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Heterosis studies in cowpea (*Vigna unguiculata* L.walp)

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ABSTRACT

In cowpea (*Vigna unguiculata L. Walp*) nine parents crossed in diallel (excluding reciprocals) to study heterosis over mid-parent (MP), better parent (BP) and standard check (SC) for ten characters. Maximum positive heterosis for green pod yield per plant over MP,BP,SC was observed 55.62, 47.99 and 20.32% respectively. The heterosis in green pod yield per plant was due to heterosis found in yield components, *viz.*, mainly pods per plant, seed per pod, pod length and branches per plant.

Key words : Heterosis, pod yield, cowpea

Cowpea is an important legume crop of the tropics area, having various uses like vegetable, grains, dry haulms and as fodder. It is an expensive source of vegetable protein and a handy crop well adapted to relatively dry environment. The exploitation of hybrid vigour in any crop depends on substantial heterosis for yield, coupled with an economical method of producing hybrid seeds. The heterosis reveals, type of gene action involved and therefore, it help in the selection of suitable breeding methodology and parameters which are to be employed for crop improvement. Very little work, has been done in studying characters in relation to green pod yield in cowpea, which would be helpful in the development of cultivars for long tender green poded cowpea.

MATERIALS AND METHODS

Nine parents having different origin, *viz.*, Pusa falguni, GC-4, CGD-25, CGD-118, CGD-77, CGD-340, CGD-352, CGD-370 and CGD-402 were crossed in all possible combinations (excluding reciprocals) to get 9x9 diallel set. The 45 genotypes (36 F_1s, and 9 parents) were laid out in randomized block design (RBD) with three replications at Agronomy Instructional farm, Sardarkrushinanagar Dantiwada Agricultural University, Sardarkrushinager during summer 2007-08. The seeds were planted at 45 cm between rows 15 cm within row. The recommended agromic practices and plant protection measures were adopted for raising a good crop. Observation were recorded by selected randomly five plants for days to 50 per cent flowering, days to first picking, plant height (cm), number of branches per plant, pod length (cm) number of seed per pod, pod per plant, green pod per plant (g), protein content(%) and crude fiber content(%). Heterosis over mid-parent, better parent and standard check was calculated as per standard formula.

RESULTS AND DISCUSSION

The mean sum of squares due to genotypes were highly significant for all the character, indicating the diversity of parents. The range of heterosis exhibited by hybrid over the respective mid parent, better parent and standard check for green pod yield(g) per plant was -17.63 to 55.62%, -27.28 to 47.99% and -30.22 to 20.32% respectively (Table 1) and 24,15 and six hybrids showed significant positive heterosis over mid, better parent and standard check. These finding are in agreement with Bhaskaraish *et al.*, (1978) and Singh (1983).

For the development of the character *viz.*, days to 50 per cent flowering, days to first picking and plant height negative heterosis will be desirable. For the character days to 50% flowering highest heterosis was recorded in CGD-370 x CGD-118 (-8.67%), CGD-370 x CGD-118 (-6.44%) over mid parent and better parent and none of heterosis over standard check. Out 36

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Table 1 Range of heterosis over Mid parent (MP), Better parent (BP) and Standard Check (SC) for different character along with best hybrids in cowpea.

Characters	Range of heterosis (%) and Best hybrid		
	MP	BP	SC
Days of 50% flowering	-8.67 to 13.76 CGD-370 x CGD-118	-6.44 to 21.16 CGD-370 x CGD-118	4.84 to 29.26 CGD-370 x CGD-118
Days to first picking	-6.72 to 12.81 CGD-402 x CGD-25	-6.03 to 16.79 CGD-402 x CGD-25	3.43 to 24.38 pusa falguni x CGD-352
Plant height (cm)	-35.66 to 18.81 GC-4 xCGD-370	-21.92 to 35.36 CGD-118 x CGD-402	-15.78 to 47.78 pusa falguni x CGD-370
Branches per plant	-0.39 x 39.53 CGD-118 x CGD-340	-21.92 to 38.43 CGD-118 x CGD-402	-10.77 x 33.31 CGD-118 x CGD-402
Pod length (cm)	-14.97 to 35.79 GC-4 x CGD-370	-19.49 to 32.31 GC-4 x CGD-370	-10.77 x 33.31 CGD-118 x CGD-402
Seeds per pod	-13.41 to 52.26 pusa falguni x CGD-402	-21.45 to 50.41 pusa falguni x CGD-402	6.94 to 60.45 pusa falguni x CGD-402
Pods per plant	-17.28 to 58.24 CGD-370 x CGD-25	-19.73 to 57.48 CGD-370 x CGD-25	-24.14 to 29.07 GC-4 x CGD-402
Green pod yield(g)	17.63 to 55.62 CGD-370 to CGD-25	-27.28 to 47.99 CGD-370 x CGD-25	-30.22 to 20.32 pusa falguni x CGD-402
Protein content	-21.17 to 16.33 CGD-77 x CGD-340	-24.82 to 13.46 CGD-352 x CGD-25	-20.40 to 7.86 CGD -370 x CGD-352
Crude fiber	-24.22 to 80.94 CGD-370 x CGD-352	-35.08 tp 70.7 CGD-370 x CGD-402	-32.49 to 22.13 pusa falguni x GC-4

crosses, 4, 1 and zero showed desired heterosis over MP, BP and SC respectively, Bhushana *et al.*, (2000) and Mehta (2000) obtained similar results.

For days to first picking 4, 1 and none hybrids showed highest heterosis over MP, BP and SC respectively. The result are in agreement with Sawarkar (1998)
Out of 36 crosses, 23, 2 and 7 showed significant heterosis over MP, BP and SC respectively and hybrid GC-4 x CGD-118 (-35.66%)CGD-118 x CGD-402 (-10.54%) and Pusa falguni x CGD-340 (-15.78) showed highest heterosis for MP, BP and SC respectively for plant height. Similar observations were made by Mehta (2000) and Haibatpure (2003)
The highest heterosis recorded for branches per plant were 39.53% (CGD-118x CGD-340), 38.43% (CGD-340 x CGD-25) and 24.05% (CGD-352 x CGD-118) over MP, BP and SC respectively. The number of positive significant hybrids were 4, 15 and 12 respectively. These results are in agreement with Singh (2004)

For Pod length and number of seeds per pod exhibited highest heterosis recorded GC-4 x CGD-370 (35.79%) GC-4 x CGD-370 (32.31%) and CGD-118 x CGD-402 (33.31%) and Pusa falguni x CGD-402 (52.26%), Pusa falguni x CGD-402 (50.41%) and Pusa falguni x CGD-402 (60.45%) over MP, BP and SC respectively, out of these 20, 17 and 16 and 20,17 and 31 crosses showed significant over MP, BP and SC respectively. These finding are closely related with Sawarkar (1998) and Valarmathi and Surendran (2007) findings.
For number of pods per plant, which is main component of yield, 21, 16 and 13 hybrids manifested significant positive heterosis over MP, BP and SC respectively and CGD-370 x CGD-25 (58.24%) CGD-370 x CGD-25 (57.48) and GC-4 x CGD-402 (29.07) showed highest heterosis over MP, BP and SC respectively. Similar result are obtained by Sawarkar (1998).
The cross combinations CGD-77 x CGD-340 (16.33%),CGD-352 x CGD-25 (13.45%) and CGD-370 x CGD-352(7.86%) and CGD-370 x CGD-352 (80.94%) CGD-370 x CGD-402 (70.7%) and

Table 2 Comparative study of most promosing heterotic hybrid for green pod yield with useful and component characters showing desired heterosis.

Hybrid	Heterosis for green yield over			Useful and significant heterosis over MP for component trait	Useful and significant heterosis over BP for component trait	Useful and significant heterosis over BP for component trait
	MP	BP	SC			
Pusa falguni x CGD-370	50.11**	24.48**	20.52**	PH,PL,SP,PP,GP	PL,SP,PP,GP	PL,SP,PP,GD
GC-4 x CGD-25	63.37**	39.88**	19.43**	PH.BP.SP.PP.GP	BP,SP,PP,GP	BP,SP,PP,GP
Pusa falguni x CGD-402	34.67**	22.62**	18.53**	PL,SP,GP	PL,SP,GP	PL,SP,GP

** Signigicant at 1% level

Where, BP=Branches per plant PP=Pod per plant PL = Pod length (cm) GP=Green pod yield(g)
PH=Plant height (cm) SP=Seeds per pods

Pusa falguni x GC-4 (22.13%) exhibited highest heterosis over MP, BP and SC respectively for protein content and crude fiber content. The number of positive heterosis 16, 9 and 10 and 22, 16 and 3 for protein content and crude fiber content over MP,BP and SC respectively. Similar result obtained by Valarmathi and Surendran (2007)

The comparative study of most promosing three cross combinations for green pod yield per plant (g) with useful and component characters showing desired heterotic hybrids for green pod yield did not show all component characters in common. In fact, appreciable heterosis for one or two components was sufficient to manifest heterosis for green pod yield. The result are agreement with the findings of Patil and Shete 1987. The high heterotic effects of grain yield in these cases were mainly with significant heterotic effects of pods per plant, seed per pod, pod length and branches per plant.

The crosses of Pusa falguni x CGD-370, GC-4 x CGD-25 and pusa falguni x CGD-402 were found high heterotic hybrids for green pod yield per plant(g). They also had high heterosis for mainly yield attributing characters in desired direction. These combinations offer best possibilities of further exploitation for development of high yielding varieties.

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