

Performance of Released and New Hybrids and Varieties of Sorghum in Dryland Alfisols

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SUMMARY

A sorghum trial was conducted in a dryland alfisol to evaluate the performance of 16 released and new hybrids and varieties. The evaluation was carried out using the Duncan's Multiple Range Test (DMRT) of Primary and Secondary Rank Sums (PRS and SRS) of 8 characters and a quadrangular analysis of different genotypes. The estimates of genotypic and phenotypic coefficients of variation, heritability and genetic advance were derived for making a selection of characters. The study indicated that CSH-13R and ICSV-88032 were the best genotypes for full season, while the hybrid SPH-657 is suitable for medium durations. SPH-656 and CSH-6 are found suitable for short growing periods. The study also indicated the importance of tall plant height, thick stem diameter and resistance to grain mold incidence as most desirable characters for increasing sorghum yield under dryland alfisols.

Key words : Hybrids and varieties, Quadrangular analysis, Duncan's multiple range test, Selection of genotypes and characters, Primary and secondary rank sums.

1. Introduction

Varietal and Hybrid improvement, though is a continuous process, evaluation of these experimental material has to be made at regular intervals in comparison with the released varieties and hybrids. This will enable the breeder to know the commercial value and recommend them as per their growing periods. Research efforts have been towards development of varieties that equal commercial hybrids with respect to yield levels and stability (Reddy and Rao [7]). The present investigation was done with the aim of analysing the relative performance of the experimental material with the released varieties by using Duncan's Multiple Range Test (DMRT) based on Primary Rank Sum (PRS) and Secondary Rank Sum (SRS) for the characters. The study also aims at identifying the most important yield contributing characters of kharif sorghum.

2. Materials and Methods

A field experiment on kharif sorghum was conducted in an alfisol at Hayathnagar Research Farm of Central Research Institute for Dryland Agriculture (CRIDA) during 1992 with 16 genotypes comprising of different durations. These were five released hybrid checks (CSH-1, CSH-6, CSH-9, CSH-13R and CSH-14); 8 hybrid entries (SPH-653, SPH-654, SPH-656, SPH-657, SPH-660, SPH-661, SPH-669 and SPH-670); 2 released varietal checks (SPV-462 and CSV-13) and one varietal entry (ICSV- 88032). The experiment was conducted in an RBD with 3 replications of 2 rows each of 5 m length with normal agronomic practices. The observations were recorded on 3 primary characters viz., grain yield (GY), stover yield (SY) and grain mold incidence (GM) and 5 secondary characters viz., seedling vigour (SV), canopy temperature (CT), agronomic score for stover (AS), final height (FH) and stem diameter (SD). Days to 50% flowering (DF) was recorded for all genotypes which were screened for selecting the best entries.

Genotypes are ranked based on Duncan's Multiple Range Test (DMRT) for each character. Rank sums of primary and secondary characters were considered separately and used for comparing genotypes. Graphical plots of Primary Rank Sum (PRS) and Secondary Rank Sum (SRS) of different characters for genotypes can be made for deriving quadrangles by considering median of PRS and SRS viz., Z_p and Z_s . The quadrangles Q-I to Q-IV can be made as follows :

Q-1	:	PRS < Z_p	and	SRS < Z_s
Q-II	:	PRS < Z_p	and	SRS > Z_s
Q-III	:	PRS > Z_p	and	SRS < Z_s
Q-IV	:	PRS > Z_p	and	SRS > Z_s

The within and between differences of genotypes falling in different quadrangles can be tested and valid inferences about their grouping can be drawn. The phenotypic and genotypic coefficients of variation were estimated following Burton [1]. The heritability and expected genetic advance for different characters were estimated by using the formulae proposed by Hanson *et al.* [3] for inferring the usefulness of characters for further research.

3. Results and Discussion

3.1 Estimates of Genetic Parameters

The estimates of genetic parameters of different primary and secondary characters are given in Table-1. These are phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense

Table 1. Estimates of genetic parameters of sorghum during 1992

Character	Mean	PCV (%)	GCV (%)	H (%)	EGA (%)
GY	34.9	25.9	11.4	19.3	10.3
SY	65.5	22.9	20.4	79.2	32.5
DF	64.3	8.6	7.5	75.8	13.5
GM	1.9	39.5	27.4	48.1	39.3
FH	140.6	14.6	10.3	49.7	15.0
SV	7.7	13.6	6.5	22.9	6.4
AS	1.9	36.6	7.2	3.8	2.9
SD	1.5	11.7	4.3	13.2	3.2

(H) and expected genetic advance over mean (EGA). The GCV was found to be maximum in GM followed by SY suggesting that there is a scope for improvement of these characters. The high heritability estimates coupled with high expected genetic advance were obtained for SY, DF, GM and FH suggesting the importance of additive gene action in the inheritance of these characters (Pause [5]). Similar observations were made by Dhoble and Kale [2].

3.2 Correlations

The estimates of phenotypic and genotypic correlations between different characters are given in Table-2. The character AS was found to have negative

Table 2. Phenotypic (p) and Genotypic (g) correlations of different characters in kharif sorghum during 1992

Character	DF	AS	FH	SD	GY	SY	GM
1. SV (p)	0.06	-0.13	0.13	0.04	0.02	0.08	-0.04
(g)	0.24	-0.32	0.03	-0.23	0.22	0.27	-0.31
2. DF (p)		-0.24	0.01	0.35	-0.01	0.21	0.40
(g)		-0.81**	0.13	0.84**	-0.04	0.29	0.72**
3. AS (p)			-0.14	-0.23	-0.19	-0.00	-0.05
(g)			-0.57*	-0.81**	-0.98**	0.04	-0.39
5. FH (p)				0.06	0.39	-0.27	-0.30
(g)				-0.01	0.80**	-0.43	-0.72**
6. SD (p)					0.05	0.05	0.16
(g)					0.86**	0.11	0.44
7. GY (p)						-0.11	-0.27
(g)						-0.38	-0.83**
8. SY (p)							0.39
(g)							0.63**

* and **: significant at 5% and 1% respectively.

phenotypic and genotypic correlation with all characters except with SY for genotypic correlations. The correlations were also negative between SV and GM, DF and GY, FH and SY, FH and GM, GY and SY and GM. The genotypic correlations have clearly indicated that GM, SD and FH are important characters which are highly and significantly related with GY, the former being negatively correlated and hence desirable. The study has indicated the importance of tall plant height, thick stem diameter and resistance to grain mold incidence as most desirable characters for increasing sorghum yield under dryland alfisols. The thick stem diameter also prevents lodging. Nimbalkar *et al.* [4] and Singh [8] obtained similar observations.

3.3 Ranking and Grouping of Genotypes

The genotypes were tested for differences for each of the 9 characters. The results indicated that there were significant differences among genotypes for primary characters viz. SY, GM, DF and FH. The genotypes were also tested by DMRT and ranked for each character including DF, the most desirable genotype getting rank I. The PRS and SRS of characters were computed. While PRS ranged between 14 and 42, SRS varied between 27 and 61. There was a minimal primary rank sum of 14 by CSH-13R, indicating its desirability for primary characters among all genotypes. The PRS gradually increased to 24 for SPH-656, and fell to 17 for SPH-653 and gradually increased to 42 for SPH-468.

The PRS and SRS of genotypes were plotted by taking PRS on X-axis and SRS on Y-axis (Fig. 1). By superimposing Z_p and Z_s , 5 genotypes (3 entries and 2 checks) were found to fall in Q-I, followed by 6 (5 entries and one check) in Q-II, 3 (all checks) in Q-III and 2 (one entry and one check) in Q-IV respectively. The entries and checks in quadrangles are SPH-657, ICSV-88032, SPH-656, CSH-13R and CSH-6 in Q-I, SPH-653, SPH-661, SPH-660, SPH-669, SPH-654 and CSH-1 in Q-II, SPV- 462, CSH-9 and SPH-468 in Q-III, and SPH-670 and CSV-13 in Q-IV.

The estimates of range, mean, standard deviation and coefficient of variation (%) for each character were worked out. The deviations among Q-I to Q-IV were significant for pairs (Q-I, Q-II) and (Q-I, Q-IV) for SY, (Q-I, Q-IV) for GM, and (Q-II, Q-IV) for DF. The genotypes in Q-I were superior to those in Q-II to Q-IV for GY, GM, DF, FH and SD based on the quadrangle means. Although the means were nonsignificant for SY, SV and CT, the entries of Q-I are preferable due to lower standard deviations.

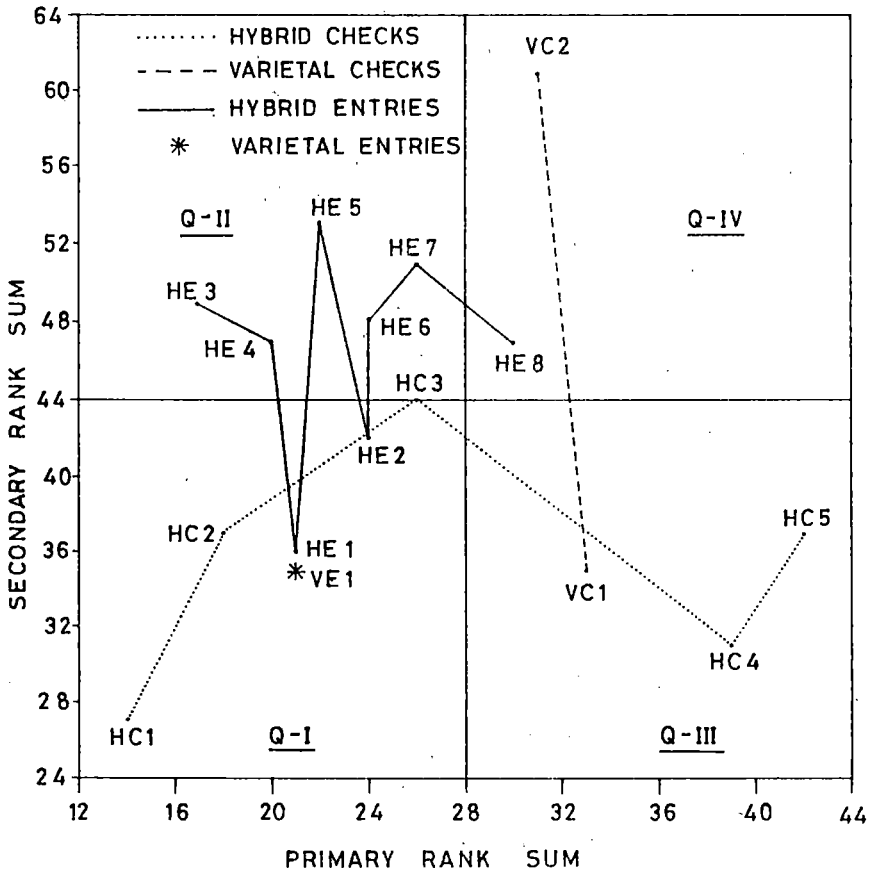


Fig. 1. Classification of Genotypes into Quadrangles in Sorghum (1992)

<u>Q-I</u>	<u>Q-II</u>	<u>Q-III</u>	<u>Q-IV</u>
HC1 : CSH-13R	HE3 : SPH-653	VC1 : SPV-462	HE8 : SPH-670
HC2 : CSH-6	HE4 : SPH-661	HC4 : CSH-9	VC2 : CSV-13
HE1 : SPH-657	HE5 : SPH-660	HC5 : SPH-468	
VE1 : ICSV-88032	HE6 : SPH-669		
HE2 : SPH-656	HC3 : CSH-1		
	HE7 : SPH-654		

3.4 Trends in Performance of Genotypes :

The genotypes of Q-I are suggested for alfisols under dryland conditions. The desirable order is given in Fig. 2 which are CSH-13R, CSH-6, SPH-657, ICSV-88032 and SPH-656. As the main objective of breeding programme is

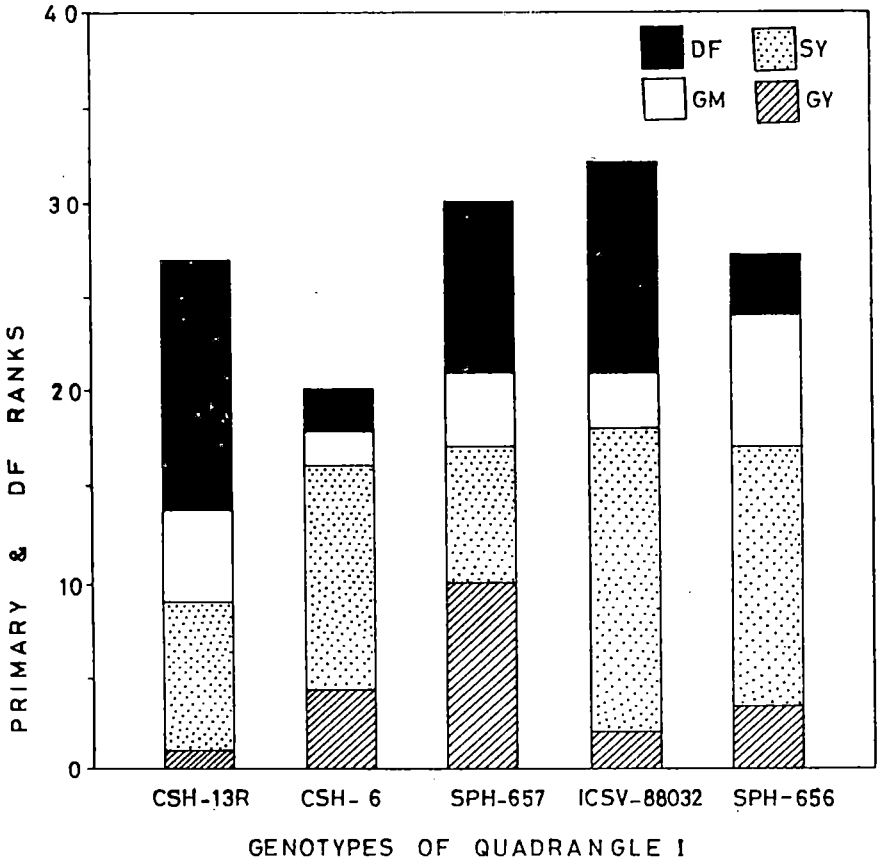


Fig. 2. Genotypes of Q-1 based on PRS in order of preference and DF ranks

to develop dual purpose hybrids and varieties, rank sum of Grain Yield and Stover Yield was least in CSH-13R which increased for entries in above order. By inclusion of GM ranks, gradation was same as above confirming superiority of CSH-13R followed by CSH-6. However, rank of CSH-13R was maximum for Days to 50% Flowering among 5 genotypes of Q-I, indicating its longer maturity period. This implies that CSH-13R may be suggested in areas of longer growing periods as compared to CSH-6 which had minimum rank for Days to 50% Flowering and is suggested for short growing season. Among entries the variety ICSV-88032 was found to follow CSH-13R for a full season crop. Such type of observations were also made by Rao *et al.* [6]. SPH-656 was found to follow CSH-6 for short crop growing periods. The hybrid SPH-657 is suggested for medium durations.

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