Sciences and Professor A.N. Mourya, The Head, Department of Horticulture, I.A.S. Banaras Hindu University, Varanasi for kindly providing facilities and and excellent suggestions. The author is grateful to U.G.C. for providing financial assistance.

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(Received : September 1995 Revised : January 1996)

Madras Agric. J., 83(9): 573-575 September 1996
https://doi.org/10.29321/MAJ.10.A01057

COMBINING ABILITY IN WINTER SORGHUM

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ABSTRACT

The nature of gene action through combining ability analysis for grain yield and its components was studied in 5 X 5 diallel cross of sorghum. Estimates of *gca* and *sca* indicated the influence of both additive and non additive gene action for the inheritance of grain yield, stem girth and plant height. The cultivar SPV-462 was the best general combiner for all the traits under study. The best specified crosses *viz.*, SPV-462 X M35- 1, SPV-472 X Moti, SPV-913 X M35-1 and M35-1 X Moti for grain yield resulted from non-additive gene action could be utilised in heterosis breeding programme.

KEY WORDS : Sorghum, Combining Ability, GCA, SCA

Genetic information about the combining ability of parents and the nature of gene action involved in the inheritance of a trait would be of immense value to breeders in the choice of suitable parents and to identify potential crosses of practical use. As limited variability existed among the winter genotypes of sorghum (*Sorghum bicolor* (L.) Moench) the investigation has been taken up with kharif and winter genotypes to produce better recombinants and evaluate the nature and extent of gene action controlling the inheritance of yield and its components.

MATERIALS AND METHODS

The material comprises of five improved genotypes *vis.*, SPV- 462, SPV-472, SPV-913, *Kharif* genotype), M35-1 and Moti (winter genotypes). A diallel cross (excluding reciprocals) among these genotypes were made during winter. The resulting ten crosses along with their parents were sown at Agricultural Research Station, Madhira during winter 1989 in a randomised complete block design replicated thrice. Each entry was represented by a single row of 5m length with 45m X 15m of spacing. All the recommended package of practices were adopted. Data were recorded on five randomly selected plants in each entry on plant height, stem girth, leaf area, panicle length, panicle girth and yield/plant. The combining ability analysis was carried out following the procedure of Griffing (1956).

RESULTS AND DISCUSSION

The analysis of variance (Table 1) for six characters revealed significant differences between the genotypes, indicating wide diversity in the

Table 1. Analysis of variance for different character (5 x 5 diallel)

Source of Variation	df	Plant height (cm)	Stem girth (cm)	Leaf area (cm)	Panicle length (cm)	Panicle girth (cm)	Yield per plant (g)
Blocks	2	835.35*	0.049*	10434.55*	15.03*	1.41*	63.48
Genotypes	14	698.53*	0.051*	15209.22*	11.62*	1.27*	216.12**
Parents	4	574.41*	0.020	13984.41*	5.74	0.71	320.75**
Fl's	9	540.44*	0.062*	16069.70*	12.67*	1.35*	57.54*
Parents vs Fl's	1	2617.90*	0.060*	12364.60*	25.70*	2.77*	1224.71*
Error	28	240.26	0.012	5262.77	4.95	0.40	37.41
gca	4	1132.18**	0.086**	43179.40**	27.63**	3.15**	245.33**
sca	10	195.10	0.024**	2163.42**	2.26	0.20	72.86**
Error	28	28.75	0.004	1754.26	1.65	0.13	12.47

* and ** Significant at 0.05 and 0.01 levels of probability, respectively

material. The significance of variance due to parents us F1 suggested, presence of heterosis in the 'Fls' for all the traits. However, the variance among the parents was significant for platn height, eaf area and grain yield. Gca variances were significant for all the characters studied, while Sca variance was significant for stem girth, leaf area, and grain yield. Variance was higher for *gca* than *sca* for all the characters.

The mean sum of squares due to genotypes were partitioned into general and specific combining ability. General combining ability is largely attributed to the additivity of gene effects, while specific combining ability is associated with inter action effects, which may be due to dominance and/or epistasiss.

The relative importance or *gca* and *sca* for grain yield components was reported by Kambal and webster (1965), Liang (1967), Swarna Latha and Rana (1988). Shinde and Kulkarni (1984), Sharma and Bhalla (1993) and Kandalkar and Nigam (1993) observed in favour of predominant *gca* for yield and yield association. The present study also revealed the predominant estimates of general combining ability for all the characters indicating presence of additive gene effects. Specific combining ability was found significant for grain yield and stem girth suggesting the importance of both additive and non additive gene effects for these traits. Hence, the breeding methods like biparental mating, recurrent selection and selective diallel mating may be useful and help in the increase of genetic recombination and the frequency of favourable alleles.

The estimates of *gca* effects and perse performance for parents (Table 2) revealed that SPV-462 was the best general combiner and contributed maximum favourable genes for all the traits under study except plant height. The other parents proved to be good general combiners on the basis of their desirable *gca* effects and performance for specific characters were SPV-472 for plant height and leaf area, and SPV-913 for panicle length. Hence use of this line through conventional breeding methods will be of great value.

Per se performance of *sca* effects of the crosses presented in Table 3, revealed that out of 10 crosses only four crosses *viz.*, SPV-462 X M 35-1, SPV-472 X Moti, SPV-913 X M 35-1 and M 35-1 X Moti were significant for *sca* effects for high yield. All those crosses involved either both or one

Table 2. General combining ability effects and mean performance of parents for six characters in sorghum

Parents	Plant Height (cm)		Stem girth (cm)		Leaf area (cm^2)		Panicle length (cm)		Panicle girth (cm)		Yield per plant (g)	
	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca
SPV - 462	180.6	1.70	1.6	0.087	415.6	48.03**	24.7	1.073*	14.7	0.509**	53.0	5.84**
SPV - 472	185.3	8.70**	1.5	0.004	410.8	41.92**	20.2	0.223	12.2	0.215	45.4	0.49
SPV - 913	210.4	-6.96	1.3	0.020	390.2	-18.26	19.5	1.078*	10.0	-0.144	23.6	-2.2
M35 - 1	215.3	-6.83	1.7	-0.047	420.4	-42.20*	18.5	-1.345	16.8	-0.192	44.2	-2.3
Moti	190.5	3.39	1.4	-0.061**	395.4	-29.49*	22.4	-0.583	9.8	-0.388	22.4	
S.E. (gi) ±		3.04		0.021		14.16		0.434		0.123		

Table 3. Specific combining ability effects and mean performance of crosses for six traits in sorghum

Crosses	Plant Height (cm)		Stem girth (cm)		Leaf area (cm^2)		Panicle length (cm)		Panicle girth (cm)		Yield per plant (g)	
	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca
SPV - 462XSPV 472	183.5	7.15	1.6	0.04	420.6	5.62	24.2	-0.16	13.4	-0.40	48.4	0.75
SPV 46XSPV 913	195.4	12.[illegible]	[illegible].5	0.08	415.3	24.56	22.4	2.14	12.3	0.43	40.3	-1.85
SPV 462X M35-1	205.2	21.68**	[illegible]	[illegible]	425.8	55.54	24.0	1.83	14.4	0.75	50.6	6.83*
SPV 462 X Moti	182.3	-1.95	1.4	-0.0[illegible]	390.4	56.06	23.8	0.28	13.0	-0.20	34.0	-3.09
SPV 472 X SPV 913	190.3	18.71*	1.6	0.13*	415.3	66.51	21.3	1.67	12.2	0.40	41.2	6.09
SPV 472 X M35-1	186.6	7.38	1.4	-0.07	405.7	-0.45	20.5	-0.14	14.6	0.25	43.4	2.16
SPV 472 X Moti	182.7	6.35	1.8	-0.06	420.4	-44.95	23.4	0.14	11.3	0.24	48.5	11.56**
SPV 913 X M 35-1	202.4	-12.97	1.7	0.15**	430.2	-24.63	19.0	-0.21	12.8	-0.23	38.0	7.27*
SPV 913 X Moti	192.3	4.00	1.4	-0.01	395.4	8.76	21.3	-0.01	11.4	-0.10	40.0	-0.45
M 35 -1 X Moti	195.6	6.28	1.6	-0.13	428.6	-28.99	23.4	-0.11	15.3	0.48	42.3	8.02*
SEM (Sij - Sik)		11.77		0.08		54.84		1.68		0.48		4.63
SEM (sij - Skl)		10.74		0.07		57.06		1.54		0.44		4.23

* and ** Significant at 0.05 and 0.01 levels of probability, respectively

parent with low *gca* indicating the expression of yield is the result of non-additive interallelic interaction. Hence, these association could provide valuable guidelines for the development of varieties as well as hybrids for future breeding programme for *rabi* sorghum.

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(Received : November 1995 Revised : September 1996)

Madras Agric. J., 83(9): 575-578 September 1996

NATURE OF GENE ACTION FOR YIELD AND YIELD COMPONENTS IN PIGEONPEA

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ABSTRACT

Study on nature of gene action in pigeonpea for quantitative characters in sets of two crosses revealed the presence of additive gene action for all the characters except number of secondary branches in one cross. Among the interaction effects, additive x additive and additive x dominance interactions were found to play a major role than dominance x dominance interaction. Duplicate type of epistasis was observed for all the traits except for number of secondary branches and days to 50 per cent maturity. Varying nature of gene action from cross to cross indicated that reciprocal recurrent selection will be the suitable breeding programme for further improvement.

KEY WORDS : Pigeonpea, Yield, Yield Components, Gene Action

Pigeonpea [*Cajanus cajan* (L.Millp.)] is one of the most important legumes, cultivated in a wide range of tropical and subtropical environments. Devel[illegible] of [illegible]