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COMBINING ABILITY ANALYSIS FOR GRAIN AND FODDER YIELD IN POST RAINY SORGHUM

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Abstract

Three lines and twenty two testers were crossed in line × tester fashion and the resultant 66 hybrids were evaluated along with the check for grain yield per plant and fodder yield per plant for combining ability analysis. The study revealed that total two 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 A × Rb 307-11 was the best cross combination with the *sca* effects of 18.23** for grain yield and 16.54** for fodder yield. Also this cross exhibited standard heterosis of 28.99% for grain yield and 21.90% for fodder yield. Thus, total two 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.

Key words : Combining ability analysis, line × tester, *sca*, sorghum, standard heterosis.

Introduction

In case of post rainy (*rabi*) sorghum both grain and fodder are of equal importance. 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 three male sterile lines *viz.*, AKRMS 80A, AKRMS 80-1-1-1A, AKRMS 47A and twenty-two testers *viz.*, Rb-307-11, Rb-400, PKV Kranti as R, Rb-local 1-2, Rb-309, Rb-397-2, AKSV-47R, Rb-324 (AKR-73 × 504-1), AKSV-70R, RS-585, AKSV-219R, G-45-3-1-1, AKSV-205R, RL-5-1, RL-5-5, Rb-316-3, AKRb-356-6-2, RL-5-3, AKSV-72R (104B × Akent 8-1-3), (275 × 104B × 1201 × Ringini × 18551 × 89022 17-1-1). These twenty-five genotypes were crossed in line x tester fashion. Twenty-five parents and their resulting 66 hybrids along with one standard check CSH-19R were sown at Sorghum Research Unit, Dr. P.D.K.V. Akola (Maharashtra), India; during *rabi* 2013-14 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) method.

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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 grain 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 × male interaction was also significant. Among the 66 hybrids in the present

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

Source of variation	d.f.	Grain yield/ plant (g)	Fodder yield/ plant (g)
Replications	2	13.55	0.87
Genotypes	90	265.25**	667.26**
Parents	24	68.72**	53.36
Hybrids	65	176.01**	420.62**
Parents vs. Hybrids	1	10782.51**	31432.53**
Error	180	25.28	46.96

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

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

Source of variation	d.f.	Mean Sum of Squares	
		Grain yield/ plant (g)	Fodder yield/ plant (g)
Replications	2	44.62	37.61
Lines	2	496.70	642.39
Testers	21	178.50	488.10
Line × Tester	42	159.49**	376.32**
Error	130	24.23	47.99

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

Table 3 : *SCA* effects, *GCA* effects and standard heterosis for grain yield and fodder yield.

S. no.	Crosses	*SCA* effects		*GCA* effects of parents involved		Standard Heterosis (%)	
		Grain yield	Fodder yield	Grain yield	Fodder yield	Grain yield	Fodder yield
1.	AKRMS 80 A × Rb 307-11	18.23**	16.54**	-2.52* × 0.59 L L	1.86 × 12.11** L H	28.99**	21.90**
2.	AKRMS 80 A × Rs 585	12.08**	5.06	-2.52* × 3.53 L L	1.86 × 14.46 L H	14.80*	5.11
3.	AKRMS 47 A × AKSV 70 R	11.99**	10.79**	2.91** × 5.35** H H	1.73 × -1.18 L L	15.76*	28.32**
4.	AKRMS 80-1-1-1 A × Rb 307-11	11.73**	10.88**	-0.39 × 0.59 L L	-3.60** × 12.11** L H	7.82	13.64
5.	AKRMS 80 A x Rb 309	9.62**	-5.71	-2.52* × 5.19 L L	1.86 × -3.30 L L	-6.67	-4.76
6.	AKRMS 47 A × Rb Local 1-2	8.51**	2.93	2.91** × 2.58 H L	1.73 × 4.80 L L	9.72	1.46
7.	AKRMS 80 A × Rb 397-2	7.83*	2.13	-2.52* × 6.36* L H	1.86 × -0.55 L L	7.66	-1.07
8.	AKRMS 80 A × (104 B × AKENT 8-1-3)	7.30*	0.10	-2.52* × -7.37* L L	1.86 × -9.93* L L	2.55	6.39
9.	AKRMS 80-1-1-1 A × (275 × 104B × 1201 × Ringini × 18551 × 89022 17-1-1)	7.19*	10.49**	-0.39 × -0.73 L L	-3.60** × 5.39 L L	7.37	24.28**
10.	AKRMS 47 A × AKSV 219 R	6.60*	-10.94**	2.91** × -5.42 H L	1.73 × 1.54 L L	5.81	-14.46*
11.	AKRMS 47 A × Rb 307-11	5.73*	15.61**	2.91** × 0.59 H L	1.73 × 12.11** L H	-2.00	19.89**
12.	AKRMS 80-1-1-1 A × RL 5-5	5.65*	12.21**	-0.39 × 0.99 L L	-3.60** × -1.26 L L	-0.45	25.95**

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

investigation, twelve 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 A × Rb 307-11 (18.23**). Out of these sixteen cross combinations only six crosses *viz*., AKRMS 80 A × Rb 307-11, AKRMS 80-1-1-1 A × Rb 307-11, AKRMS 47 A × AKSV 70 R, AKRMS 80-1-1-1 A × (275 × 104B × 1201 × Ringini × 18551 × 89022 17-1-1),

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 A × Rb 307-11	18.23**	16.54**	-2.52* × 0.59 L L	1.86 × 12.11** L H	28.99**	21.90**
2.	AKRMS 47 A × AKSV 70 R	11.99**	10.79**	2.91** × 5.35** H H	1.73 × -1.18 L L	15.76*	28.32**

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

AKRMS 47 A × Rb 307-11 and AKRMS 80-1-1-1 A × RL 5-5 showed positive significant *sca* effects for fodder yield also. 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. Out of these six cross combinations total two crosses *viz.*, AKRMS 80 A × Rb 307-11 and AKRMS 47 A × AKSV 70 R exhibited positive significant *sca* effects for both grain yield as well as fodder yield along with the 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 A x Rb 307-11. This cross recorded the sca of 18.23** for grain yield and 16.54** for fodder yield. Also this cross showed the positive significant standard heterosis of 28.99% and 21.90% 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.

Second best cross combination was AKRMS 47 A × AKSV 70 R. This cross exhibited the sca of 11.99** for grain yield and 10.79** for fodder yield. Also this cross recorded the positive significant standard heterosis of 15.76% and 28.32% for grain yield and fodder yield, respectively. Regarding the gca effects of the parental lines involved in this cross it was H × H for grain yield and L × L for fodder yield. It was observed form the table 3 that high sca effects are not associated with high standard heterosis. Prakash *et al*. (2010), Hariprasanna *et al*. (2012), Prabhakar *et al*. (2013) and Ghorade *et al*. (2014) also reported such promising crosses based on high *sca* effects and heterosis for grain yield as well as fodder yield in sorghum.

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 × high, high × low and low × low. Hariprasanna *et al*. (2012) reported that some of the crosses with positive significant *sca* for grain yield involved even low × low combinations of parents. However, Ravindrababu *et al*. (2001) 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 twelve crosses exhibited positive significant *sca* effects for the character grain yield per plant. Out of these twelve crosses, total two cross combinations *viz.*, AKRMS 80 A × Rb 307-11 and AKRMS 47 A × AKSV 70 R 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 two 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 *rabi* sorghum.

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