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COMBING ABILITY AND INHERITANCE STUDIES IN COWPEA (*Vigna unguiclata* (L.) *Walp.*)

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ABSTRACT

In a six parent diallel cross in cowpea, the combining ability studies revealed ıat both the additive and non-additive gene effects were important for plant height, ranches plant, clusters plant, pods plant, pod length, seeds pod, 100 seed weight nd yield plant. The cultivars Co4, EC 164370 and EC 170777 were the best general ombiners on the basis of their gca effects. Components of variance analysis revealed ıat non-dditive effects were preponderant for the characters except pod length. liparental mating system was suggested for the improvement of cowpea.

KEY WORDS: Cowpea, diallel, combining ability, gene action.

Cowpea (*Vigna unguiculata* (L) Walp.) is one of the important pulse crops of India. The information on the genetics and combining ability studies on this crop are very little. The present study, was therefore, carried out to know the pattern of inheritance of different characters and combining ability of parents and crosses for different characters from the diallel analysis.

MATERIALS AND METHODS

Six genotypes of cowpea viz. TVu 3661, EC 170767. EC 160370, EC 170777 (IITA, Ibadan, Nigeria), Co 4 and NPRC 2 (Tamil Nadu) were selected for the present study. All possible crosses (excluding reciprocals) were attempted during summer 1986. The resultant 15 F1 s. along with their six parents were grown in a randomized block design with three replications during Kharif 1986 at the National Pulses Research Centre, Pudukkottai, Tamil Nadu. The seeds were sown in single rows of 4.5 m long, 45 cm apart with plant to plant spacing of 15 cm. Observations were recorded on five random and competitive plants for plant height, number of primary branches / plant, number of clusters/plant, number of pods/plant, pod length, number of seeds/pod, 100 seed weight and seed yield/plant. The combining ability analysis was done following Griffings' (1956) model I method II and components of variance using Hayman (1954).

RESULTS AND DISCUSSION

The data on analysis of variance for all the charcters are given in Table 1. The analysis of variance for combining ability revealed that both general

Table 1. Combining ability analysis for yield and yield components in cowpea.

Source	df	Mean sum of squares							
		Plant height.	Branches/ plant	Clusters plant	Pods/plant	Pod length	Seeds/pod	100 seed weight	Yield/plant
g c a	5	1648.193**	2.526**	10.534**	39.841**	37.024**	2.607**	11.809**	75.720**
s c a	15	622.997**	0.996**	12.292**	26.406**	2.531**	1.846**	3.315**	143.819**
Error	40	12.201	0.049	0.227	0.533	0.181	0.184	0.034	1.944

* Significant at 5% level ** Significant at 1% level

Table 2. General combining ability effects in a 6 x 6 diallel in cowpea.

Parents	Plant height	Branches/ plant	Clusters plant	Pods/plant	Pod length	Seeds/pod	100 seed weight	Yield/plant
TVu 3661	-16.527**	-0.497**	1.043**	1.429**	-3.252**	-0.509**	-1.379**	-2.181**
Co 4	18.030**	0.965**	0.126	0.666**	-0.098	0.219	1.075**	4.630**
EC 170767	15.509**	-0.576**	-1.569**	-1.637**	3.405**	0.144	-0.604**	-3.269**
EC 164370	-6.502**	0.215**	-0.015	-0.129	-0.715**	-0.843**	1.304**	1.818**
EC 170777	1.593	-0.143*	1.418**	2.970**	-2.777**	0.269	-1.241**	1.322**
NPRC 2	-12.102**	0.036	-1.002**	-3.300**	0.663**	0.719**	0.845**	-2.319**
G (i)	1.127	0.071	0.153	0.235	0.137	0.138	0.059	0.450

* Significant at 5% level ** Significant at 1% level

Table 3. Specific combining ability effects in a 6 x 6 diallel in cowpea.

Crosses	Plant height	Branches/ plant	Clusters/ plant	Pods/plant	Pod length	Seeds/pod	100 seed weight	Yield/plan
TVu 3661 x Co 4	10.265**	-0.060	-1.801**	-3.181**	-0.047	0.383	0.599**	-6.532**
TVu 3661 x EC 170767	-19.347**	0.048	1.194**	2.655**	-3.717**	-0.307	-0.654**	2.567*
TVu 3661 x EC 164370	-5.267*	0.189	0.207	5.780**	0.102	0.279	-1.663**	2.579*
TVu 3661 x EC 170777	-9.263**	-0.118	1.273**	-0.885**	-0.409	1.267**	-0.350**	-3.157**
TVu 3661 x NPRC 2	7.565**	1.202**	6.761**	4.918**	1.190**	1.217**	1.961**	15.983**
Co 4 x EC 170767	18.361**	0.385*	-1.388**	-0.781	0.361	0.529	-1.308**	-3.211**
Co 4 x EC 164370	50.173**	1.394**	5.823**	8.510**	0.582	1.217**	1.982**	25.033**
Co 4 x EC 170777	32.711**	1.219**	6.257**	10.010**	0.369	2.404**	-1.471**	23.263**
Co 4 x NPRC 2	6.673**	-0.293	-1.588**	-2.385**	-0.530	0.088	-0.558**	-7.928**
EC 170767 x EC 164370	10.794**	2.380**	1.719**	0.680	0.744	1.125**	2.328**	3.567**
EC 170767 x EC 170777	-1.201	0.560**	0.886*	3.747**	-0.701	-0.386	2.474**	5.329**
EC 170767 x NPRC 2	0.494	0.748**	-0.692*	-0.948	-1.134**	-0.303	0.286*	1.371
EC 164370 x EC 170777	-27.822**	1.402**	-1.167**	-4.927**	1.786**	-0.566	-0.667**	-6.124**
EC 164370 x NPRC 2	-12.559**	-0.410*	-1.247**	-1.056**	1.519**	0.983**	-3.954**	-6.149**
EC 170777 x NPRC 2	-3.988	-0.318*	-1.47**	-2.556**	-0.340	0.438	1.457**	0.079
S (ij)	2.556	0.162	0.348	0.534	0.312	0.314	0.135	1.020

* Significant at 5 % level ** Significant at 1 % level

combining ability *(gca)* and speciific combining ability *(sca)* effects were significant for all the charcters indicating both additive and non-additive gene action were important for these characters. Similar results were reported by Ramanujam (1977), Nagaraja Rao and Mahboob Ali (1984) and Wilson et al. (1985) in greengram. Sandhu et al., (1981),reported non-additive gene action for clusters/ plant and pods/ plant in blackgram.

The estimated gca effects of parents for different characters are giveen iin Table 2. Among the best combiners were TVu 3661, NPRC and EC 164370 for plant height, CO 4 and EC 164370 for branches/plant and TVu 3661 and EC 170777 for clusters/plant. Good combiners for pods/plant were EC 170777, TVu 3661 and Co 4. EC 170767 and NPRC 2 were good combiners for pod length andNRC 2 for seeds/pod. CO 4, EC 164370 and NPRC 2 were good combiners for 100 seed weight. Good combiners for yield were Co 4, EC 164370 and EC 170777.

The estimates of sca effects are presented in Table 3. Among the specific combinations Co 4 xEC 164370 and CO 4xEC 170777 were found to be best for grain yield and also for branches/plant, clusters/plant, pods/ plant and seeds/pod. It is interesting that these crosses involved one or both parent which was a good combiner for branches/plant, clusters/plant, pods/ plant and 100 seed weight. These are considered most potent components of yield. The cross EC 164370 xEC 170777 was best for dwarfness and also a good specific combination for branches/plant and pod length.The crosses EC 170767x EC 164370 and EC 170767 x EC 170777 were good specific combination for 100 grain weight. The best two hybrids for most of the characters (Co 4 xEC 164370 and Co 4x EC 170777), generally involved parents Co 4, EC 164370 and EC 170777.

These studies indicate that the parents Co 4, EC 164370 and EC 170777 can be used in the crossing programme for yield improvement in cowpea.

The components of variance studies (Table 4) revealed that additive component was not significant for plant height, clusters/plant and yield/plant. For branches/plant, pods/plant, pod length, seeds/pod and 100 grain weight both additive (D) and dominance (H1 and H2) components of variance were significant and important, whereas for yield/plant only dominance type of gene action was important. Sandhu *et al.* (1981) reported similar results for yield/plant in urd bean. The mean degree of dominance given by the ratio $[\frac{H_1}{D}]^{\frac{1}{2}}$ were in the overdominance range for all the characters except pod length. This confirms the importance of dominance effects in the expression of these charcters. The estimates of H2 showing variation due to non-additive effects corrected for gene distribution was less than H1.Also, the ratio H2/4H1deviated from 0.25, suggesting asymmetry in distribution of positive and negative alleles. The h2 being postive and significant for branches/plant, clusters/plant, pods/plant,seeds/pod and yield/plant revealed that these characters were mostly governed by dominant genes with positive effects. The heritability estimates in narrow sense were very high for all the characters. However, non-addiitive variance being predominant for most of the characters, it is suggested that biparental mating system should be followed for creation of more variability and breaking undesirable linkages, and then purelines can be developed by pedigree method.

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YIELD, WATER USE AND NUTRIENTS UPTAKE OF WHEAT AS INFLUENCED BY SOWING TIME, IRRIGATION AND NITROGEN LEVELS.

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ABSTRACT

A field experiment was conducted at the Research Farm of Indian Institute of Technology, Kharagpur, India to evaluate the effects of nitrogen and irrigation levels under different sowing times on wheat during winter seasons (November-March) of 1978-79 and 1979-80. The grain yield was highest when sowing was done during the second fortnight of November. Delaying the sowing beyond 30th November resulted in decreased yields. Early sowing also produced significantly less yield as compared to normal sowing time. Grain yield increased significantly upto 100 kg N/ha. Irrigations scheduled at 0.8 IW/CPE ratio recorded the highest grain yield. Nitrogen uptake was maximum when sown at normal time. Water-use efficiency (WUE) decreased with increase in IW/CPE ratio from 0.8 to 1.0. Nonetheless, relatively more moisture was extracted from the upper layer at 1.0 IW/CPE ratio as compared to 0.6 and 0.8 ratios. However, soil moisture extraction from deeper layer was comparatively more under 0.6 IW/CPE than under 0.8 and 1.0. Application of nitrogen favoured the extraction of soil moisture from deeper layer.

KEY WORDS: Winter wheat, Sowing time, Nitrogen uptake, water use Efficiency, Grain yield.

Optimum time of sowing, one of the most important factors in influencing the crop yield, primarily depends on the residual moisture retained after the harvest of the preceding crop, the temperature at the time of sowing and suitability of climatic condition during growth. The main objective of irrigation is to minimize yield reduction due to water deficit. However, irrigation water is a limited resource and therefore, irrigation practices must be rationalized for higher water-use efficiency. It appears that frequent irrigations after pre-