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Combining Ability Analysis in Vegetable Cowpea

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ABSTRACT

Twenty one hybrids produced by diallel mating without reciprocals alongwith seven parents were evaluated for combining ability analysis in vegetable cowpea (*Vigna unguiculata* L. Walp.). Prepondarence of additive type of gene action was observed for all the characters. The best genotype on the basis of general combining ability (gca) effects and *per se* performance for pod yield and its contributing characters was Punjab-263 followed by Arka Garima. Similarly the best hybrid on the basis of specific combining ability (sca) effect and *per se* performance for pod yield was Punjab-263 x Arka Garima, followed by Punjab-263 x Gujarat-1 and GC-82-7 x Arka Garima. Hence emphasis should be concentrated to isolate desired segregants from these hybrids through pedigree method.

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INTRODUCTION

For the genetic improvement of economic characters whch are quantitative in nature and polygenically controlled, comprehensive information on the mode of inheritance is a pre-requisite. Therefore, the present study was attempted to decipher the genetic architecture of yield and its components through combining ability analysis in vegetable cowpea.

MATERIALS AND METHODS

Twenty one hybrids were produced by mating 7 parents namely, Line Selection 102, Punjab-263, Pusa Barsati, Gujarat-1, GC-82-7, Arka Garima and In-103 in a diallel fashion without reciprocals in vegetable cowpea (*Vigna unguiculata* L. Walp.). These 21 hybrids alongwith 7 parents were sown in a randomized block design with three replications during *kharif*, 1996. Each entry was accomodated in a single row of 3 m spaced at 60 cm between rows and 30 cm within rows. All the cultural practices were adopted to raise a good crop. Five competitive and random plants were evaluated for pod yield and yield contributing characters viz., days to 50 per cent flowering, dsys to first picking, number of seeds per pod, pod length (cm), leaf area cm^2 plant height (cm) and number of pods per plant. Mean data were analysed for combining ability following Griffing (1956).

RESULTS AND DISCUSSION

Mean squares due to treatments were significant for all the characters (Table 1). Mean squares due to general oombining ability (gca) and specific combining ability (sca) were also

TABLE 1

Mean squares for combining ability in vegetable cowpea.

Source	d.f.	Mean sum of squares								
		Day to 50% flowering	Dys to first picking	Number of seeds/ pod	Pod length (cm)	Leaf area (cm)	Number of branches/ plant	Plant height (cm)	Number of pods/ plant	Pod yield/ plant (gm)
Replications	2	15.155	8.583	1.740	5.223	398.555*	1.319	594.750	45.820	678.369
Treatments	27	192.839**	155.296**	6.812**	28.036**	6143.204**	7.185**	5588.555**	513.934**	5018.231**
GCA	6	133.435**	101.25**	4.02**	35.55**	3793.99**	4.20**	3763.51**	343.72**	2496.56**
SCA	21	44.52**	37.67**	1.77**	1.86**	1548.82**	1.87**	1339.80**	122.05**	1437.36**
Error	54	2.56	3.21	0.23	0.75	37.04	0.16	62.44	4.81	71.39
GCA/SCA	—	2.99	2.68	2.27	19.11	2.44	2.24	2.85	2.81	1.74

* = Significant at 5% level

** = Significant at 1 % level

TABLE 2

General combining ability effects of parental lines in vegetable cowpea.

Parents	Day to 50% flowering	Days to first picking	Number of seed/ pod	Pod length	Leaf area	Number of branches/ plant	Plant height	Number of pods/ plant	Pod yield/ plant
Line selection-102	-3.04**	-2.44**	-0.35*	-1.57**	-14.07**	-0.41**	-13.16**	8.28**	-2.02
Punjab-263	-4.78**	-4.41**	0.21	2.63**	9.14**	-0.98**	-29.42**	3.10**	32.89**
Pusa Barsati	-0.44	-0.11	1.15**	0.32	-7.71**	0.87**	4.32	-1.32	-6.88*
Gujarat-1	3.93**	3.26**	-0.24	-0.39	13.62**	0.82**	24.06**	-2.85**	-15.22**
GC-82-7	1.52**	1.19*	-1.04**	-2.46**	-5.81**	0.22	-8.31**	0.53	-12.96**
Arka Garima	5.59**	4.93*	0.18	2.59**	37.70**	-0.44**	27.84**	-11.32**	9.97*
In-13	-2.78**	-2.41**	0.11	-1.13**	-28.87**	-0.08	-5.34*	3.57**	-5.59*
S. E. (g_i) ±	0.494	0.552	0.15	0.27	1.878	0.124	2.438	0.677	2.607
S. E. (g_i-g_j) ±	0.755	0.844	0.22	0.409	2.868	0.189	3.725	1.034	3.982

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

significant (Table 2). It indicated the importance of both the additive and non-additive components for most of the characters. Excess of additive type of gene action was observed for all the characters. This is in accordance with Patel *et al.* (1964), Sawant (1995) and Hazra *et al.* (1996).

The best genotype on the basis of gca effects for pod yield and most of the yield contributing characters was Punjab-263 followed by Arka Garima. The gca effects and *per se* performance were similar (significant correlation in Table 3) for most of the characters. These findings are in close agreement with Arvindhan and Vijendra Das (1996).

The best hybrid on the basis of sca effects for pod yield per plant was GC-82-7 x Arka Garima followed by Pusa Barsati x GC-82-7, Punjab-263 x Gujarat-1 and Punjab-263 x Arka Garima (Table 4). One parent had high gca effect in these hybrids. Sawant (1995) and Madhusudan *et al.* (1995) also reported that superior hybrids had alteast one parent with high gca effect. The significant rank correlation between sca effects and *per se* performance indicated that the two estimates were similar (Table 3) for all the hybrids. Hence, more weightage should be given to *per se* performance in selection of hybrids. Interestingly, the hybrids selected on the basis of sca were similar to hybrids selected on the basis of *per se* performance, but their ranking was difference in both the criteria.

From the out going discussion, one can conclude that additive type of gene action was more prevalent than non-additive type. Secondly, hybrids Punjab-263 x Arka Garima, Punjab-263 x Gujarat-1 and GC-82-7 x Arka Garima had good promise for most of the

TABLE 3

Correlation co-efficients between *per se* performance and gca effects of the parents, *per se* performance and sca effects of hybrids in vegetable cowpea.

Characters	*r between per se and gca of parents*	*r between per se and sca of hybrids*
Days to 50% flowering	0.8068*	0.8211**
Days to first picking	0.7886*	0.8391**
Number of seeds/pod	0.6998	0.8695**
Pod	0.9811**	0.6595**
Leaf area	0.8809**	0.8394**
Number of branches/plant	0.5750	0.8060**
Plant height	0.8510*	0.7818**
Number of pods/plant	0.3821	0.8468**
Pod yield/plant	0.6297	0.8729**

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

TABLE 4

Sca effects of promising crosses for pod yield and other component traits in vegetable cowpea.

Promising crosses	*Day to 50% flowering*	*Days to first picking*	*Number of seeds/ pod*	*Pod length (cm)*	*Leaf area (cm)*	*Number of branches/ plant*	*Plant height (cm)*	*Number of pods/ plant*	*Pod yield/ plant (gm)*
$P_2 \times P_6$	2.19	2.31	0.51	1.46	-60.80**	1.13**	48.23**	1.63	42.27**
	(50.7)	(58.7)	(14.4)	(25.31)	(131.39)	(9.6)	(204.33)	(37.1)	(246.00)
$P_2 \times P_4$	-9.48**	-7.69**	0.63	0.75	32.86**	0.14	62.34**	10.56**	43.45**
	(37.3)	(47.0)	(14.1)	(21.62)	(205.04)	(9.9)	(214.67)	(54.5)	(222.00)
$P_3 \times P_5$	-1.74	0.57	-2.84**	-1.70*	20.32**	1.42**	-31.69**	16.61**	44.64**
	(47.0)	(56.3)	(10.8)	(14.79)	(151.22)	(12.4)	(122.00)	(59.50)	(185.67)
$P_5 \times P_6$	-5.44**	-1.94	2.66**	1.96*	-45.9**	1.13**	-13.88	9.80*	53.79**
	(49.3)	(60.00)	(15.3)	(20.72)	(132.22)	(10.8)	(163.33)	(42.7)	(211.67)
$P_2 \times P_7$	-2.44	-2.02	0.08	-0.25	8.29	-0.02	-9.92	3.35	22.49**
	(37.7)	(47.0)	(13.9)	(19.88)	(137.98)	(8.8)	(113.00)	(53.7)	(210.67)
$P_2 \times P_3$	-3.78**	-2.98	0.41	-0.45	-33.04**	-0.18	-15.58*	6.97**	20.12**
	(38.7)	(48.3)	(15.3)	(21.13)	(117.80)	(9.6)	(117.00)	(52.4)	(207.00)
$P_2 \times P_5$	-3.41*	-4.28**	0.46	1.87*	31.87**	1.01**	4.38	11.05**	25.86**
	(41.00)	(48.3)	(13.1)	(20.67)	(184.61)	(10.1)	(124.33)	(58.3)	(206.67)
SE (S_{ij}) ±	1.437	1.607	0.433	0.779	5.462	0.360	7.092	1.969	7.583
SE $(S_{ij} - S_{ik})$ ±	2.135	2.387	0.644	1.158	8.114	0.535	10.536	2.925	11.265
SE $(S_{ij} - S_{kl})$ ±	1.997	2.233	0.603	1.083	7.590	0.501	9.855	2.736	10.537

Figures in parentheses are mean value.

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

P_1 = Line selection-102, P_2 = Punjab-263, P_3 = Pusa Barsati, P_4 = Gujarat-1, P_5 = GC-82-7, P_6 = Arka Garima, P_7 = In-103.

characters studied. Hence, these hybrids should be studied in detail for desired segregants during subsequent generations following pedigree method or modified pedigree like single seed descent or single pod descent.

A high correlation between *per se* performance and gca effect was noticed for characters viz., days to 50 per cent flowering, days to first picking, pod length, leaf area and plant height which suggested that *per se* performance can safely be used to judge the gca effect of the parents for these characters. On the other hand a high correlation was observed between *per se* performance of the hybrid and their sca effect which also suggested that *per se* performance can also be used to judge sca effect of the hybrid.

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