

Original Research Article

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## Specific Combining Ability analysis for Grain Yield and its Components in Post Rainy Sorghum

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### ABSTRACT

#### Keywords

Combining ability analysis, Line x tester, SCA, Sorghum, Standard heterosis

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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 out of the fifty hybrids, thirteen hybrids revealed positive significant SCA effects along with positive significant standard heterosis for grain yield per plant. Hybrid AKRMS-80-1A (39) x PKV-Kranti recorded the highest positive significant SCA effects (25.93\*\*) along with positive significant standard heterosis (19.72\*\*) for grain yield/plant. All these crosses need to be evaluated on large scale multilocation and multiseason trials to find out the most stable cross combination for higher grain yield in *rabi* sorghum.

### Introduction

Post rainy (Rabi) sorghum is dual purpose crop with best grain quality and fodder quality and hence fetches good market price. Post rainy sorghum is mostly taken on the residual soil moisture. The study was undertaken to estimate the specific combining ability effects in post rainy sorghum hybrids which in turn helped in identification of the potential cross combinations for yield and its components in post rainy sorghum. Promising cross combinations were sorted out based on the specific combining ability along with the

desirable and significant standard heterosis for grain yield per plant.

### 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 plant height (cm), panicle length (cm), panicle breadth (cm), number of primaries/ panicle, number of grains/ panicle, 1000 seed weight (g) and grain 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) method.

## Results and Discussion

Analysis of variance showed that the mean squares due to genotypes were highly significant for all the traits studied under this investigation (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 grain yield per plant. Analysis of variance for combining ability is presented in Table 2. It is revealed that crosses exhibited significant variation for grain yield as well as all the component traits. The male x female interaction was also significant. Among the 50 hybrids in the present investigation, thirteen cross combinations exhibited positive SCA effects for grain yield per plant along with some of the component characters (Table 3). The hybrid AKRMS-80-1A x PKV-Kranti (25.93\*\*) exhibited highest positive significant SCA effects for grain yield per plant along with all other component characters.

The second hybrid AKRMS-66-2-3A x SLR-136 exhibited desirable significant SCA effects for grain yield per plant (20.37\*\*) along with all other component characters except plant height. The SCA effects were 8.55\*\* for number of primaries, 2.73\*\* for panicle length, 0.71\*\* for panicle breadth and 4.22\*\* for 1000 seed weight.

Third cross AKRMS-80-1A (39) x Elangovan-35 exhibited positive significant SCA effects for grain yield per plant (13.43\*\*) along with all other component characters except for panicle length and panicle breadth. Total thirteen crosses exhibited positive significant SCA effects along with positive significant standard heterosis for grain yield per plant.

Ghorade *et al.*, (2016) reported ten promising cross combination based on positive significant SCA effects for grain yield per plant.

Kalpande *et al.*, (2016) also reported three promising crosses based on positive significant SCA effects for grain yield per plant. Thus it was also observed that thirteen crosses exhibited positive significant SCA effects accompanied with positive significant standard heterosis for grain yield per plant. It is very well known that if SCA variance, which is a measure of non-additive genetic variance, is high for a character and also observed heterosis is also high, such crosses can be utilized for commercial exploitation of heterosis.

Similarly, it was also observed from the Table 3 that high heterotic crosses exhibited significant SCA effects with higher *per se* performance. Similar relationship was also noticed by Prabhakar (2013) in *rabi* sorghum. However Patil and Bapat (1991) reported that high SCA was not reflected in high heterosis.

Prakash *et al.*, (2010), Prabhakar *et al.*, (2013), Ghorade *et al.*, (2014<sup>b</sup>) and Kalpande *et al.*, (2015<sup>c</sup>) also reported such promising crosses based on SCA, heterosis and mean performance.

Gunjal (2014) also reported fourteen promising crosses with positive significant SCA effects along with positive significant standard heterosis in his study.

Kalpande *et al.*, (2016<sup>d</sup>) reported seventeen promising cross combinations based on positive significant SCA effects for grain yield per plant along with some of the component characters.

Ghorade *et al.*, (2018) reported the cross combination AKMS 90 A x AKR 337 with highest significant standard heterosis as well as highest significant SCA effects for grain yield per plant.

**Table.1** Analysis of variance of parents and hybrids for various characters under Line x Tester analysis

Source of Variation	d.f.	Plant Height (cm)	Number of primaries per cob	Panicle Length (cm)	Panicle breadth (cm)	Number of Grains/ Panicle	1000 Seed Weight (g)	Grain Yield/ Plant (g)
Replications	2	9.89	2.72	1.68	0.11	814.74	2.27	1.26
Genotypes	64	3340.27**	263.78**	11.28**	1.22**	571863.91**	85.30**	566.34**
Parents	14	2741.95**	174.46**	8.96**	0.28*	215933.56**	83.48**	296.44**
Females	4	154.44**	401.16**	9.99**	0.31	233073.87**	121.34**	598.69**
Males	9	547.24**	84.59**	9.26**	0.29*	226876.72**	74.31**	165.29**
Females vs Males	1	32844.3617**	76.54**	2.19	0.007	48883.86**	14.48*	267.73**
Hybrids	49	3565.7858**	277.41**	11.58**	1.51**	678127.736**	83.41**	651.57**
Parents vs Hybrids	1	666.56**	846.26**	29.02**	0.015	347961.26**	203.78**	168.86**
Error	128	20.23	6.57	1.98	0.14	4526.13	2.49	7.62

**Table.2** Analysis of variance for combining ability for various characters

Source of Variation	d.f.	Plant Height (cm)	Number of Primaries per cob	Panicle Length (cm)	Panicle Breadth (cm)	Number of Grains/ Panicle	1000 Seed Weight (g)	Grain Yield/ Plant (g)
Replications	2	11.198	15.020	1.958	0.138	6158.657	2.382	2.064
Crosses	49	3565.786 **	277.418 **	11.585 **	1.516 **	678127.800 **	83.414 **	651.575 **
Lines	4	12546.210 **	416.333	13.590	1.353	2222591.000 **	51.456	2291.907 **
Testers	9	3579.973	355.456	9.845	1.701	857341.700	149.956	881.244
Line x Tester	36	2564.414 **	242.474 **	11.797 **	1.488 **	461717.200 **	70.330 **	411.899 **
Error	98	20.770	7.347	2.122	0.164	3670.258	2.538	8.735

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

**Table.3** SCA effects of promising hybrids for grain yield per plant

S.N	Crosses	Mean for Grain yield / plant (g)	SCA effects for grain yield	Standard Heterosis for grain yield (%)	GCA effect with type of parents for grain yield	Desirable significant SCA effects for component traits
1	AKRMS-80-1A(39) X PKV-Kranti	66.42	25.93**	19.72**	-2.72** X -4.68** L L	plant height, panicle length,, panicle breadth, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
2	AKRMS-66-2-3A X SLR-136	69.17	20.37**	24.67**	3.56** X -2.65** H L	panicle length,, panicle breadth, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
3	AKRMS-80-1A(39) X Elangovan-35	66.76	13.43**	20.32**	-2.72** X 8.15** L H	plant height, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
4	AKRMS-80-1-1A(62) x Rb-Local-1-1-sel-1	67.46	13.05**	21.59**	-9.14** X 15.66** L H	plant height, panicle length,, panicle breadth, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
5	AKRMS-66-2-3A X Rb- Local -5(Bold))	63.42	10.44**	14.30**	3.56** X 1.52* H H	panicle length, number of primaries/ panicle, number of grains/ panicle
6	AKRMS-66-2-3A X AKSV-370	65.36	10.38**	17.80**	3.56** X 3.52** H H	number of primaries/ panicle
7	AKRMS-66-2A(38) X SLR-137	72.21	10.22**	30.15**	13.30** X 0.17 H H	plant height, panicle length,, panicle breadth, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
8	AKRMS-66-2A(40) X Rb-Local-1-1-sel-1	68.00	9.45**	22.57**	-5.01** X 15.66** L H	panicle breadth, 1000 seed weight
9	AKRMS-66-2A(38) X RSV-962	65.26	9.32**	17.61**	13.30** X - 5.26** H L	plant height, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
10	AKRMS-80-1A(39) X Rb-Local-1-1-sel-1	69.87	9.04**	25.93**	-2.52** X 15.66** L H	plant height, panicle length,, panicle breadth, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
11	AKRMS-66-2-3A X Elangovan-35	68.52	8.91**	23.50**	3.56** X 8.15** H H	plant height, panicle breadth, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight
12	AKRMS-66-2A(38) X Rb-Local-5(Bold)	68.92	6.19**	24.21**	13.30** X 1.52* H H	plant height, panicle length,, number of primaries/ panicle, number of grains/ panicle
13	AKRMS-66-2A(38) x AKSV-370	69.91	5.19**	26.01**	13.30** X 3.52** H H	panicle breadth, number of primaries/ panicle, number of grains/ panicle, 1000 seed weight

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

For grain yield per plant, out of the total thirteen hybrids, six hybrids involved high x low type of GCA value of parents involved in the crosses while six cross combination involved high x high type of GCA value of the parents and one cross combination involved low x low type of GCA value of the parents

Ravindrababu *et al.*, (2001) and Ghorade *et al.*, (2014) also reported that some of the promising hybrids involved high x low GCA parental lines. However Hariprasanna *et al.*, (2012) reported that some of the crosses with positive significant SCA for grain yield involved even low x low combination of parents.

Gunjal (2014) also reported that out of the total sixteen promising hybrids, eleven hybrids involved high x low type of GCA value of parents involved in the crosses while five cross combination involved low x low type of GCA value of the parents.

Thus it was concluded from the present study that total thirteen cross combinations recorded positive significant SCA effects along with positive significant standard heterosis for grain yield per plant and hence appeared to be best for further exploitation. These crosses need to be evaluated on large scale multilocation and multiseason trials to find out the most stable cross combination for higher grain yield in *rabi* sorghum.

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