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PREDICTION OF HIGH-YIELDING CROSSES IN RABI SORGHUM

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ABSTRACT

Forty-five F_1crosses from 10x10 dialled mating were utilized for the study. Classification of high yielding crosses based on **Per se** performance and **gca** effects of parents and classification of crosses with desirable significant **sca** effects has shown that **gca** estimates can be used with more reliability though both the methods gave similar conclusion. High x high, high x medium and high x low groups were promising than the other three types of crosses, viz. medium x medium, medium x low and low x low. At least one high yielding or high general combining parent is necessary to obtain high yielding crosses.

Prediction of high yielding crosses is an important step in heterosis breeding. In **kharif** sorghums, high yielding hybrids involved good general combiners like 296A, 2077A, 2219A and CS-3541. The **per se** performance of these lines is also satisfactory. Such prediction with **rabi** material is yet to be ascertained conclusively. In the present study, an attempt is made to predict crosses with high yields and significant desirable sca separately, classifying parents based on **per se** performance and general combining ability. A reliable prediction facilitates selection of desirable parents and restricts the number of crosses one should attempt to get a high yielding cross.

MATERIALS AND METHODS

Forty five F_1crosses obtained from dialled mating of 10 parental lines, viz., SPV-232, SPV-140, M35-1, 296B, CSV-8R, 36B, D-71396, E36-1 and CSV-5 were utilized for the study. The experiment was conducted at the College Farm, A.P.Agricultural University, Hyderabad during **rabi**. The parents and F_1s were grown in a randomized complete block design with three replications. Normal cultural practices were followed with 80 kg N, 40 kg P_2O_5 and 30 kg K_2O per hectare. Five characters, viz., grain yield, days to flowering, plant height, number of leaves and 100-grain weight were considered.

Parents were classified as high (H), medium (M) and low (L) based on two criteria i.e., (1) **per se** performance and (2) **gca** effects.

(1) Based on **per se** performance: Parents were classified as high (H) if parental mean exceeds grand mean (of parents) +SE(m) while parents with grand mean -SE(m) were considered as low(L). Parents falling in the range of grand mean ± SE(m) belonged to medium (M) group.

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Crosses with mean above the grand mean of crosses were classified into different groups, viz., HH, HM, HL, MM, ML and LL. The number of high-yielding crosses (above grand mean of crosses) observed (nh) and the percentage of high yielding crosses (p) in each group were calculated.

(2) Based on gca effects: Parents were classified based on gca effects. A parent with gca above SE(gi) in desired direction was considered high (H), while a low (L) parent had opposite sign and value which was more than SE(gi). The medium parents fall in the range of -SE(gi) and + SE(gi).

(a) The crosses with mean above grand mean of crosses were classified into different groups, viz., HH, HM, HL, MM, ML and LL.

(b) The high-yielding crosses result from high gca as well as high sca. Hence, it was also attempted to classify the crosses with significant desirable sca, with parents being classified based on gca effects.

RESULTS AND DISCUSSION

The parents belonging to high, medium and low groups based on per se performance and gca of parents are listed for each of the five characters, viz., grain yield, days to flowering, plant height, number of leaves and 100-grain weight in Table 1. Eight crosses giving significantly higher yield than m 35-1 are given in Table 2.

CLASSIFICATION OF CROSSES WITH HIGH MEAN AND sca:

(1) Based on per se performance of parents: Crosses with mean above grand mean of crosses were classified into different groups based on parental performance and are presented in Table. 3.

For grain yield, out of 45 crosses tested, 23 crosses had yield above the grand mean. Maximum crosses were classified in HM group (39%) followed by HL (31%) and HH (17%) groups. Among the eight high-yielding crosses which are superior to M35-1, 38% belonged to HM group, 25% each to HH and HL groups and 12% to ML group. Results of Upadhyaya and Rasmusson (1967), Singhania and Rao (1975) and Patel et al. (1984) also suggested a preliminary evaluation of lines per se providing an effective test of potential parents and subsequent test cross evaluation of high x high lines could yield highest yielding hybrids.

For days to flowering, 19 crosses were earlier in flowering as compared to grand mean of crosses. Of these, maximum crosses (47%) belonged to HL group followed by HM (21%) and HH (16%) groups. For plant height, of the 22 crosses that had more height than grand mean of crosses, 73% were classified in HL group while the remaining 27% in HH group.

For number of leaves, 26 crosses gave more values than grand mean of crosses. Maximum crosses were clas-

Table 1 : Classification of parents into high, medium and low groups based on per se performance and gca of parents

Character	Based on per se performance			Based on gca		
	High	Medium	Low	High	Medium	Low
Grain yield	SPV-232	296B	2219B	SPV-232	SPV-104	296B
	SPV-104	D-71396	36B	M35-1	36B	2219B
	M35-1	E36-1	CSV-5	CSV-8R		E36-1
	CSV-8R			D-71396	CSV-5	
Days to flowering	SPV-104	SPV-232	M35-1	2219B	-	SPV-232
	2219B	D-71396	296B	D-71396		SPV-104
	E36-1		CSV-8R	E36-1		M35-1
			36B		296B	
			CSV-5		CSV-8R 36B CSV-5	
Plant height	SPV-104		SPV-232	M35-1		SPV-232
	M35-1		296B	CSV-8R		SPV-104
	CSV-8R		2219B	E36-1	296B	
	E36-1		36B			2219B
			D-71396		36B	
			CSV-5			D-71396
						CSV-5
No.of	M35-1	SPV-232	SPV-104	SPV-232	SPV-104	2219B
Leaves.	296B	36B	2219B	296B	M35-1	E36-1
CSV-BR	D-71396	E36-1	CSV-BR	36B		
CSV-5			D-71396			
				CSV-5		
100-grain	M35-1	SPV-232	2219B	SPV-104	296B	SPV-232
weight	CSV-8R	SPV-104	CSV-5	M35-1 36B	2219B	
	E36-1	296B		CSV-8R	D-71396	CSV-5
		36B		E36-1		
		D-71396				

Table 2 Crosses giving significantly higher yield than M 35-1.

S. No.	Crosses	Grain yield/ plant (g)	Grain yield as % of M 35-1	Based on	
				per se	gca
1.	SPV-232 x CSV-8R	123.0	182	H H	H H
2.	296 B x CSV-8R	115.5	171	H H	L H
3.	M 35-1 x CSV-8R	115.5	171	H H	H H
4.	22198B x CSV-8R	111.7	165	L H	L H
5.	SPV-104 x 36B	110.3	163	H L	M M
6.	SPV-232 x D-71396	108.1	160	H M	H H
7.	36B x D-71396	106.9	158	L M	M H
8.	SPV-104 x D-71396	99.6	147	H M	M H
	M 35-1 (Check)	67.7	100		
	CD (0.05)	30.5	-		

sified in HM group (42%) followed by HH (19%) and HL (15%) groups.

For 100-grain weight, 22 crosses had more values than grand mean of

Table 3 Classification of crosses with high mean into different groups based on parental performance

Character		HH	HM	HL	MM	ML	LL	Total
Grain yield	nh	4	9	7	-	2	1	23
	p	17	39	31	-	9	4	100
Days to	nh	3	4	9	-	2	1	19
flowering*	p	16	21	47	-	11	5	100
Plant height	nh	6	-	16	-	-	-	22
	p	27	-	73	-	-	-	100
No.of leaves	nh	5	11	4	3	2	1	26
	p	19	42	15	12	8	4	100
100 grain	nh	3	12	3	4	-	-	22
weight	p	14	54	14	18	-	-	100
Total	nh	21	36	39	7	6	3	112
	p	19	32	35	6	5	3	100

nh = No.of crosses with high mean in each group

p = %of crosses with high mean in each group

* = Crosses with low values considered desirable.

crosses. Of these, maximum crosses were classified in HM group (54%) followed by MM (18%) and HH and HL groups (14% each).

Over all the five characters, the desirable crosses were more in HL group (35%) followed by HM (32%) and HH (19%) groups.

(2) Based on gca effects of parents: (a) crosses with mean above grand mean of crosses were classified into different groups based on parental gca and presented in Table 4.

For grain yield, of the 23 crosses having value more than grand mean of crosses, 35% of the crosses were classified in HL followed by HH and HM groups (26% each). Among the eight high-yielding crosses which were superior to M 35 - 1, 38% belonged to HH group, 25% each to HM and HL groups and 12% to MM group. Similar observations were made earlier by Johnson and Hayes (1940), Chauhan and Singh (1973) and Reddy and Arunachalam (1981).

For days to flowering, of the 19 crosses, 79% were classified in HL group followed by HH (16%) group.

For plant height, of the 22 crosses, 86% were classified in HL group and the remaining 14% in HH group.

For number of leaves, 26 crosses had more value than grand mean of crosses. Of these, 54% of the crosses

Table 4 Classification of crosses with high mean into different groups based on gca of parents

Character		HH	HM	HL	MM	ML	LL	Total
Grain yield	nh	6	6	8	1	2	-	23
	p	26	26	35	4	9	-	100
Days to	nh	3	-	15	-	-	1	19
flowering*	p	16		79	-	-	5	100
Plant height	nh	3	-	19	-	-	-	22
	p	14	-	86	-	-	-	100
No.of leaves	nh	8	14	2	1	1	-	26
	p	31	54	7	4	4	-	100
100 grain	nh	6	9	5	-	2	-	22
weight	p	27	41	23	-	9	-	100
Total	nh	26	29	49	2	5	1	112
	p	23	26	44	2	4	1	100

nh = No.of crosses with high mean in each group
p = % of crosses with high mean in each group
* = crosses with low values considered desirable.

Table 5 Classification of crosses with significant positive sca in different groups based on gca of parents

Character		HH	HM	HL	MM	ML	LL	Total
Grain yield	nh	2	2	4	1	1	-	10
	p	20	20	40	10	10	-	100
Days to	nh	14	-	6	-	-	6	14
flowering*	p	-	-	43	-	-	43	100
Plant height	nh	-	-	12	-	-	5	17
	p	-	-	71	-	-	29	100
No.of leaves	nh	-	2	1	-	1	4	
	p	-	50	25	-	25	-	100
100 grain	nh	-	3	2	-	1	2	8
weight	p	-	37	25	-	13	25	100
Total	nh	4	7	25	1	3	13	53
	p	8	13	47	2	6	24	100

nh = No.of crosses with high mean in each group
p = % of crosses with high mean in each group
* = crosses with low values considered desirable

were classified in HM group followed by HH group having 31% of the crosses.

For 100 - grain weight, of the 22 crosses that had more values than grand mean, 41% of the crosses were grouped in HM followed by HH (27%) and HL (23%) groups.

Over all the five characters studied, the desirable crosses were maximum in HL group (44%) followed by HM (26%) and HH (23%) groups.

(b) Crosses with significant positive sca (sca in desired direction) were classified into different groups based on parental gca and pre presented in Table 5.

For grain yield, out of the 45 crosses tested, 10 crosses had significant positive sca. Of these, maximum crosses were

Table 6. Average yield performance and average sca effects of crosses in each group

Classification based on	unit	Group					
		HH	HM	HL	MH	ML	LL
per se performance of parents	Yield/plant (g)	86.8	80.7	79.2	46.0	56.1	67.6
	No.of crosses	(6)	(12)	(12)	(3)	(9)	(3)
gca of parents	Yield/plant (g)	101.3	83.0	73.3	110.3*	58.2	44.2
	No.of crosses	(6)	(8)	(16)	(1)	(8)	(6)
	sca effect	10.1	2.3	3.2	40.2*	-1.3	-4.6
	No.of crosses	(6)	(8)	(16)	(1)	(8)	(6)

* = based on one cross only.

classified in HL group (40%) followed by HH and HM groups (20% each). Of the eight high yielding crosses which were superior to M35-1 in grain yield, seven crosses had significant positive sca. One cross, M35-1 x CSV-8R had non significant positive sca. Chauhan and Singh (1973) also observed that crosses with high sca had at least one of the parents with high gca.

For days to flowering, 14 crosses had significant negative sca which is desirable. of these, more crosses were classified in HL and LL groups (43% each). For plant height, 71% of the crosses that had significant positive sca 50% were grouped as HM and 25% each in HL and ML groups. For 100-grain weight, of the eight crosses with significant positive sca,maximum crosses were grouped in HM group (37%) followed by HL and ll groups (25% each).

Considering all the five characters, 47% of the crosses with significant sca in desirable direction were in HL group followed by 24% in LL group.

Comparison of the two methods (Table 6) using the group mean suggests that selection and prediction based on gca of parents is a little more effective since the group H x H has a high average performance for both average yield and average sca effect for yield.

This shows that per se performance and gca of parents can be taken as criteria for selection of parents in obtaining high-yielding crosses for which H x H, H x M and H x L combinations should be attempted.

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