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Combining ability analysis for grain and fodder yield in post rainy sorghum

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Abstract
Five lines and ten testers were crossed in line x tester design to produce 50 cross combinations and were evaluated along with the check for grain yield and its components for combining ability analysis. The study revealed that total eight crosses exhibited positive significant sca effects as well as positive significant standard heterosis for both grain yield per plant as well as fodder yield per plant. The cross combination AKRMS-80-1A(39) x PKV-Kranti was the best cross combination with the sca effects of 25.93** for grain yield and 29.67** for fodder yield. Also this cross exhibited standard heterosis of 19.72% for grain yield and 32.28 % for fodder yield. Thus, total nine cross combinations appeared best due to their positive significant sca effects for both grain as well as fodder yield along with positive significant standard heterosis for both these traits.

Keywords: Combining ability analysis, line x tester, SCA, sorghum, standard heterosis

Introduction
Post rainy (*rabi*) sorghum is one of the important crop of the dryland region. This crop caters the need of both feed for human consumption and fodder for the livestock. The fodder of *rabi* sorghum is one of the major source of fodder for the livestock. The quality of fodder from *rabi* sorghum is superior than the fodder quality of kharif sorghum and hence it fetches higher market prize. The study was undertaken to identify the promising cross combinations showing both positive significant sca effects along with positive significant standard heterosis for both grain yield as well as fodder yield in post rainy sorghum.

Materials and Methods
The experimental material comprised of five male sterile lines viz.,AKRMS-66-2A(38), AKRMS-66-2A(40), AKRMS-66-2-3A, AKRMS-80-1A(39) and AKRMS-80-1-1A(62) and ten testers viz., SLR-136, SLR-137, Elangovan-35,AKSV-252, Rb-Local-1-1-sel-1, Rb-Local-5(Bold), RSV-962, AKSV-330, PKV-Kranti and AKSV-370. These fifteen genotypes were crossed in line x tester fashion. Fifteen parents and their resulting 50 hybrids along with one standard check CSH-19R were sown at Sorghum Research Unit, Dr. P.D.K.V. Akola in randomized block design with three replications. The observations were recorded on five randomly selected plants per plot per replication for grain yield/ plant (g) and fodder yield/ plant (g). The standard heterosis was estimated as per cent increase or decrease of the mean of F_1 over the value of the standard check CSH 19 R. The data on all the above characters were subjected to combining ability analysis by following Kempthorne (1957) [4] method.

Results and Discussion
Analysis of variance revealed that the mean squares due to genotypes were highly significant for both grain yield per plant and fodder yield per plant (Table 1). This indicated the presence of substantial genetic variability for these characters. Further partitioning of genotypic variance into components viz., parents, hybrids and parents vs. hybrids revealed that the parents differed among themselves significantly for both grain yield per plant and fodder yield per plant. Similarly, hybrids also showed highly significant differences for both grain yield per plant and fodder yield per plant. Further, parents vs. hybrids showed highly significant differences for both these characters. Analysis of variance for combining ability is presented in Table 2 it revealed that the crosses recorded significant variation for both grain and fodder yield per plant. The female x male interaction was also significant. Among the 50 hybrids in the present investigation, thirteen cross combinations exhibited positive sca effects for grain yield per plant (Table 3). The highest sca effects for grain yield per plant was noted in the cross AKRMS-80-1A(39) X PKV-Kranti (25.93**). Out of these thirteen cross combinations only eight crosses viz., AKRMS-80-1A(39) X PKV-Kranti, AKRMS-80-1A(39)

X Elangovan-35, AKRMS-80-1-1A(62) x Rb-Local-1-1-sel-1, AKRMS-66-2A(38) X SLR-137, AKRMS-66-2A(40) X Rb-Local-1-1-sel-1, AKRMS-66-2A(38) X RSV-962, AKRMS-66-2-3A X Elangovan-35 and AKRMS-66-2A(38) X Rb-Local-5(Bold) showed positive significant sca effects for fodder yield also (Table 4). The sca alone is not sufficient to mark the cross as potential unless high sca is associated with the positive significant standard heterosis. It is very well known that if sca variance, which is a measure of non-additive genetic variance, is high for characters and also observed heterosis is also high, such crosses can be utilized for commercial exploitation of heterosis. All these eight cross combinations exhibited positive significant sca effects for both grain yield as well as fodder yield along with the positive significant standard heterosis for both these traits.

The best cross combination with this unique combination of positive significant sca effects along with positive significant standard heterosis for both grain as well as fodder yield was found to be AKRMS-80-1A(39) X PKV-Kranti. This cross recorded the sca of 25.93** for grain yield and 29.67** for fodder yield. Also this cross showed the positive significant standard heterosis of 19.72% and 32.28% for grain yield and fodder yield respectively. Regarding the gca effects of the parental lines involved in this cross it was L x L for grain yield and L x H for fodder yield was observed.

Second best cross combination was AKRMS-80-1A(39) X Elangovan-35. This cross exhibited the sca of 13.43** for grain yield and 28.85** for fodder yield. Also this cross recorded the positive significant standard heterosis of 20.32% and 24.12% for grain yield and fodder yield respectively. Regarding the gca effects of the parental lines involved in this cross it was L x H for grain yield and L x L for fodder yield. It was observed form the table 3 that high sca effects was associated with high standard heterosis. Prakash *et al*. (2010) [6], Hariprasanna *et al*. (2012) [3], Prabhakar *et al*. (2013) [5] and Ghorade *et al*. (2014) [1] also reported such promising crosses based on high sca effects and heterosis for grain yield as well as fodder yield in sorghum. Ghorade *et al*. (2018) [2] reported cross combination AKMS 30 A x AKR 337 with positive significant sca effects for both grain yield and fodder yield per plant.

The hybrids with significant & desirable sca effects for grain yield and fodder yield recorded all the three types of gca combinations of the parental lines involved in the cross combinations i.e. High x high, high x low and low x low. Hariprasanna *et al*., (2012) [3] reported that some of the crosses with positive significant SCA for grain yield involved even low x low combinations of parents. However, Ravindrababu *et al*. (2001) [7] reported that in the development of high yielding hybrids; at least one parent should be having high gca effects for grain yield.

Thus it was concluded from the present study that total thirteen crosses exhibited positive significant sca effects for the character grain yield per plant. Out of these thirteen crosses, total eight cross combinations viz., AKRMS-80-1A(39) X PKV-Kranti, AKRMS-80-1A(39) X Elangovan-35, AKRMS-80-1-1A(62) x Rb-Local-1-1-sel-1, AKRMS-66-2A(38) X SLR-137, AKRMS-66-2A(40) X Rb-Local-1-1-sel-1, AKRMS-66-2A(38) X RSV-962, AKRMS-66-2-3A X Elangovan-35 and AKRMS-66-2A(38) X Rb-Local-5(Bold) recorded positive significant sca effects along with positive significant standard heterosis for both grain yield per plant and fodder yield per plant and hence appeared to be best for further exploitation. These nine crosses need to be evaluated on large scale multilocation and multiseason trials to find out the most stable cross combination for higher grain as well as fodder yield in *post rainy* sorghum.

Table 1: Analysis of variance of parents and hybrids under Line x Tester analysis.

Source of Variation	d.f.	Grain Yield/ Plant (g)	Fodder Yield/ Plant (g)
Replications	2	1.26	44.52
Genotypes	64	566.34**	1793.98**
Parents	14	296.44**	597.20**
Females	4	598.69**	430.42**
Males	9	165.29**	628.08**
Females vs Males	1	267.73**	986.38**
Hybrids	49	651.57**	1595.74**
Parents vs Hybrids	1	168.86**	28262.19**
Error	128	7.62	25.12

* - Significant at 5 % level of significance ** - Significant at 1 % level of significance

Table 2: Analysis of variance for combining ability under Line x Tester analysis.

Source of Variation	d.f.	Mean Sum of Squares	
		Grain Yield/ Plant (g)	Fodder Yield/ Plant (g)
Replications	2	2.064	70.331
Crosses	49	651.575 **	1595.749 **
Lines	4	2291.907 **	1253.260
Testers	9	881.244	1596.381
Line x Tester	36	411.899 **	1633.645 **
Error	98	8.735	31.596

* - significant at 5% level of significance ** - significant at 1% level of significance

Table 3: SCA effects for grain yield and fodder yield

S. N.	Crosses	SCA effects	
		Grain yield	Fodder yield
1	AKRMS-80-1A(39) X PKV-Kranti	25.93**	29.67**
2	AKRMS-66-2-3A X SLR-136	20.37**	6.64*
3	AKRMS-80-1A(39) X Elangovan-35	13.43**	28.85**

4	AKRMS-80-1-1A(62) x Rb-Local-1-1-sel-1	13.05**	24.86**
5	AKRMS-66-2-3A X Rb- Local -5(Bold))	10.44**	3.98
6	AKRMS-66-2-3A X AKSV-370	10.38**	2.29
7	AKRMS-66-2A(38) X SLR-137	10.22**	6.39*
8	AKRMS-66-2A(40) X Rb-Local-1-1-sel-1	9.45**	29.64**
9	AKRMS-66-2A(38) X RSV-962	9.32**	27.77**
10	AKRMS-80-1A(39) X Rb-Local-1-1-sel-1	9.04**	-42.98**
11	AKRMS-66-2-3A X Elangovan-35	8.91**	30.58**
12	AKRMS-66-2A(38) X Rb-Local-5(Bold)	6.19**	8.18**
13	AKRMS-66-2A(38) x AKSV-370	5.19**	-1.89

* - significant at 5% level of significance ** - significant at 1% level of significance

Table 4: Promising cross combinations for grain yield per plant and fodder yield per plant

S. No.	Crosses	SCA effects		GCA of parents		Standard Heterosis (%)	
		Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield
1	AKRMS-80-1A(39) X PKV-Kranti	25.93**	29.67**	-2.72** X -4.68** L L	-1.98* x 7.39** L H	19.72**	32.28**
2	AKRMS-80-1A(39) X Elangovan-35	13.43**	28.85**	-2.72** X 8.15** L H	-1.98* x 1.23 L L	20.32**	24.12**
3	AKRMS-80-1-1A(62) x Rb-Local-1-1-sel-1	13.05**	24.86**	-9.14** X 15.66** L H	-4.79** x -0.98 L L	21.59**	13.61**
4	AKRMS-66-2A(38) X SLR-137	10.22**	6.39*	13.30** X 0.17 H H	9.04** x 12.69** H H	30.15**	24.11**
5	AKRMS-66-2A(40) X Rb-Local-1-1-sel-1	9.45**	29.64**	-5.01** X 15.66** L H	4.20** x -0.98 H L	22.57**	29.68**
6	AKRMS-66-2A(38) X RSV-962	9.32**	27.77**	13.30** X -5.26** H L	9.01** x -3.41** H L	17.61**	30.28**
7	AKRMS-66-2-3A X Elangovan-35	8.91**	30.58**	3.56** X 8.15** H H	-6.44** x 1.23 L L	23.50**	20.94**
8	AKRMS-66-2A(38) X Rb-Local-5(Bold)	6.19**	8.18**	13.30** X 1.52* H H	9.01** x 7.90** L L	24.21**	20.61**

* - significant at 5% level of significance ** - significant at 1% level of significance

References

1. Ghorade RB, Kalpande VV, Bhongle SA, Band PA. Combining ability analysis for drought tolerance and grain yield in *rabi* sorghum. International Journal of Agricultural Sciences 2014;10(1):344-347.
2. Ghorade RB, Girnale VB, Tayde NR, Kalpande VV, Bhuyar AR, Kamble PS. Assessment of newly developed diverse parental lines in sorghum through combining ability. Int. J Curr. Microbiol. App. Sci 2018;6:1992-1998.
3. Hariprasanna K, Rajendrakumar P, Patil JV. Parental selection for high heterosis in sorghum (*Sorghum bicolor* (L.) Moench)-Combining ability, heterosis and their relationship. Crop Res 2012;44(3):400-408.
4. Kempthorne O. An Introduction to genetic statistics. John Willey and Sons. Increased.New York, 1957, 468-470.
5. Prabhakar Elangovan M, Bahadure DM. Combining ability of new parental lines for flowering, maturity and grain yield in *rabi* sorghum. Electronic J of Plant Breeding 2013;4(3):1241-1218.
6. Prakash R, Ganeshmurty K, Nirmalkumar A, Nagarajan P. Combining ability for fodder yield and its components in sorghum (*Sorghum bicolor* (L.) Moench). Electronic Journal of Plant Breeding 2010;1(2):140-144.
7. Ravindrababu Y, Pathak AR, Tank CJ. Studies on combining ability for yield and yield attributes in sorghum (*Sorghum bicolor* (L.) Moench). Crop Res 2001;22(2):274-277.