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DIALLEL ANALYSIS FOR FODDER YIELD AND ITS COMPONENTS IN COWPEA

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ABSTRACT

Diallel analysis conducted in six genotypes of cowpea revealed that additive gene action for the expression of days to flowering, number of leaves, leaf area index, specific leaf weight, green fodder yield, dry matter yield and leaf:stem ratio and non-additive gene action for plant height, number of branches and crude protein content. Among the parents, UPC 9202, UPC 9103 and CO 5 were found to be the best combiners. The crosses UPC 9202 x CO 5 and UPC 9103 x CO 5 were found to be the best specific combiners for green fodder and dry matter yield.

KEY WORDS : Cowpea, Fodder yield, Additive Gene Action

Cowpea (*Vigna unguiculata* (L.) Walp.) is an important leguminous forage crop. An understanding of combining ability is important before systematic breeding action for crop improvement is initiated. Combining ability helps in identifying the parents which could be used for hybridisation programme to provide superior genotyes in the segregating generations. The present work was, therefore, undertaken to study the general and specific combining ability effects in a 6 x 6 diallel cross involving cowpea genotypes.

MATERIALS AND METHODS

Six geographically diverse genotypes (CS 98, IFC 901, UPC 9202, C 152, UPC 9103 and CO 5) constituted the experimental materials for the present study. The 30 F_1 hybrids (direct and reciprocals) and 6 parents were grown in a randomised block design with three replications during summer 1994 in the Agricultural College and Research Institute, Killikulam. A spacing of 45 x 20 cm was adopted and the crop was grown under irrigation. Five plants were selected at random form each row and observations were recorded for days to flowering, plant height, number of leaves, leaf area index, specific leaf weight, number of branches, green fodder yield, dry matter yield, leaf;stem ratio and crude protein yield. The analysis of variance of the data for combining ability and estimation of various effects was done following the method I and model I of diallel analysis (Griffing, 1956).

RESULTS AND DISCUSSION

The analysis of variance for combining ability revealed that variances due to general combining ability (GCA) and the specific combining ability (SCA) were significant for all the traits (Table 1). The traits such as days to flowering, number of leaves, leaf area index, specific leaf weight, green fodder yield, dry matter yield and leaf : stem ratio showed high GCA:SCA ratio (above one), indicating that additive gene action governs them. For the traits, plant height, number of branches and crude protein content, the GCA:SCA ratio was found to be below one indicating the predominance

Table 1. Analysis of variance for combining ability for 10 traits in cowpea

Source	df	Mean squares									
		Days to flowering	Plant height	Number of leaves	Leaf area index	Specific leaf weight	Number of branches	Green fodder yield	Dry matter yield	Leaf : stem ratio	Crude protein content
GCA	5	9.003**	47.795**	153.790**	1.345**	0.757**	7.058**	6944.250**	249.552**	0.565**	6.130**
SCA	15	1.599**	133.731**	72.656**	0.628**	0.210**	13.306**	3503.194**	74.201**	0.122**	18.656**
RCA	15	4.337**	2.541**	2.654**	0.033**	0.001	1.477**	238.387**	0.484**	0.008**	0.097**
Error	70	0.148	0.043	0.392	0.001	0.001	0.465	2.815	0.037	0.001	0.040
GCA/SCA		5.63:1	0.36:1	2.12:1	2.14:1	3.60:1	0.53:1	1.98:1	3.36:1	4.63:1	0.33:1

** - Significant at 1 per cent level

Table 2. **Estimates of general combining ability effects of parents for 10 traits in cowpea**

	Days to flowering	Plant height	Number of leaves	Leaf area index	Specific leaf weight	Number of branches	Green fodder yield	Dry matter yield	Leaf : stem ratio	Crude protein content
CS 98	-0.65**	-0.96**	3.65**	-0.45**	-0.22**	-0.26	-23.65**	- 2.79**	0.10**	-2.41**
IFC 901	-0.01	-1.31**	-1.32**	-0.16**	0.23**	-0.23	-9.13**	-3.04**	-0.27**	0.01
UPC 9202	-0.20*	1.75**	-4.11**	0.24**	0.05**	-0.49**	0.30	1.98**	-0.18**	-0.90**
C 152	-0.65**	-0.78**	-1.69**	0.05**	-0.23**	-0.89**	-11.28**	-1.18**	-0.05**	0.74**
UPC 9103	-0.18	-1.88**	-1.67**	0.49**	0.35**	1.06**	- 2.27**	-3.36**	0.07**	1.39**
CO 5	1.69**	3.18**	5.14**	-0.17**	-0.18**	0.82**	46.02**	8.36**	0.34**	1.16**
SE (gi)	0.10	0.05	0.16	0.01	0.01	0.18	0.44	0.05	0.01	0.03

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

of non-additive gene action (Table 1). These results are in agreement with those published earlier for days to flowering (Sawant, 1994), green fodder yield and dry matter yield (Vijay Pal, 1989), plant height (Sanghi and Kandalkar, 1991), number of branches (Thiyagarajan *et al.*, 1990) and crude protein content (Gupta, 1982).

In addition to information on gene effects, combining ability analysis also helps in identifying the better combining parents and in selecting best specific cross combinations. The *gca* effects for parents and *sca* effects of hybrids are presented in Tables 2 and 3. UPC 9202 had positive *gca* effects for plant height, leaf area index, green fodder yield and dry matter yield. CO 5 was having higher *gca* effects for all the characters except leaf area index and specific leaf weight. UPC 9103 had positive *gca* effects for leaf area index, specific leaf weight, number of branches, leaf;stem ratio and crude protein content. Among the parents, CO 5, UPC 9103 and UPC 9202 appeared to be good combiners on the basis of significant *gca* effects for fodder yield and its components. In order to synthesize a dynamic population with most of the favourable genes it will be pertinent to make use of the above parents in a multiple corssing programme. The crosses UPC 9103 x CO 5 (number of leaves and leaf: stem ratio), UPC 9202 x CO 5 (green fodder and dry matter yields), IFC 901 x C 152 (number of branches and crude protein content), CS 98 x C 152 (plant height), IFC 901 x UPC 9103 (days to flowering and crude protein content) and CS 98' x UPC 9103 (leaf area index) of the present study showed the highest *sca* effects.

The high *sca* effects represent dominance and epistatic components of variation which are non

Table 3. **Estimates of specific combining ability effects of direct crosses for 10 traits in cowpea**

Cross	Days to flowering	Plant height	Number of leaves	Leaf area index	Specific leaf weight	Number of branches	Green fodder yield	Dry matter yield	Leaf : stem ratio	Crude protein content
$P_1 \times P_2$	0.12	-7.58**	1.80**	-0.36**	-0.26**	-3.40**	6.02**	3.54**	0.13**	0.24**
$P_1 \times P_3$	-0.52*	-4.88**	9.56**	-0.44**	0.11**	-0.74	4.84**	-1.25**	0.20**	0.50**
$P_1 \times P_4$	-0.24	14.59**	-2.73**	0.39**	0.25**	2.37**	46.32**	-1.79**	0.14**	-0.27**
$P_1 \times P_5$	-0.21	0.89**	4.35**	1.21**	-0.35**	2.66**	25.38**	7.83**	-0.18**	-0.13
$P_1 \times P_6$	0.76**	7.92**	2.57**	-0.29**	0.15**	2.12**	- 11.90**	-4.36**	-0.12**	-0.11
$P_2 \times P_3$	-0.49*	1.08**	3.33**	0.47**	0.26**	0.03	- 7.84**	1.16**	0.00	-1.49**
$P_2 \times P_4$	-0.88**	2.43**	1.00**	-0.26**	-0.17**	3.29**	11.34**	3.59**	-0.44**	3.62**
$P_2 \times P_5$	1.31**	6.93**	-0.19	-0.06**	0.76**	1.61**	23.25**	-1.54**	0.15**	-0.01
$P_2 \times P_6$	0.79**	2.40**	-2.33**	0.47**	-0.18**	0.07	-21.39**	-7.85**	-0.03*	-0.90**
$P_3 \times P_4$	-0.02	6.44**	-0.67	0.40**	-0.06**	0.45	- 8.56**	5.08**	0.16**	0.63**
$P_3 \times P_5$	0.34	3.54**	5.16**	-0.30**	-0.02	1.57**	2.06*	-7.28**	-0.49**	-1.14**
$P_3 \times P_6$	0.81**	5.73**	-2.72**	-0.10**	-0.05**	1.00*	56.93**	10.21**	-0.02	2.32**
$P_4 \times P_5$	-0.21	-6.20**	3.04**	-0.24**	0.09**	-0.35	- 5.10**	-1.88**	0.13**	0.80**
$P_4 \times P_6$	1.26**	-0.08	2.01**	0.65**	0.10**	-1.19**	38.86**	2.63**	0.01	-1.84**
$P_5 \times P_6$	-1.71**	1.11**	9.86**	0.21**	0.29**	1.51**	38.51**	8.12**	0.45**	2.70**
S.E.(Sij)	0.23	0.12	0.38	0.01	0.02	0.41	1.00	0.12	0.01	0.07

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

... FC 901; P : UPC 9202; P_4 : C 152; P_5 : UPC 9103; P_6 : CO 5 fixable in nature. The crosses showing high *sca* effects are expected to throw desirable segregants in subsequent generations. So they may be used in a breeding programme (Natarajan *et al.,* 1989). The crosses UPC 9202 x CO 5 and UPC 9103 x CO 5 were found to be the best specific combiners for green fodder and dry matter yields. In the present study, the cross UPC 9103 x CO 5 recorded higher *sca* effects for six traits out of the ten studied *viz.,* number of leaves, specific leaf weight, green fodder yield, dry matter yield, leaf:stem ratio and crude protein content. The estimation of genetic variation influences breeding methodologies. From this study it is inferred that for the improvement of traits governed by additive gene action, the simple progeny selection in the pedigree method of breeding may be adopted for the exploitation of additive genes. On the other hand, for characters, where predominance of non-additive genetic component has been found, breeding methods like modified recurrent selection or repeated crossing in segregating generations may prove useful in pooling up the desirable genes in one genotype by simultaneousuly exploiting non-additive variance.

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STABILITY OF GRAINYIELD IN PEARL MILLET

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ABSTRACT

Five male steriles, 3 inbreds, 30-3 - way cross, 120 double cross and 6 varietal cross hybrids of pearl millet were evaluated under three environments with two replications. Highly significant genotype X environment interactions were recorded, the hybrids being more stable than parents. Eleven single cross, 23 three-way cross, 93 double cross and 5 varietal cross hybrids were with average stable performance.

KEY WORDS : Stability, Pearlmillet, G X E interaction

Pearl millet (*Pennisetum glaucum* (L.) R.Br.) is one of the important cereal crops in India. Several hybrids have been successfully released and found superior with respect to stability and productivity. Advancement in diversification of parents and their hybrids in pearlmillet is a contineous process and in heterosis breeding, information on stability of newly developed parents and behaviour of hybrids under different environments is quite important. The present study provides information on the lines of pearl millet and their hybrids, and its utility in breeding programme.

MATERIALS AND METHODS

Five male sterile lines (MS 732A, 861A, ICMA 1, 862A, and 302A) were mated with three inbred lines (Pt 811/9, Pt 1650 and Pt 2086) in line X tester design and 15 single cross hybrids were obtained. For the production of three - way cross hybrids, 15 Fl's were used as female parents and 3