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Combining ability studies of local land races based restorers in sorghum

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ABSTRACT

The experiment material comprised of four male sterile line *viz.*, 1409 A, 104 A, 185 A and 116 A were crossed with ten local land races in a line x tester mating design to produce forty hybrid combinations. These hybrid combinations were evaluated in Randomized Block Design with three replication during *rabi* 2005. Analysis of variance for combining ability revealed that significant variation for general combining ability among males and females for all characters under study. Male x Female interaction indicated the significant variation for specific combining ability for all characters studied. The general combining ability effects showed that none of the parents was a good general combiner for all characters. Among the females 185A contributed favorable genes for panicle length, panicle breadth, 1000 grain weight and grain yield. While 1409 A was the good general combiner for days to 50 % flowering and panicle length. In term of plant height, 104 A was a good general combiner. Amoung the males RSLG 301 was found to have a high and desirable gca for grain yield and panicle breadth. Another male parents RSLG 320 was the best general combine for 1000 grain weight plant height and panicle length.

Key words : Hybrid, Local land race, General combining ability and Specific combining ability.

INTRODUCTION

Knowledge of the genetic behavior of various characters is important in the selection of superior parents for hybridization is a successful breeding programme. Therefore, present study was undertaken to assess the combining ability of different local land races of *rabi* sorghum collected from different *rabi* sorghum growing tracts of Maharashtra. However, these local land races are good source of drought, shootfly tolerance and having local adaptability. Using line x tester analysis with objectives to collect information about*= -*-gca effects of parents and gca effects of crosses in F_1 generations with view to identify promising hybrids better than CSH 15 R.

MATERIALS AND METHODS

The experiment material comprised of four male sterile line *viz.*, 1409 A, 104 A, 185 A and 116 A were crossed with ten local land races in a line x tester mating design to produce forty hybrid combinations. These hybrid combinations were evaluated in Randomized Block Design (RBD) with three replication during *rabi* 2005. Each entry was planted in two rows of 4.50 m with spacing of 45 cm between rows and 15 cm between plant with in a row at experimental field of AICSIP, MPKV., Rahuri.(M.S.). The recommended agronomic practices were followed to raise a healthy crop. The data were recorded in randomly selected five plants in each plots for days to 50 per cent flowering, plant height, panicle length, panicle breadth, 1000 grain weight and grain yield plant^{-1}. The combining ability analysis was performed according to methodology suggested by Kempthrone (1957).

RESULTS AND DISCUSSION

Analysis of variance for combining ability (Table 1) revealed that significant variation for general combining

Table 1 : Analysis of variances for combining in *rabi* sorghum

Source	DF	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	Panicle breadth (cm)	1000 grain weight	Grain yield (g)
Lines	3	377.85**	1373.67**	30.50**	9.87**	37.00**	3165.66**
Tester	9	196.60**	2937.11**	16.52**	3.68**	30.53**	346.00**
L x T	27	65.06**	1813.44**	8.46**	2.04**	27.24**	812.00**
Error	39	1.84	80.88	1.14	0.20	0.92	41.46
O^2 gca	-	2.34	3.42	0.72	0.22	0.31	44.94
O^2 sca	-	21.08	577.54	2.43	0.39	8.77	256.86
O^2 gca/ O^2 sca	-	0.11	0.005	0.30	0.56	0.40	0.17

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ability among males and females for all characters under study. Male x Female interaction indicated the significant variation for specific combining ability for all characters studied. These observations are further supported interaction of parents V_s crosses for all characters. The importance of both general and specific combining ability have been reported by Kambal and Webster (1965), Harer and Bapat (1982) and Patil *et al.* (2005).

The estimates of variances indicated the specific combining ability (sca) variances to be higher than the gcs varieties for all the characters studied. This shows that predominance of non-additive gene action in the inheritance of these characters. Similar, to the present finding, the importance of non-additive gene effects for grain yield and other attributes in sorghum have also been observed by Hovny *et al*. (2000) and Umakanth *et al.* (2002). Kadam *et al.* (2000) reported sca variances to be higher than gca variances for plant height which is in accordance with the present study. Similarly Pillai *et al.* (1995) reported non-additive gene action to be governing

Table 2 : Estimation of general combining ability effect for different characters in r*abi* sorghum

Source	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	Panicle breadth (cm)	1000 grain weight (g)	Grain yield plant $^{-1}$ (g)
Female						
1409 A	-1.48**	-1.40	1.40**	-0.17*	0.90**	-1.87**
104 A	1.22*	7.60**	0.82**	0.19*	1.01**	4.74**
185 A	-0.05	-8.84**	0.64**	0.67**	1.46**	12.23**
116 A	0.32	-1.60**	0.21	0.02	-0.72**	-5.43
S.E.±	0.25	1.64	0.19	0.08	0.18	1.17
Tester						
RSLG 114	-0.97**	29.77**	-2.65**	-0.42**	2.05**	1.14**
RSLG 133	-4.88**	-15.55**	-1.09**	-0.24	2.32**	-4.05
RSLG 143	2.45**	6.57*	0.81**	-0.13	2.20**	1.54**
RSLG 148	3.45**	0.38	0.46**	0.06	-1.97**	-5.52
RSLG 295	-3.30**	-9.97**	-1.07**	-0.39**	-1.27**	-1.88
RSLG 301	-1.97**	-13.11**	0.87**	1.07**	-0.74**	6.67**
RSLG 320	2.24	12.77**	1.88**	-0.07	2.32**	4.05**
RSLG 336	1.97**	-12.69**	-0.64*	0.37**	1.46**	1.092
RSLG 442	-2.20	-11.86**	-0.35*	1.03**	1.58**	1.21**
RSLG 423	3.45**	34.44**	-1.32**	0.01	1.27**	1.88
S.E.±	0.39	2.60	0.31	0.13	0.28	1.86

* and ** indicates significance of values at P=0.05 and 0.01, respectively

Table 3 : Promising crosses selected the basis of sca effect and *per se* performance for different characters

Characters	No. of crosses	Promising crosses	sca effect	Mean performance
Days to 50 % flowering	15	1409 A x RSLG 133	-6.43**	70.00
		185 A x RSLG 295	-6.23**	76.00
Plant height (cm)	9	104 A x RSLG 320	40.87**	258
		1409 A x RSLG 114	33.21**	245
Panicle length (cm)	5	1409 A x RSLG 301	2.46**	20.61
		185 A x RSLG 320	2.74**	23.00
Panicle breadth (cm)	4	104 A x RSLG 442	1.87**	7.77
		185 A x RSLG 301	0.97**	7.06
1000 grain weight (g)	14	104 A x RSLG 143	3.63**	37.37
		185 A x RSLG 301	3.13**	42.90
Grain yield plant $^{-1}$	12	1409 A x RSLG 301	29.79**	119.91
		185 A x RSLG 320	18.43**	103.21
		1409 A x RSLG 114	17.63^{NS}	98.38
		104 A x RSLG 114	18.29^{NS}	70.48

* and ** indicates significance of value at P ≤ 0.05 and P ≤ 0.01, N.S. = Non-significant
RSLG = *Rabi* sorghum local germplasm. Mean performance of CSH 15 R (Check) for grain yield (82.40 g).

various panicle characters.

The general combining ability effects (Table 2) showed that none of the parents was a good general combiner for all characters. Among the females 185A contributed favorable genes for panicle length, panicle breadth, 1000 grain weight and grain yield. While 1409 A was the good general combiner for days to 50 % flowering and panicle length. In term of plant height, 104 A was a good general combiner.

Amoung the males RSLG 301 was found to have a high and desirable gca for grain yield and panicle breadth. Another male parents RSLG 320 was the best general combine for 1000 grain weight plant height and panicle length. RSLG 114 found to be good combiner for plant height, 1000 grain weight and grrin yield plant^{-1} . The male parents RSLG 336, RSLG 295 and RSLG 133 were proved to be undesirable for grain yield to produce dwarf hybrids and hence appeared inferior for fodder yield. Of the parents tested 185 A and RSLG 301 exhibited favourable gene effects for grain yield while 104 A, 1409 A and RSLG 320 and RSLG 114 exhibited favourable gca effects for other important yield contributing characters. These parents could be extensively used to achieve high yields through optimum combination of there yield components. The promising crosses were identified on the basis of sca effects and *per se* performance (Table 3). Twelve crosses showed high sca effects for grain yield. Rao (1970) suggested cross showed high sca effects for hybrids programme and cross with low sca effects and high gca effects of parents involved in the cross alongwith its high mean for development of superior varieties. In presents study two crosses *viz*; 1409 A x RSLG 301 and 185 A x RSLG 320 showed significantly high sca effects for grain yield plant $^{-1}$, panicle length with high mean performance over the check CSH 15 R. This suggests that these cross combinations may be tested in larger plots at multilocations to assess their economics potentialities for development of hybrids. The crosses 1409 A x RSLG 114 and 104 A x RSLG 114 had non-significant with high mean performance and high gca effects of parents involved for grain yield, panicle length and panicle breadth. These crosses could be expected to yield promising trasngrants in segregating generation for the desirable genes of the parents.

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