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POTENTIAL PARENTS FOR YIELD AND ITS COMPONENTS IN RABI SORGHUM

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ABSTRACT

The general combining ability study revealed that among the lines, AKRMS-47 A was the best general combiner for yield per plant (2.91) along with four other component characters i.e. plant height (12.37), number of primaries per panicle (2.93), number of grains per panicle(63.35) and thousand grain weight (2.10). Among the testers, the tester RL-5-1 was the best tester and exhibited significant desirable gca effects for grain yield per plant (7.95) along with component character like plant height (19.45). Second tester Rb-397-2 exhibited the positive significant gca effects for the grain yield per plant (6.36).Third tester AKSV-70 R also showed significant positive gca effects for grain yield per plant (5.35) as well as for number of primaries per panicle (7.25) and 1000 seed weight (2.93).Fourth promising tester was G-45-3-1-1 with positive significant gca effects for grain yield per plant (4.70) as well as for the component traits like number of leaves per plant (0.70), panicle breadth (0.64) and number of primaries per panicle (4.55). This one line and four testers need to be extensively used in crossing programme for development of high yielding rabi sorghum hybrids.

INTRODUCTION

Post rainy sorghum is the sorghum grown in the rabi sorghum. The yield levels of rabi sorghum are low as compared to the kharif sorghum. Development of high yielding hybrids has resulted in the quantum jump in the yield levels of the kharif sorghum. But in case of rabi sorghum the phenomenon of heterosis has not been exploited to the full extent. There is need to develop high yielding rabi sorghum hybrids. Identification of the potential parents is the prerequisite for exploitation of heterosis. Prabhakar and Raut (2010) also stressed the need for exploitation of the phenomenon of heterosis in rabi sorghum to increase the productivity of the rabi sorghum. Developing high-yielding post-rainy season-adapted varieties/hybrids is the main objective in almost all the crop improvement programmes. In the development of the high yielding hybrids, the identification of the potential parental lines is of prime importance. Selection of parents on the basis of phenotypic performance alone is not a sound procedure since phenotypically superior lines may yield poor recombination. It is therefore, essential that parents should be chosen on the basis of their genetic value (Krupakar *et al.,* 2013). Prakash *et al.* (2010) studied 35 hybrids resulting from seven lines and five testers and observed that the parents ISCA 693 and PKB 192 recorded high *per se* performance with positively significant gca effects for green fodder yield per plant. Prabhakar et al. (2013) observed combining ability effects involving five females, four males and their 24 crosses and reported that the female SL-9B and males SLR-57 and SLR-30 were good general combiners for grain yield and need to exploited further in heterosis breeding programme. Jain and Patel (2014) studied nine genetically diverse lines of sorghum using diallel mating design excluding the reciprocals. Form the study they concluded that considering the general combining ability effects, the parental lines GJ-39, GFS-5 and CSV-15 were the best parents for grain yield and some of the yield components. They also reported that it would be worthwhile to use above parents in breeding programme for exploiting additive gene effects. Selection of parents on the basis of phenotypic performance alone is not a sound procedure since phenotypically superior lines may yield poor recombination. It is therefore, essential that parents should be chosen on the basis of their genetic value. Combining ability analysis provide information on additive and non-additive variances (*i.e.* dominance and epistasis), which are important to decide the proper parents for hybridization to produce superior hybrids (Jaiswal *et al.,* 2013). General combining analysis is the best tool to assess the potential of any parent. The present study was undertaken with the objective to identify the promising parental lines for grain yield and its components using combining ability analysis.

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 x 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 x Akent 8-1-3), (275 x 104B x 1201 x Ringini x 18551 x 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, 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 plant height (cm), number of leaves/ plant, panicle length (cm), panicle breadth (cm), number of primaries per panicle, number of grains per panicle, 1000 seed weight (g), grain yield per plant (g) and fodder yield per plant (g). The data on all the above characters was subjected to combining ability analysis by following Kempthorne (1957) method.

RESULTS AND DISCUSSION

Analysis of variance for combining ability is presented in the Table 1. The total variance due to hybrids was partitioned into portions attributable to lines (females), testers (males), their interaction (lines x testers) and error sources. The components of variances attributable to lines and testers were used as a measure of general combining ability.

Jain and Patel (2014) sated that the per se performance of the parent with high general combining ability provide the criteria for the choice of the parents for hybridization. On this basis, those parents which performed well for per se performance and general combining ability effects can be considered as desirable parents. Further the parents with high gca effects are desirable for obtaining useful segregants in early generations. The potentially of parents to produce better off springs with superior genes was evaluated based on their general combining ability effects. To get desirable recombinants in segregating generations, the parents of the hybrids must be good general combiners for the characters to which improvement is sought (Jain and Patel, 2014)

The estimates of general combining ability effects of the lines and testers are presented in Table 2 and Table 3 respectively. The estimates of general combining ability effects for all the traits revealed that none of the line showed desirable significant general combining ability effects for all the characters together, indicating that different parents should be used for genetic improvement of different yield components. Among the three lines, the line AKRMS-47 A was the best general combiner for yield per plant (2.91) along with four other component characters *i.e.* plant height (12.37), number of primaries per panicle (2.93), number of grains per panicle (63.35) and thousand grain weight (2.10).

Among the testers, the tester RL-5-1 was the best tester and exhibited significant desirable gca effects for grain yield per plant (7.95) along with component character like plant height (19.45). Second tester Rb-397-2 exhibited the positive significant gca effects for the grain yield per plant (6.36).Third tester AKSV-70 R also showed significant positive gca effects for grain yield per plant (5.35) as well as for number of primaries per panicle (7.25) and 1000 seed weight (2.93).Fourth promising tester was G-45-3-1-1withpositive significant gcaeffects for grain yield per plant (4.70) as well as for the component traits like number of leaves per plant (0.70), panicle breadth (0.64) and number of primaries per panicle (4.55). Thus, it would be worthwhile to use above parents in breeding programme for exploitation of additive gene effects. Premlatha *et al.*, 2006, Mukesh *et al.*, 2007, Prabhakar and Raut, 2010 and Ghorade *et al.*, 2014 also reported the promising general combiners for yield and its components from their study.

Thus it was concluded form the present study that there is need to extensively use one line AKRMS 47 A and the four testers *i.e.* RL-5-1, Rb-397-2, AKSV-70 R and G-45-3-1-1 in hybridization programme to develop high yielding hybrids in post rainy sorghum.

Table 1: Analysis of variance for combining ability for various characters

Source of variation	d.f.	Mean Sum of Squares								
		Plant height (cm)	Number of leaves /plant	Panicle length (cm)	Panicle breadth (cm)	Number of primaries /panicle	Number of grains/ panicle	1000 seed weight(g)	Grain yield/ plant (g)	Fodder yield/ plant (g)
Replications	2	66.83	0.20	0.27	0.39	9.70	14675.44	14.01	44.62	37.61
Lines	2	7642.54**	2.14	0.06	2.05	429.74*	201831.90	269.63	496.70	642.39
Testers	21	1471.85*	1.72	0.58	1.20	120.10	89506.57	150.08	178.50	488.10
Line xTester	42	711.95**	1.37**	0.91	1.15**	122.36**	105931.17**	93.66**	159.49**	376.32**
Error	130	123.07	0.33	2.49	0.30	24.85	26635.07	8.82	24.23	47.99

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

Table 2: Estimates of general combining ability effects of lines for various characters under line × tester analysis

Parents	Plant height (cm)	Number of leaves/ plant	Panicle length (cm)	Panicle breadth (cm)	Number of primaries /panicle	Number of grains/ panicle	1000 seed weight (g)	Grain yield/ plant (g)	Fodder yield/ plant (g)
AKRMS-80A	-7.14**	0.03	-0.03	-0.10	-1.27	-38.55**	-1.93*	-2.52*	1.86
AKRMS-80-1-1-1A	-5.23**	-0.19	0.03	-0.10	-1.66	-24.80**	-0.16	-0.39	-3.60**
AKRMS-47A	12.37**	0.15	0.00	0.20	2.93**	63.35**	2.10*	2.91**	1.73
SE (gi)+	1.36	0.07	0.19	0.06	0.61	20.08	0.36	0.60	0.85
CD AT 5 %	2.70	0.14	0.38	0.13	1.21	39.74	0.72	1.19	1.68
CD AT 1 %	3.56	0.18	0.50	0.17	1.60	52.51	0.95	1.58	2.22

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

Table 3: Estimates of general combining ability effects of testers

Parents	Plant height	Number of leaves/ plant	Panicle length	Panicle breadth	Number of primaries /panicle	Number of grains/ panicle	1000 seed weight	Grain yield/ plant	Fodder yield/ plant
RS-585	-1.64	0.53*	-0.09	0.38	0.07	34.66	7.86 **	3.53	14.46 **
AKSV-219R	-7.65	-0.11	0.12	0.06	-5.46	35.04	2.42	-5.42	1.54
(275 x 104B x 1201 x Ringini x 18551 x 89022 17 1-1)	-9.49	0.32	0.05	-0.23	1.07	51.41	2.50	-0.73	5.39
Rb-397-2	4.00	0.44	0.24	-0.67 *	-0.09	-0.59	5.86 **	6.36 *	-0.55
G-45-3-1-1	-14.76 *	0.70 *	0.03	0.64 *	4.55**	131.94	0.99	4.70**	-11.53 **
(AKR-73 x 504-1)	-18.13 **	-0.03	0.05	-0.29	-4.64	-60.13	-6.61 **	-8.21 **	-7.18
RL-5-3	-13.85 *	0.00	0.23	-0.59	3.52	-20.00	2.25	-3.33	-5.87
(104B x Akent 8-1-3)	-16.95 **	-0.52	0.11	0.22	-2.41	-25.45	0.16	-7.37 *	-9.93 *
Rb-316-3	3.21	-0.72 *	-0.58	0.49	0.39	-8.02	-0.14	-4.10	0.42
PKV Kranti New R	4.06	-0.17	-0.17	-0.30	-7.97 **	-91.03	-4.41 *	-4.32	-7.99 *
AKSV-47R	-21.67 **	-0.22	0.32	-0.09	-0.41	-140.45	2.36	-3.65	-4.56
AKSV-205R	2.44	0.45	-0.20	0.39	0.45	128.84	-5.81 **	-0.15	-1.01
Rb-324	17.28 **	0.50	0.59	-0.11	3.58	7.92	-3.81 *	0.34	-1.91
Rb-307-11	8.92	0.39	0.11	0.34	3.23	-136.62	0.54	0.59	12.11 **
RL-5-1	19.45 **	0.02	-0.07	0.11	-0.46	36.24	-2.77	7.95 **	1.00
RL-5-5	-3.13	-0.38	-0.28	0.16	-5.50	55.43	-1.84	0.99	-1.26
AKSV-72R	25.35 **	0.49	-0.07	-0.59	-1.28	-209.52 *	-5.54 **	-1.30	-5.97
Rb local 1-2	17.29 **	-0.48	0.17	-0.11	1.99	147.83	-2.49	2.58	4.80
Rb-400	0.35	-0.38	-0.13	-0.15	3.09	-82.67	0.85	0.74	8.43 *
AKRb-356-6-2	0.27	-0.23	-0.08	-0.03	-1.53	189.93 *	-2.65	0.24	14.10 **
AKSV-70R	-0.67	-0.75 *	0.04	-0.03	7.25 *	-68.39	2.93**	5.35**	-1.18
Rb-309	5.33	0.15	-0.42	0.41	0.56	23.65	7.33 **	5.19	-3.30
SE (gi) +	3.69	0.19	0.52	0.18	1.66	54.40	0.99	1.64	2.30
CD at 5 %	7.31	0.38	1.04	0.36	3.28	107.62	1.95	3.24	4.56
CD at 1 %	9.66	0.50	1.37	0.48	4.34	142.21	2.58	4.28	6.03

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

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