS 3783 X BSMR 853	97.54**	MS3783 X BSMR 853	35.36**
	MS 3783 X ICPL 84060	82.53**	MSC 11 X P 185	25.21**
	MSCO 5 X P 185	43.51**	MS3783 X ICPL 84060	25.08**
Protein content	MSC 11 X SKNP 9226	10.16**	MSC 11 X SKNP 9226	7.70*
	MSCO 5 X SKNP 9226	7.27*	MSCO 5 X SKNP 9226	4.46
	MSC 11 X P 318	5.71	MSCO 5 X P 315	4.10
Reproductive period	MSC 11 X GT 1	12.43**	MSC 11 X GT 1	24.58**
	MS 3783 X P 318	6.68*	MS3783 X P 318	18.44**
	MS 3783 X GT 1	6.49*	MS3783 X GT 1	18.23**

* and ** , significant at P = 0.05 and P = 0.01 levels, respectively

Table 2. The mean and magnitude of hrterosis (%) for seed yield over better parent and standard check (Asha)and component characters in pigeonpea.

Crossess	Mean seed yield per plant	Heterosis (%) over BP*	Standard Check
MS3783 x BSMR853	88.01	97.54**	35.36**
MS3783 x ICPL84060	81.33	82.53**	25.08**
MSCo5 x P185	81.28	43.51**	25.01**
MS3783 x KM34	73.38	17.05**	12.86**
MSCo5 x P3760	69.02	-13.62**	6.15
MS3783 x P185	68.85	24.06**	5.89
MSC11 x WRG9701	67.80	35.13**	4.28
MSC11 x P3760	66.65	-16.58**	2.51
MSCo5 x P318	66.05	16.63**	1.58
MS3783 x ICPL87119	63.44	-28.94**	-2.43
Asha	65.02	-	-
S.Em.±	2.70	1.57	2.70

*, ** significant at 5% and 1% lelels, respectively
BP* = Better parent and SC = Standard check DF = Days to flowering, DM = Days to maturity, PH = Plant height, BP = Branches per plant, PP = Pods per plant SP = Seeds per pod, PL = Pod lengthand, TW = Test weight

Four and five hybrids recorded superiority over better parent and standard check, respectively for pod length. Heterosis for 100-seed weight ranged from –22.59 to 15.41 per cent and –19.59 to 23.81 per cent over better and standard parent, respectively. The hybrid MS 3783 x BT 20 (15.41%) showed the highest positive heterosis over better parent and (14.18%) and standard check for 100-seed weight. The results are in agreement with the results of Singh *et al.* (3). Only two hybrids over better parent and one hybrids over standard check showed significant positive heterosis for protein content. For reproductive period, 3 and 18 hybrids recorded significant positive heterosis over better parent and standard check, respectively.

Heterosis for seed yield per plant ranged from –48.66 to 97.54 per cent and –55.28 to 35.36 per cent over better parent and standard check, respectively. Out of 45 hybrids, 18 and 29 hybrids exhibited significant and positive heterosis over better and standard check, respectively. The hybrid MS 3783 x BSMR 853 (97.54%) showed the highest positive heterobeltiosis, while hybrid MS 3783 x BSMR 853 (35.36%) showed the highest standard heterosis. The results are corroborating with the findings of Phad *et al.* (4).These hybrids showed useful heterosis for one or more yield component traits like branches per plant, pods per plant, 100-seed weight, seeds per pod and pod length. This indicated that hybrid vigour at even small magnitude for any one yield components may have additive effect on seed yield.

In case of hybrid breeding programme, high heterotic effect for economic yield and other associated characters measures the feasibility of commercial cultivation of hybrids. Out of 45 hybrids, four promising hybrids were identified which exceeded to standard check Asha in respect of seed yield per plant. Thus, the use of these hybrids MS 3783 x BSMR 853 (35.36%), MS 3783 x ICPL 84060 (25.08%), MSCo 5 x P 185 (25.01%) and MS 3783 x KM 34 (12.86%) would be advantageous for commercial cultivation. But to judge its utility on commercial scale, large scale evaluation over year still would be necessary.

Reference

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