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COMBINING ABILITY STUDIES IN SORGHUM AND SUDANGRASS

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Analysis of data on three traits of 35 F_1s from crosses between 5 male sterile sorghums and 7 sudangrasses revealed that sorghum line 3048 on average basis gave an excellent performance in respect of plant height and tillers per plant whereas sorghum strain 10390 outyielded all the other sorghum strains in respect of dry fodder yield per plant. Piper sudangrass showed the highest general combining ability value in recpect of plant height and sudangrass 337 was good combiner on average basis for number of tillers per plant whereas average performance of cross combinations of Low HCN sudangrass outyielded in respect of dry fodder yield . sorghum 3048 showed highest values of specific combining ability in respect of plant height and fodder yield in combinations with piper and Low HCN, respectively whereas sorghum 10390 showed its superiority for specific combining ability in corss combinations with Low HCN in respect of number of tillers per plant

INTRODUCTION

Breeding of new varieties is a continuous process and the success of plant breeding programme, aiming at the evolution of high yielding, better quality and fertilizer responsive, disease and insect resistant varieties of fodder crops,depend upon the selection of suitable parents to be utilized in a breeding programme. The parents must be genetically superior, physiologically efficient possessing better general and specific combining ability, so that they can be utilized in accordance with the genetic system of fodder crop. The present studies were initiated to estimate the general and specific combining ability of the five elite male sterile sorghum lines and seven sudangrasses .

Khan (1961) while studying the combining ability of 13 sorghum varieties observed the highest general and specific combining ability values in respect of fresh weight per plant and plant height. Gyawali *et al.* (1968) reported that specific combining ability values were significant for plant height during one year only whereas general combining ability effects were significant for all of the characters for both years.Tarumato (1970) also observed the combining ability for four male sterile sorghum varieties by crossing with four sudangrasses and showed that all the F_1 hybrids were taller than normal sorghum varieties with fewer tillers and showed the highest specific combining ability for green forage yield. Kulkarni and sreeramulu (1974) showed in a study on nine variable characters in the parents and progeny of a diallel cross of nine sorghum varieties, higher values of general combining ability than specific combining ability values for dry fodder yield indicating the predominant role of additive genes. Sangwan *et al.* (1977) and paroda *et al.* (1979) also reported sorghum crosses showing good general and specific combining ability for dry fodder yield. Sangwan *et al.* (1977) also reported that specific combining ability variance was higher than general combining ability variance for dry matter and tillers per plant. Desai *et al* . (1980) observed negative general combining effects for height.

MATERIALS AND METHODS

Studies were carried out in the departmen

of Plant Breeding and Genetics, University of Agriculture, Faisalabad during the year 1981–82 and 1982–83. Five male sterile sorghum genotypes viz. OK11 ,KS 8 ,10316 10390 , and 3048, and seven sudangrass strains viz. 39501 , 9580, 39830, piper ,Low HCN, 337 and SG 58 were used for the production of sorghum sudangrass hybrids. Each sorghum genotype was crossed with each of the seven sudangrasses. The cross combinations among sorghum lines and sudangrasses were made during kharif, 1982 . During the next growing season i.e. Spring ,1983 the experimental material consisting of 35 hybrids and their twelve parents were sown in 30 cm apart rows in randomized complete block design in four replications keeping 30 cm plant to plant distance.

Observations on the following characters of parents and hybrids on both fresh sown and ratoon crops, were recorded.

Plant height

Height of the mother shoot of randomly selected guarded plants was recorded in centimetres and average height per plant was calculated by dividing the total height of all plants in each variety and replication by the number of selected plants.

Number of tillers per plant

Number of tillers per plant for all the selected plants in each variety/replication were counted and average number of tillers per plant was calculated by dividing the number of selected plants.

Dry weight per plant

Each selected plant was harvested and weighed in grams to record fresh weight. It was then sundried to a constant weight and the final sundried weight was also recorded in grams. The average dry fodder weight per plant was then calculated by dividing the total weight by total number of selected plants.

RESULTS AND DISCUSSION

Statistical analysis of the data is presented in Table. 1.1 which shows significant differences among heights of the entries. It is evident from Table 1.2 that sorghum line 3048 gave the highest mean plant height of 195.18 cms. when crossed with the seven Sudangrasses followed by OK11 which gave average plant height of184.50 cms. Amongst the Sudangrasses 39830 showed the highest general combining ability with the five sorghum lines yielding average value of 192.50 cms. plant height and Piper Sudangrass followed closely with the mean plant height of 185.55 cms.

Cross combinations of sorghum line 3048 with Piper and 39830 Sudangrasses gave the maximum plant height of 216.25 cms and 216 cms. respectively and cross of KS 8 with Piper Sudangrass followed closely with a mean value of 215 cms.

Table 1.1. Analysis of variance for plant height

Due to	D.F.	S.S.	M.S.	F.R.
Replications	3	72614.1	3071.37	
Varieties	46	134348.1	2920.61	2.66 **
Error	138	151538.0	1098.10	
Total	187	358500.4		

Table 1.2. General and specific combining ability for Plant height in 35 intercrossed progenies of 5 sorghum and 7 Sudangrasses.

Sorghum (Female)	Sudangrasses (Male)							
	39501	9580	39830	Piper	Low HCN	337	SG-58	Mean
KS8	196.00	177.50	178.00	215.00	156.25	178.75	135.75	176.75
10316	130.25	150.00	174.25	137.00	129.50	129.50	188.75	148.41
10390	172.50	150.75	196.75	197.50	198.50	146.50	155.25	174.18
OK11	201.25	181.25	197.50	162.00	187.25	185.00	177.25	184.50
3048	177.25	186.75	216.00	216.25	174.75	179.50	195.50	195.18
Mean	175.45	170.40	192.50	185.55	173.25	163.90	170.50	

The results are in confirmity with the findings of Khan (1961), Gyawali *et al* . (1968) and Tarumato (1970) who obtained similar results for general and specific combining ability. Desai *et al.* (1980) obtained negative combining ability for plant height in sorghum crop.

Statistical analysis presented in Table 2.1 shows non–significant differences among various entries for number of tillers per plant. Sorghum line 3048 showed maximum general combining ability in crosses with seven Sudangrasses with a highest mean value of 8.52 tillers/plant, followed by 10390 which gave 6.23 tillers per plant. Amongst the Sudangrasses 337 gave the highest general combining ability value of 7.23 for number of tillers per plant and Low HCN closely followed with 6.80 tillers per plant. Sorghum line 10390 with Sudangrass Low HCN gave the best specific combining ability value of 11.26 tillersl/plant while sorghum 3048 with Sudangrasses 39830 and SG 58 followed closely with 10.95 and 9.60 tillers per plant respectively. Tarumato (1970) obtained non-significant results for this character while Sangwan *et al.* (1977) showed that specific combining ability variance was higher than general combining ability variance for many characters including number of tillers per plant.

Table 2.1. Analysis of variance of number of tillers per plant

Due to	D.F.	S.S.	M.S.	F.R.
Replications	3	236.32	78.74	
Varieties	46	808.21	17.57	N.S.
Error	138	2228.93	16.14	1.09
Total	187	3273.46		

Table 2.2. General and specific combining ability for number of tillers per plant in 35 intercrossed progenies of 5 sorghum and 7 Sudangrasses.

Sorghum (Female)	Sudangrasses (Male)							
	39501	9580	39830	Piper	Low HCN	337	SG.58	Mean
KS8	4.74	5.53	3.89	5.40	6.92	6.00	4.64	5.30
10316	4.94	5.05	5.74	4.98	4.27	4.44	7.04	5.81
10390	3.30	5.17	5.41	6.85	11.26	8.19	3.45	6.23
OK11	3.85	5.74	6.52	4.00	4.44	8.71	6.91	5.74
3048	6.68	8.93	10.95	7.57	7.10	8.81	9.60	8.52
Mean	4.70	6.08	6.50	5.76	6.80	7.23	6.31	

Although non–significant differences among 35 crosses for dry fodder weight were observed, yet the data in Table 3.2 showed that sorghum 10390 gave 0.72 kg, the highest average yield of dry fodder weight/ plant showing maximum general combining ability followed by sorghum 3048 with an average of 0.68 kg/plant. Amongst the Sudangrasses Low HCN has shown high general combnining ability with a value of 0.68 kg/plant and sudangrass 337 with a mean value of 0.67 kg/plant closely followed. In respect of specific combining ability Sorghum 3048 showed its superiority in cross combinations with Sudangrass, Low HCN and 337 with a value of 0.90 and 0.88 kg per plant and OK 11 with Low HCN closely followed with mean value of 0.84 kg/plant. Khan (1961) and Tarumato (1970) showed similar results for dry fodder weight and green forage weight per plant in sorghum respectively. The results are also in accordance with achievements of Kulkarni and Sreeramulu (1974), Sangwan *et al.* (1977) and Paroda *et al.* (1979) who observed higher values of general and specific combining ability for dry fodder yield in sorghum.

Table 3.1 Analysis of variance for dry fodder weight per plant.

Due to	D.F.	S.S.	M.S.	F.R
Replications	3	0.45	0.15	
Varieties	46	4.41	0.095	
Error	138	21.92	0.16	0.59^{NS}
Total	187	26.75		

Table 3.2. General and specific combining ability for dry fodder weight per plant in 35 intercrossed progenies of 5 sorghum and 7 sudangrasses.

Sorghum (Female)	Sudangrasses (Male)							
	39501	9580	39830	Piper	Low HCN	337	SG - 58	Mean
KS8	.77	.54	.40	.77	.35	.78	.45	.58
10316	.61	.54	.54	.60	.62	.31	.43	.52
10390	.78	.75	.67	.60	.71	.76	.78	.72
OK 11	.47	. 47	.59	.68	.84	.60	.82	.64
3048	.52	.69	.59	.47	.90	.88	.71	.68
Mean	.63	.60	.56	.62	.68	.67	.64	

LITERATURE CITED

Desai, K. B., S. D. S. Tikka, D. V. Patel, P.T.Desai and M.V.Kukadia 1980 Combining ability of borer resistant lines for grain yield and borer resistance. Sorghum–News letter 23, 20–21 Gujrat Agric. Univ. NM Coll. Agric. Navsari, India. (Pl. Br. Absts., 52(1) : 377; 1982).

Gyawali K. K . C. O. Qualset and W. T. Yamazaki. 1968 Estimates of heterosis and combining ability in winter wheat. Crop Sci., 8(3): 322–324.

Khan, M. A. 1961 Heterosis and combining ability studies in Sorghum vulgare pers. M.Sc. Agri. Thesis, Punjab University, Lahore.

Kulkarni, N., and C. Sreeramulu. 1974 Combining ability and heterosis for sorghum fodder yeild. Andhra Agricultural Journal 20 (12) : 1.12. Sorghum Improvement project Rajendra nagar. Hyderabad, India (Pl. Br. Absts., 45(11): 8999; 1975).

Paroda, R.S., G.P.Lodhi. and O. P. Dangi. 1979 Heterosis and combining ability studies in forage sorghum. Agricultural University Journal of Research 9 (3): 199-206. Dep. Pl. Br. Haryana Agric. Univ., Hissar, India. (Pl. Br. Absts., 51(5) : 4131; 1981).

Sangwan, R.S., N. P. Arera and G. P. Lodhi 1977 Combining ability studies in sorghum Haryana Agricultural University Journal 7 (4) : 178 - 184. Dep. Pl. Br. Haryana Agriculture Univ. Hissar, India. (Pl.Br. Absts., 50(3): 3043; 1980).

Tarumato, I.1970 Studies on breeding forage sorghum by utilysing heterosis and combining ability in F_1 plants of the MS–SU types Ikushugaku, Zasshi/Jap. J. Breeding 20(1) : 35–39; 1970)