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COMBINING ABILITY EN GRAIN COWPEA

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Abstract: Combining ability analysis involving two lines, six testers and 12 hybrids revealed the importance of specific combining ability for all the characters except for length of pod and days to flowering. The varieties Chharodi-1, Culture-9, V 26 and GC-82-7 were the best general combiners and the cross combinations Chharodi-1 x V 26, Chharodi-1 x Kanakamani and Culture-9 x V 322 were the best specific combinations for yield and yield attributes under partially shaded upland conditions.

Key words: Combining ability, grain cowpea, lines, testers.

INTRODUCTION

Cowpea (*Vigna unguiculata* [L.] Walp) is one of the cheapest sources of protein. It is so versatile that it always becomes an important plant in intercropping, rotation cropping and relay cropping. Moreover, identification of a new variety with high yield potential and suitability to partial shaded conditions can go a long way in extending the cultivation of this crop as a component of the coconut based farming system. Most of the present day varieties have been developed by selection by exploiting the existing variability. However, very little effort has been made for generating additional variability through hybridization. The present investigation was undertaken to assess the combining ability with respect to seed yield and other characters, nature and magnitude of gene action and to isolate high yielding genotypes with early synchronous maturity and shade tolerance.

MATERIALS AND METHODS

The material consisted of eight varieties of grain cowpea collected from the germplasm assembled at the Department of Plant Breeding, College of Agriculture, Vellayani, Trivandrum and the Regional Agricultural Research Station, Pattambi. Two well adapted and early maturing grain cowpea varieties viz., Chharodi-1, which is a high yielding short duration shade tolerant variety recommended for upland shaded conditions and Culture-9 (Krishnamani culture with brown seed coat) were used as ovule parents. Six distinct varieties viz., Kanakamani, V 240, V 322, GC-82-7, V 26 and S 488 with varying phenotypic expressions were selected based on their general performance and yield and used as testers in hybridisation programme. The eight parents and their 12 F_1 hybrids obtained by crossing them in a line x tester manner were used for the study. Field experiment was laid out in the interspace of coconut garden under partially shaded condition in RBD with three replications. Observations were recorded on yield and yield attributes. The general and specific combining ability effects were estimated based on the method described by Kempthorne (1957). The significances of lines and testers were tested against mean square due to line x tester, while the significance of line x tester was tested against mean square for error (Singh and Choudhary, 1979).

RESULTS AND DISCUSSION

The mean squares due to lines were significant for six characters viz., days to flowering, plant height, number of pods per plant, pod length, 100 seed weight and percentage of pod borer infestation, whereas variation due to testers showed significant differences only for the character pod length. The interaction between line x tester was significant for most of the characters except days to flowering, pod length and pod borer incidence.

The estimates of variance due to gca was greater than sca for days to flowering and length of *pod,* indicating the importance of gca for these characters. For all other attributes, the sca variance was greater in magnitude than gca variance, denoting the predominance of sca for these characters.

Table 1. Best general combiners and specific combination for eleven characters

Sl. No.	Character	Best general combiner				Best specific combination	
		Line	gca effect	Tester	gca effect	Hybrid	sca effect
i	Days to flowering	Culture-9	-0.78*	V 240	-0.56	Culture-9 x V 240	-0.58
2	Days to maturity	Culture-9	-0.50	V 26	-1.61**	Chharodi-1 x V 26	-1.56
3	Plant height : tallness dwarfness	Chharodi-1 Culture-9	6.18** -6.18**	S 488 V 26	7.97** -5.71**	Culture-9 x S 488 Chharodi-1 x S 488	4.98** -4.98**
4	No. of branches /plant	Chharodi-1	0.06	V 240	0.72**	Chharodi-1 x V 26	0.59**
5	No. of pods / plant	Chharodi-1	3.55**	V 26	3.01**	Chharodi-1 x V 26	3.63**
6	Length of pod	Culture-9	0.75**	Kanakamani	1.80**	Culture-9 x Kanakamani	0.85
7	No. of seeds / pod	Chharodi-1	0.79**	Kanakamani	1.59**	Culture-9 x Kanakamani	2.04**
8	100 seed weight	Culture-9	1.43**	GC-82-7	0.71**	Chharodi-1 x Kanakamani	0.96*
9	Seed yield / plant	Chharodi-1	1.91**	V 26	2.39**	Culture-9 x V 322	4.13**
10	Chlorophyll 'b'	Culture-9	0.03	GC-82-7	0.13*	Chharodi-1 x Kanakamani	0.11
11	Pod borer	Chharodi-1	-2.02*	V 322	-1.01	Culture-9 x S 488	-1.87

* Significant at 5 per cent level ; ** Significant at 1 per cent level

The best line and tester with high general combining ability and specific combination for each character are given in Table 1. It was found that the line Culture-9 was the best general combiner for early flowering, early maturity, dwarfness, length of pod, 100 seed weight and chlorophyll `b' content, Chharodi-1 was the best general combiner for tallness, number of branches per plant, number of pods per plant, number of seeds per pods, seed yield per plant and low pod borer incidence.

Among testers, it was seen that the variety V 26 was the best general combiner for early maturity, dwarfness, number of pods per plant and seed yield per plant. The variety GC-82-7 was the best general combiner for 100 seed weight and chlorophyll `b' content. For early flowering and number of branches per plant the variety V 240, and for length of pod and number of seeds per pod the variety Kanakamani were the best general combiners.

Some of the best specific combinations were Chharodi-1 x V 26 for early maturity, number of branches per plant and number of pods per plant, Culture-9 x Kanakamani for length of pod and number of seeds per pod and Chharodi-1 x Kanakamani for 100 seed weight and chlorophyll `b' content.

For seven out of eleven characters studied for combining ability, the best specific combination involved at least one of the best general combiners. A critical examination of the performance of parents and crosses showed that crosses having the highest sca effects for different characters involved parents with high x low and low x low gca effects of which high x low combinations were more frequent.

Similar results were observed in blackgram (Rajarathinam and Rathnasamy, 1990) and in pea (Singh and Singh, 1990). to the crosses involving high x low combinations, generic interactions might be of additive x dominance type and gca effect played an important role in the expression of positive and significant sca effects (Singh *et al.*, 1987). However, in hybrids significant sca effects associated with low x low performers reflected non-additive type of gene effects, hence these hybrids could be exploited for heterosis breeding (Singh and Singh, 1990).

The study in general indicated that in view of the preponderance of non-additive gene action for seed yield and some important yield components commercial exploitation of hybrid vigour is the most appropriate method of utilizing such gene action. The varieties Chharodi-1, Culture-9, V 26 and GC-82-7 and cross combinations Chharodi-1 x V 26, Culture-9 x V 26, Culture-9 x Kanakamani and Chharodi-1 x Kanakamani can be given due consideration while formulating future breeding programmes.

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