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GENETIC ANALYSIS OF GRAIN SIZE AND OTHER CHARACTERS OF SORGHUM

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Six genotypes of sorghum were crossed in half diallel fashion. Combining ability analysis indicated that E35-1 was a desirable combiner for days to 50% bloom, grain yield and 1000-grain weight. E35-1 x Vidisha 60-1 and E35-1 x GJ 108 were identified as desirable crosse for grain yield and 1000 - grain weight respectively.

Recently released sorghum hybrids and varieties in India are significantly superior than the indigenous varieties for grain yield. Bold and lustrous grain get a premium in market. Indigenous varieties have bolder grains than the high yielding varieties. Hence, there is a need to incorporate boldness of grains in the forthcoming varieties. Present investigation was aimed to identify parental lines which could act as desirable combiners for grain size coupled with grain yield and some of the agronomic attributes.

MATERIALS AND METHODS

In the rainy season of 1980, six genotypes of sorghum were crossed in all possible ways except reciprocals. Vidisha 60-1 and E35-1 are bold grained, tall statured indigenous cultivars from Madhya Pradesh and Ethiopia

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respectively. Rest of the four parental lines were of derivative origin. CSV2 (IS 3922 x Karad local) and GJ 108 (Surat 1 x Nursery 108) are bold grained derivatives of Indian x exotic origin. CSV 4 (IS3675 x IS3541) has medium sized pearly white grains which are mould resistant. It has a zerazera background. Zerazeras are known for grain quality in Africa. 2077B (IS2046 x 3677B) is midtall genotype with bold grains which are susceptible to grain moulds.

Fifteen F_1 s and six parents were planted in the rainy season of 1981 at Research Farm, College of Agriculture, Indore. Experimental material was planted in a randomized block design with 2 replications. Plot size comprised of a single row 3m long spaced 45 cm apart. Observations were recorded on 5 competitive plants of each genotype on days to 50% flowering, plant height (cm), number of leaves/plant grain yield plant (g) and 1000-grain weight (g).

Data were subjected to analysis followed Griffing's (1956) model I and method 2.

RESULTS AND DISCUSSION

It seems that for grain size natural and human selection pressures acted in opposite directions. This is true at least with reference to sorghum. Nature favoured plants which produced large number of grains whereas in the past human efforts were directed towards selection of bold and attractive grained types. Negative association between grain size and number of grains is well known (Liang *et al.*, 1969). However, grain number is the predominant determinant of grain yield (Niehaus and Pickett, 1966).

Mean squares for both the components of variances, viz., GCA and SCA, were found to be highly significant (Table 1) which implied that there were significant differences among parental lines for g. c. a. effects and among F_1 s for s. c. a. effects.

The sign and magnitude of g. c. a. effects facilitates the choice of parental lines for hybridization. Although g. c. a. effects of CSV2, 2077B, CSV4 and E35-1 were significant and positive for days to 50% bloom, CSV2 was the

TABLE 1. Anova for combining ability analysis (mean squares)

Source	df	Characters				
		Days to 50% bloom	Plant height	No. of leaves	Grain Yield	1,000 - grain wt.
GCA	5	2715.33**	1026.36**	5.646**	479.75**	73.88**
SCA	15	9.65**	3541.51**	1.815**	443.93**	5.50**
Error	20	0.56	53.39	0.141	104.18	1.849

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

TABLE 2. General combining ability effects in sorghum

S. No.	Parent	Days to 50% bloom	Plant height	No. of leaves	Grain Yield	1,000 - grain wt.
1.	CSV 4	—3.35**	—42.33**	—0.99**	—3.25	—2.09**
2.	CSV 2	—5.50**	—3.16	—0.69**	—5.30	0.72
3.	2077B	—4.56**	—22.67**	—0.88**	—8.66*	—4.45**
4.	E35-1	—2.88**	25.58**	—0.25*	10.17*	0.92*
5.	Vidisha 60-1	6.13**	37.85**	1.21**	10.15*	0.38
6.	GJ 108	10.18**	—3.13	1.49**	—3.47	4.51**
	S. E. (g_i)	0.3162	2.360	0.1212	3.608	0.438
	S. E. ($g_i - g_j$)0	.3473	3.650	0.1877	5.100	0.679

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

most desirable combiner for his attribute (Table 2). Midtall plant stature is preferred for sorghum. CSV4 exhibited g. c. a. effect in the desirable direction. It was significantly superior to 2077B. GJ 108 and Vidisha 60-1 appeared to transmit genes for more leaves to their progeny since their g. c. a. effects were positive.

E35-1 and Vidisha 60-1 recorded significant and positive g. c. a. effects for grain yield. On the other hand, 2077B was the most undesirable combiner for this character. Grain size as tmeasured in terms of 1,000-grain weight. G. c. a. effect of GJ 108 and E35-1 were significant and positive for this character, 2077B and CsV4 were found to be undesirable parents since their g c. a. effects were significant and negative.

Choice of specific crosses which could be advanced for isolation of desirable plante from segregating ma terial rests on the sign and magnitude of their s. c a. effects. Only two crosses registered significant and positive s c. a. effects for grain yield, viz 2077B x Vidisha 60-1 (Table 3). S. c. a. effects of only two crosses were significat and positive for grain size, however, cross E35-1 x GJ 108 appeared to be significantly superior to CSV4 x Vidisha 60-1 on the basis of s. c. a. effects. Not a single cross was found to be desirable for plant height.

Those crosses which could be regarded as specifically desirable for 1000 - grain weight and grain yeild involved both the parents having, g. c. a. effects in desirable direction. There was also a close agreement between crosses chosen on the basis of their *per se* performance and s c. a. effects, especially for grain yield (E35 - x8 Vidisha 60 - 1) and 1,000-grain weight (E35-1 x GJ 108). No cross appeared desirable for both of these attributes. Since E35-1 was identified as the most desirable com-

TABLE 3. Specific combining ability effects in sorghum

S. No.	Cross	Days to 50% bloom	Plant height	No. of leaves	Grain Yield	1,000-grain wt.
1.	CSV 4 x CSV 2	—2.50**	—4.47	—0.74*	6.89	0.87
2.	CSV 4 x 2077B	—1.33	9.53	0.05	—6.94	—2.18
3.	CSV 4 x E35-1	0.57	22.27**	0.03	8.13	—1.93
4.	CSV 4 x Vidisha60-1	—0.13	38.00**	0.25	2.11	3.05*
5.	CSV 4 x GJ 108	—3.34**	20.7**	0.18	18.06	2.27
6.	CSV 2 x 2077B	1.01	—11.64	0.45	—7.63	—0.41
7.	CSV 2 x E35-1	1.52*	36.67**	0.73*	9.20	1.99
8.	CSV 2 x Vidisha60-1	2.21**	23.37**	0.95**	14.36	—0.46
9.	CSV 2 x GJ 108	—0.54	19.27**	—0.22	6.47	0.95
10.	2077B x E35-1	—0.71	50.07**	0.31	1.60	—0.51
11.	2077B x Vidisha 60-1	—0.72	57.47**	0.54	27.91	1.50
12.	2077B x GJ 108	—5.58**	—0.16	0.26	18.28	—0.17
13.	E35-1 x Vidisha 60-1	—1.91**	—7.93	0.41	22.01*	1.02
14.	E35-1 x GJ 108	—2.86**	38.07**	0.24	15.80	6.68**
15.	Vidisha 60-1 x GJ 108	—0.78	20.27**	—0.34	4.56	—2.46
	SE sij	0.6636	6.480	0.3328	9.047	1.205
	SE (sij—sik)	0.9904	9.660	0.4967	13.500	1.798
	SE (sij—skl)	0.9170	8.940	0.4598	12.500	1.665

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

biner with respect to maturity, grain yield and grain size and Vidisha 60-1 for grain yield, cross E35-1 x Vidisha 60-1 could be considered as most desirable. Since there is a close agreement between the *per se* performance and s.c.a. effect of the cross E35-1 - x Vidisha 60-1, it appears that the non-allelic interaction is of relatively less importance. Hence, it should be possible to exploit the potential of this cross through conventional breeding procedures.

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