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COMBINING ABILITY STUDIES FOR GRAIN YIELD, FODDER YIELD AND IT'S PARAMETERS OF *KHARIF SORGHUM* PARENTAL LINES (*Sorghum bicolor* (L.) Moench)

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ABSTRACT

The present investigation was carried out with *Kharif* sorghum to understand the combining ability of kharif sorghum for grain yield, fodder yield and its parameters. The experiment was confined to 25 hybrids which were developed by utilizing 5 females lines (232A,237A,1001A,PMS98A,PMS8A) and 5 testers (I-26,I-29,KR-125,KR-196,KR-210). These 25 hybrids along with four checks (PVK-801, SPH-1641,CSH-16,CSH-25) and ten parents were evaluated in RBD during Kharif 2013-14 at Sorghum Research Station, VNMKV, Parbhani.The observations on 10 yield attributing characters were recorded on randomly selected five plants. The results revealed that, hybrids developed from 232A and PMS 8A showed good mean performances for most of the characteristics. The ratio of ^{2} gca : ^{2}sca variance for general and specific combining ability was less than unity for all the characters indicating preponderance of non addictive gene action (dominance and epistatic).The parents 232A, PMS 8A, KR-125 and KR-196 were best general combiners for grain yield and for fodder yield. line 232A and tester KR-125 had high gca effect. The highest per se performance for grain yield and its attributes were noted in the crosses 232A X KR-196, PMS 8A X I-29 and PMS 8A X I-26. The hybrid 232A X I-26 have high mean and high sca effect for fodder yield and other important yield parameters. The hybrid 1001A X KR-196 and 1001A X KR-210 recorded high sca effect for maximum yield contributing traits viz. panicle length, panicle breadth, number of primaries, number of grains per primaries, grain yield per plant, fodder yield per plant and harvest index.

Key words : *Sorghum, GCA, SCA, line x tester analysis.*

Sorghum(*Sorghum bicolor* (L.) Moench) is an important staple food for more than 500 million people worldwide. It is the fifth most important cereal following rice, wheat, maize and barley across the world, which is mostly cultivated in the arid and semi-arid tropics for its better adaptation to various stresses. Sorghum is unique to adopt to environmental extremes of abiotic and biotic stress. So this makes the crop to minimize the risk and enables to fit to a sustainable and economically profitable dry land production system. The knowledge of combining ability is necessary for selection of appropriate parents in hybridization. Since it gives an idea whether a particular parent combines well in a cross and also denote the specific performance of a cross combination against the expectations from the GCA of the parents. The information on the nature and magnitude of gene action is important in understanding the genetic potential of population and decide the breeding procedure to be adopted in given population. Line x tester analysis is a precise method for obtaining such information when a large number of parents to be tested.

MATERIALS AND METHODS

The present investigation was undertaken in sorghum (*Sorghum bicolor* (L.) Moench) at Sorghum Research Station, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.) during Kharif 2014. Elight Twenty five kharif sorghum F_1 hybrids along with parents (232A,237A,1001A,PMS 98A,PMS 8A) and five testers (I-26,I-29,KR-125,KR-196 and KR-210) and four checks PVK-801,SPH-1641,CSH-16,CSH-25 evaluated in randomized block design during Kharif 2014-2015 for grain, fodder yield and their component traits. The row length was 4 m with 45 cm x 15 cm spacing between and within rows. Observations were recorded on five randomly selected plants in each entry from each replication. Observations were recorded for the following ten characters. Days to 50 % flowering, Panicle length (cm), Panicle breadth (cm), Panicle weight (gm), number of primaries, number of grains per primaries, Grain yield per plant (gm), Fodder yield per plant (gm),Test weight and Harvest index.

RESULTS AND DISCUSSION

The analysis of variance for line x tester design indicated significant differences due to the parents and crosses for most of the characters under study, in yield contributing traits. The significant variances due to parents vs crosses indicated occurrence of substantial heterotic response for almost all the traits except No. of grains per primary branch and test weight.

Lines showed significant variances for days to flowering and plant height. While testers were non-significant. The component of line x tester was significant for most of traits except panicle length, panicle width and harvest index. High magnitude of variance due to lines against line x tester interaction for these traits

Table-1 : ANOVA for line x tester analysis

Genotypes	d.f.	Days to 50% flowering	Panicle length (cm)	Panicle width (cm)	Panicle weight (gr)	No.of primaries per panicle	No. of grains per primaries	Grain yield per plant(gm)	Fodder yield per plant(gm)	Test weight (gm)	Harvest index (%)
Replications	1	2.80	2.23	0.12	11.84	0.014	4.784	8.729	3.28	1.86	3.16
Genotypes	34	19.05*	13.78**	0.47**	447.15**	342.58**	167.84**	274.16**	235.44**	16.97**	36.61**
Crosses	24	14.84	7.65	0.32	321.80**	332.72**	155.96**	203.20**	243.60**	13.84**	31.23**
Parents	9	23.35*	23.47**	0.466*	329.56**	274.37**	336.84**	271.91**	102.94**	25.12**	41.30**
Parents vs. Cross	1	80.24**	73.61**	4.3151**	4514.08*	1192.90**	12.56	1997.37**	1232.09**	18.49	123.32**
Lines	4	23.35	40.08**	0.433	401.34**	335.86**	336.84**	323.08**	80.81*	30.73**	42.38**
Testers	4	28.85*	5.42	0.162	302.92**	281.06**	148.87**	244.02**	93.02*	20.21**	19.30*
Line x tester	16	13.57	1.398	0.346	316.62**	176.66**	89.80**	198.04**	60.69*	12.64**	30.68
Error	34	9.74	5.075	0.20	24.90	35.07	27.87	29.26	29.30	4.78	7.09

* Significant 5 per cent level, ** Significant 1 per cent level.

Table-2 : General combining ability effects (GCA) for yield and yield parameters.

Genotypes	Days to 50% flowering	Panicle length (cm)	Panicle width (cm)	Panicle weight (gm)	No. of primaries per panicle	No. of grains per primaries	Grain yield per plant (gm)	Fodder yield per plant (gm)	Test weight (gm)	Harvest index (%)
Lines										
232A	-0.780	0.940	0.083	10.004**	-0.248	9.922**	3.926*	9.157**	0.864	-0.761
237A	0.220	1.630*	-0.161	2.364	15.492**	-8.888**	-1.974	1.277	-0.896	-0.686
1001A	2.520*	-3.300**	0.125	-6.256**	-7.688**	-3.038	-8.014**	-3.055	-1.256	-2.606**
PMS 98 A	-1.080	1.14	-0.101	-2.636	0.132	1.442	2.528	-4.310*	2.578**	2.027*
PMS 8 A	-0.880	-0.410	0.052	-3.476*	-7.688**	0.562	3.536*	-3.067	-1.291	2.027*
SE +	0.9870	0.7124	0.1425	1.5782	1.8729	1.6695	1.7108	1.7119	0.6920	0.8424
Tester										
I-26	-0.180	0.390	0.349*	-0.356	0.232	1.782	-3.244	-0.926	-0.385	-1.177
I-29	0.320	0.060	-0.066	-4.536**	-6.408**	-3.968**	-0.752	-9.186**	0.363	2.271*
KR-125	-1.780	-0.220	-0.171	-0.356	1.832	-1.268	4.686*	5.717**	0.164	0.295
KR-196	0.420	-0.190	-0.029	8.424**	9.372**	4.472*	3.846*	13.086**	-0.860	-1.746*
KR-210	1.220	-0.040	-0.05	-3.176	-5.028*	-1.1018	-4.534*	-8.691**	0.717	0.358
SE +	0.9870	0.7124	0.1425	1.5782	1.8729	1.6695	1.7108	1.719	0.6920	0.8424

* Significant 5 per cent level, ** Significant 1 per cent level

indicated the presence of considerable variability among female lines. In most of the other traits viz., panicle length, panicle breadth, number of primaries, number of grains per primary, harvest index, number of leaves per plant and days to flowering. Presence of considerable variability was due to line x tester interaction. These results are in agreement with those published earlier days to 50 per cent flowering, plant height, panicle length and grain yield per plant, (1) days to 50 per cent flowering and grain yield per plant (2) and days to 50 per cent flowering, plant height, grain yield per plant, test weight (3).

General combining ability (GCA) effects : The parental liens showing high GCA effects are presented in table 2. The estimates of GCA effects revealed that parental line 232A were the best general combiners for grain yield and its attributing traits.

In general, good combiners for grain yield also had good or average combining ability for one or more of the yield components. In most of the parents high GCA effects were associated with high per se mean for yield and yield components. These results are in agreement with the results reported by (3).

Female lines 1001A exhibited significant and negative GCA effect. None of the tester recorded significant and negative or positive GCA effects. Negative GCA effect for days to 50 per cent flowering in parents is desirable to breed early maturity hybrid (4) also reported that negative GCA effects for days to 50% flowering might be useful in breeding programme for earliness.

(5) also identified one line SL-39B with positive significant GCA for grain yield and negative significant GCA for days to flowering and reported the use of this line in developing high yielding early maturing hybrids in *rabi* sorghum. For panicle length, the female lines 237A (1.63) exhibited significant and positive GCA effects. none of the tester showed significantly positive GCA effects. None of the female lines exhibited significant positive GCA effect for panicle width. Among the testers I-26 recorded significant positive GCA effect. For panicle weight the female line 232A (10.00) exhibited significant positive

Table-3 : Specific combining ability effects (SCA) for yield and yield parameters.

Genotypes	Days to 50% flowering	Panicle length (cm)	Panicle width (cm)	Panicle weight (gm)	No. of primaries per panicle	No. of grains / primary branch	Grain yield per plant	Fodder yield per plant	Test weight (gm)	Harvest index (%)
232A × I-26	4.080	-1.35	-0.447	-8.90	-3.07	3.01	-4.856	10.69*	-0.36	-3.84
232A × I-29	0.58	-0.37	-0.14	-16.92	-4.63	0.66	-7.148	-5.58	-2.55	-1.44
232A × KR-125	-4.82*	0.81	0.16	-11.60	0.42	-6.38	-5.36	0.52	-1.18	-1.64
232A × KR-196	-1.02	0.58	0.27	24.96	4.58	2.07	23.954**	-0.74	1.92	8.20**
232A × KR-210	1.18	0.33	0.15	12.51	2.68	0.61	-6.566	-4.89	2.17	-1.27
237 A × I-26	0.58	0.46	0.93**	7.03	0.88	1.22	1.244	-2.72	1.85	1.08
237 A × I-29	0.58	-0.01	-0.34	4.41	-0.47	-4.47	-2.04	-8.10*	-1.84	1.23
237 A × KR-125	-1.32	1.02	0.00	0.83	0.28	-1.22	-2.78	1.34	-1.72	-1.41
237 A × KR-196	-1.02	-1.01	-0.23	-5.24	2.44	3.23	-4.14	3.91	2.53	-2.49
237 A × KR-210	1.18	-0.46	-0.35	-7.04	-3.15	1.22	7.73	5.56	-0.83	1.58
1001 A × I-26	1.28	-0.26	-0.24	-10.14	-12.43**	-5.62	-9.81*	-2.09	1.24	-4.49*
1001 A × I-29	-1.22	-0.28	-0.36	8.83	-5.49	-3.62	-3.70	5.85	0.28	-3.31
1001 A × KR-125	1.38	0.65	0.42	16.15	-3.43	10.72**	7.15	1.92	3.63*	2.93
1001 A × KR-196	0.18	0.12	-0.14	-4.82	11.52*	-9.32*	1.89	-4.97	-5.34**	2.43
1001A × KR-210	-1.62	-0.23	0.33	-10.02	9.82*	7.87*	4.47	-0.71	0.18	2.43
PMS 98 A × I -26	-4.12	0.70	-0.32	8.53	9.74*	3.59	3.64	1.89	-1.21	2.56
PMS 98 A × I -29	2.38	-0.27	0.49	-8.08	-3.31	-1.25	1.16	3.805	0.370	-0.16
PMS 98 A × KR -125	0.48	-1.19	-0.13	0.83	-5.65	6.34	-0.38	-4.75	-0.421	-0.46
PMS 98 A × KR -196	1.78	0.38	0.10	-1.04	2.20	-1.99	-5.74	0.846	1.95	-2.09
PMS 98 A × KR -210	-0.52	0.38	-0.13	-0.24	-2.99	-6.70	1.33	-1.79	-0.68	0.15
PMS 8 A × I -26	-1.82	0.45	0.08	3.476	4.86	-2.22	9.78*	-7.77	-1.51	4.68*
PMS 8 A × I -29	-2.32	0.93	0.36	11.75	13.90**	8.72*	11.74**	4.02	3.74*	3.67
PMS 8 A × KR-125	4.280	-1.29	-0.45	-6.22	8.36	-9.47*	1.40	0.959	-0.30	0.587
PMS 8 A × KR -196	0.080	-0.07	0.002	-13.80	-20.77**	5.98	-15.95**	0.953	-1.07	-6.05**
PMS 8 A × KR -210	-0.220	-0.02	0.008	4.79	-6.37	-3.02	-6.97	1.832	-0.84	-2.89
SE +	2.2069	1.590	0.3187	3.52	4.188	3.732	3.825	3.820	1.547	1.883

* Significant 5 per cent level, ** Significant 1 per cent level

GCA effect. Among the testers KR-196(8.42) recorded significant positive GCA effect. Female line 237A (15.49) exhibited significant positive GCA effects for number of primary branches per panicle. The tester KR-196(9.37) exhibited significant positive GCA effect. For number of grains per primaries the female line 232A exhibited significant positive GCA effect. Among the testers KR-196 exhibited significant positive gca effect. Female lines 232A (3.92), PMS 8A(3.53) exhibited significant positive GCA effect for grain yield .Among the testers KR-125(4.68),KR-196(3.84) recorded significant positive GCA effect. For fodder yield per plant, the female line 232A exhibited significant positive GCA effect. Among the testers KR-125, KR-196 recorded significant positive GCA effects. Female lines PMS 8A(2.02),PMS 98A(2.02) recorded significant positive GCA effects for harvest index. Among the testers I-29 exhiibited significant positive GCA effect.

Specific combing ability (SCA) effects : The estimates of SCA effects (Table 3) showed that three crosses recorded significantly desirable SCA effects for enhanced grain yield and one cross for fodder yield. The significantly high SCA effects with high per se performance were recorded in the crosses 232A X KR-196, PMS 8A X I-29 and PMS 8A X I-26 for grain yield per plant. The parents involved high x lower, low x low GCA combinations. Similar results also obtained by (3). (6) also reported that some of the promising hybrids involved high x high GCA parental lines. However (7) reported that some of the crosses with positive significant SCA for grain yield involved even low x low combination of parents.

Among the 25 crosses, for days to 50% flowering, one cross 232A X KR-125 (-4.82) exhibited significant negative SCA effect. For Panicle length (cm), Out of 25 crosses, none of the cross recorded significant positive SCA effect. For panicle width (cm), Among the 25 crosses, one cross 237A X I-26 (0.93) recorded significant and positive SCA effects. For panicle weight(cm), Among the 25 crosses, none of the cross exhibited significant SCA effect. For number of primary branches per panicle, Among 25 crosses four crosses recorded significant positive SCA effect. The highest significant positive effect was observed in the cross PMS 8A X I-29(13.90) closely followed by 1001A X KR-196(11.52), 1001A X KR-210 (9.82) and PMS 98A X I-26(9.74). For number of grains per primary branch, among 25 crosses, three crosses exhibited significant positive SCA effect. The highest significant positive SCA effect was observed in 1001A X KR-125(10.72) closely followed by PMS 8A X I-29(8.72) and 1001A X KR-210 (7.87). For grain yield per plant, out

of 25 crosses three crosses recorded significant positive SCA effects. The highest significant positive SCA effect was recorded in 232A X KR-196(23.95) closely followed by PMS 8A X I-29 (11.74) and PMS 8A X I-26 (9.78). For fodder yield per plant, out of 25 crosses one cross 232A X I-26(10.69) recorded significant positive SCA effect. For test weight, out of 25 crosses two crosses exhibited significant positive SCA effects. The highest significant SCA effect was recorded in the cross PMS 8A X I-29(3.74) closely followed by 1001A X KR-125(10.72). For harvest index, out of 25 crosses two crosses exhibited significant positive SCA effect. The highest significant positive SCA effect was recorded in the cross 232A X KR-196(8.20) closely followed by PMS 8A X I-26(4.68).

REFERENCES

1. Maheshwari, J.J.; Reddy, P.V.R.; Ghorpade, P.B.; Sakhare, R.S. and Shekar, V.B. *(1993)*. Studies on combining ability of newly developed restorers in sorghum. *J. Soils and Crops, 3(1):* 1-5.
2. Veerabadhiran, P.; Palanisamy, S. and G.A. Palanisamy *(1994)*. Combining ability for days to flowering and grain yield in sorghum. *Madras agric J., 8 (1):* 585-887.
3. Khapre, P.R.; Lakshmi, G.S.; Ambekar, S.S. and Borikar, S.T. *(2000a)*. Heterosis and combining ability in grain sorghum involving newly developed male sterile and restorer lines. Paper presented in VIII, Vasantrao Naik Memorial National Agricultural Seminar on “Sorghum under different agro ecological systems and its industrial utilization” held at College of Agriculture, Nagpur. Mar. 1-2, 2000 P.P. 5.
4. Premlatha, N.; Kumaravadivel N. and Veerabadhiran, P. *(2006)*. Heterosis combining ability for grain yield and its components in sorghum (*Sorghum bicolor* (L.) *Moench*). *Indian Journal of Genetics and Plant Breeding. 66 (2):* 123-126.
5. Prabhakar, Elanngovan M. and Bahadure D. M. *(2013)* Combining ability for new parental lines for flowering, maturity and rain yield in rabi sorghum. *Electronic Journal of Plant Breeding 4 (3):*1214-1218.
6. Ghorade, R.B.; Kalpande V.V. and Bhongle S.B. *(2014)*. SPH-1635-A dual purpose high yielding *kharif* sorghum hybrid. *International Journal of Agricultural sci., 10 (1):* 134-137.
7. Hariprasanna, K.; Rajendrakumar, P. and Patil, J.V. *(2012)*. Parental selection for high heterosis in sorghum (*Sorghum bicolor* (L.) moench) combining ability, heterosis and their inter relationships. *Crop Res., 44 (3):* 400-408.

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