

PERFORMANCE OF SORGHUM VARIETIES AND HYBRIDS FOR GRAIN YIELD UNDER IRRIGATED CONDITIONS OF D.I.KHAN

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ABSTRACT

Eighteen sorghum varieties, hybrids and advanced lines were evaluated for grain and other associated traits at Agricultural Research Institute, Dera Ismail Khan, Pakistan during kharif-2007. Analysis of variance revealed that sorghum varieties/hybrids differed significantly for grain yield, stalk yield, plant height, days to 50 percent flowering and maturity. Hybrid 85-G-83 produced higher grain yield (4250 kg/ha) followed by MR-Buster (3805 kg) against the lowest (745 kg/ha) by RIS-101. Variety CSV-15 performed better (3611 kg/ha) than other varieties. Hybrids RIS-102 and RIS-101 produced higher stalk yield (76.5 and 76.0 t/ha) whereas variety PARC-SS-2 produced the lowest stalk yield (27 t/ha). The highest plant height (325 cm) was recorded in RIS-102 against the lowest (108 cm) in S-2244. Sorghum hybrids S-2244 and RIS-102 took maximum days to 50 percent flowering (82) followed by variety RS-29 (81 days) while hybrid 86-G-87 and 84-G-01 took minimum days (62) to 50 percent flowering. DS-97-1 developed at ARI, D. I. Khan took 67 days to 50 percent flowering. It was concluded that sorghum hybrids showed superiority in grain yield over varieties. Hybrids 85-G-83 and MR-Buster are recommended for general cultivation in the area.

KEYWORDS: *Sorghum bicolor*; cultivars; hybrids; performance; agronomic characters; Pakistan.

INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench) is a major kharif cereal crop in arid and semi-arid areas of southern part of NWFP i.e. Dera Ismail Khan (D.I. Khan) and Kohat divisions. Sorghum is also grown in other parts of Pakistan which are less favoured with moisture conditions but actual production areas are concentrated in D.I. Khan division. Sorghum is consumed as food, feed and fodder but grain yield at farmer's field is very low. Use of sorghum as

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feed is very conventional and for last two decades 50 percent sorghum produced is being utilized in feeding rural cattle and poultry. Use of sorghum as a staple food has been decreased due to rise in living standard of people. Sorghum is also a good substrate for ethanol production which can be added to the fuel in saving precious foreign exchange (4).

In Pakistan sorghum is planted on an area of 291.6 thousand hectares with annual grain production of 179.5 thousand tons and average grain yield of 616 kg per hectare. In NWFP, sorghum is planted on an area of 6.3 thousand hectares with annual grain production of 3.6 thousand tons and average grain yield of 571 kg per hectare. In D. I. Khan 809.3 thousand hectares are available for cultivation of which 1.184 thousand hectares were planted under sorghum crop during kharif 2008 (3). However, yield per unit area of sorghum in NWFP is comparatively less than national average yield.

Among various factors responsible for low yield, lack of quality seed of improved varieties and hybrids of sorghum is the most important and responsible factor (4). Therefore, hybrid seed of sorghum is becoming popular among progressive growers of NWFP.

Sousa *et al.* (9) stated that performance of five grain sorghum cultivars differed for grain yield as well as yield components. Sorghum cultivars "IPA-8602502" and "IPA 73000201" gave higher grain yield than average grain yield (3.9 t/ha).

Osmanzai (6) reported that hybrids performed better or at par with cultivars and produced 36 percent more grain yield than cultivars (3320 kg vs 2430 kg/ha). He further reported that no significant differences were found between hybrids and cultivars for days to bloom, physiological maturity, plant height and seed weight while significant differences were found for number of panicles per hectare, panicles weight and grain yield. Osmanzai (7) also assessed 28 sorghum genotypes/hybrids and reported that hybrids produced 28 percent more grain yield than cultivars. In another study (11) 38 hybrids and 22 millet composites were evaluated for days to 50 percent flowering, plant height, grain yield and threshing percentage. The results indicated that pearl millet hybrids did not offer sufficient advantage over composite in arid regions.

AlagarSwamy (1) tested 9 sorghum hybrids and 17 varieties at 47 locations and reported that hybrids as a group had higher yield (4.5 ± 0.1 t/ha) than

varieties (3.8 ± 0.12 t/ha). Days to 50 percent flowering ranged from 66 to 71 days and plant height varied from 180 to 250 cm.

Present study was conducted to evaluate different sorghum varieties and hybrids for maximum grain yield under agro-climatic conditions of D. I. Khan.

MATERIALS AND METHODS

Eighteen sorghum varieties and hybrids received from National Agricultural Research Centre, Islamabad were evaluating at Agricultural Research Institute, D. I. Khan, Pakistan during 2007. Layout system was randomized complete block design with three replications. Each plot consisted of 60 cm apart and 5 meter long four rows. Seed bed was prepared at proper wattar condition. A fertilizer dose of 90 kg N and 45 kg P₂O₅ per hectare was applied as urea and phosphorus. All P and half N was applied at sowing time and remaining N was side dressed with second irrigation. All other agronomic practices were kept uniform for all the treatments/entries. Detail of varieties and hybrids alongwith source is given below:-

S. No.	Varieties	Source	S. No.	Hybrids	Source
1.	PARC-SS-1	National Agricultural Research Center, Islamabad	10.	RIS-101	Fodder Research Institute, Sargodha
2.	PARC-SS-2	-do-	11.	RIS-102	-do-
3.	CSV-15	ICRISAT	12.	MR-Buster	ICI
4.	RS-29	National Agricultural Research Center, Islamabad	13.	85-G-83	Pioneer
5.	SPV-462	International Crop Research Institute for Semi-Arid Tropics, India	14.	86-G-87	-do-
6.	YSS-9	Maize and Millet Research Institute, Yousafwala	15.	S-2244	SAWA-AG
7.	DS-97-1	Aridzone Research Institute, D. I. Khan	16.	84-G01	Pioneer
8.	RARI-S-3	Regional Agricultural Research Institute, Bahawalpur	17.	Enforcer	SAWA-AG
9.	RARI-S-4	-do-	18.	Liberty	-do-

Data on days to 50 percent flowering, days to maturity, plant height, stalk yield and grain yield was recorded in two central rows of each plot of each variety and hybrid. Plant height was recorded from surface of soil to tip of head. Fifty percent flowering was recorded when 50 percent plants

completed heading. Grain and stalk yields per plot were recorded and then converted into kg and tons per hectare, respectively. The data were statistically analyzed following Steel and Torrie (10) and means were compared using least significant differences procedure.

RESULTS AND DISCUSSION

Grain yield

The data (Table 1 and 2) revealed that sorghum varieties and hybrids differed significantly for grain yield. The highest grain yield (Table 2) was obtained from sorghum hybrid 85-G-83 (4250 kg/ha) followed by hybrids MR-Buster (3805 kg) and 86-G-87 (3722 kg). Among varieties CSV-15 gave maximum yield (3611 kg/ha). The lowest yield (745 kg/ha) was recorded in hybrid RIS-101 followed by RIS-102 (878 kg/ha). Main reason for low grain yield of these two hybrids was their fodder nature and not as dual purpose hybrids. DS-97-1 advanced breeding line of ARI, D. I. Khan also performed better (3111 kg/ha). The results also revealed that hybrids produced more grain yield as compared to varieties. These results are in agreement to findings of AlagarSwamy (1) and Osmanzai (6).

Table 1. Mean squares for analysis of variance for agronomic traits in sorghum.

SOV	Df	Grain yield kg/ha	Stalk yield ton/ha	Plant height (cm)	Days to 50 percent flowering	Days to maturity
Replications	2	1020486.13	46.71	268.85	1.72	2.35
Varieties/hybrids	17	3718029.18**	713.37**	13910.78**	145.97**	124.42**
Error	34	210154.85	60.34	120.99	1.87	2.98
Total	53					

Stalk yield

Varieties and hybrids also differed significantly in stalk yield (Table 2). The highest stalk yield was obtained from hybrids RIS-102 (76.5 t) and RIS-101 (76.0 t/ha) followed by S-2244, (60 t/ha). The lowest stalk yield was recorded in variety PARC-SS-2 (27 t/ha). Stalk yield of varieties and hybrids ranged between 27 to 76.5 tons per hectare. This parameter was positively correlated with plant height. Earlier scientists (1, 6, 7, 9) also further reported similar results. The data further showed that S-2244 and Enforcer proved as dual purpose hybrids with better grain and stalk yields.

Plant height

A perusal of data (Table 2) indicated that hybrid RIS-102 excelled in plant height (325 cm) followed by RIS-101 (323 cm) and differed significantly from varieties. Plant height of different varieties and hybrids ranged from 108 to 325 cm. The lowest plant height (108 cm) was recorded in hybrid S-2244. Similar results were reported by Olakajo and Iken (8) who reported that maize varieties differed in plant height but had no relation with grain yield.

Table 2. Grain yield, stalk yield, plant height, days to 50 percent flowering and days to maturity of various sorghum varieties and hybrids.

S. No.	Varieties/ Hybrids	Grain yield (kg/ha)	Stalk yield (t/ha)	Plant height (cm)	Days to 50% flowering	Days to maturity
Varieties						
1.	PARC-SS-1	3222bcd	36efg	182f	75de	111.7ab
2.	PARC-SS-2	2695de	27g	158g	71f	108.3ab
3.	CSV-15	3611abc	55bc	237c	77bc	114ab
4.	RS-29	2222ef	50bcd	212d	81a	118a
5.	SPV-462	2500de	35efg	212d	78b	115.7ab
6.	YSS-9	1395gh	56bc	260b	76bcd	113.7ab
7.	DS-97-1	3111bcd	35efg	175g	67g	104ab
8.	RARI-S-3	1111gh	45cde	202de	76cd	112ab
9.	RARI-S-4	2933cde	41def	182ef	75de	111.7ab
Hybrids						
10.	RIS-101	745h	76a	323a	72f	109ab
11.	RIS-102	878h	76.5a	325a	82a	118a
12.	MR-Buster	3805ab	35efg	112h	63hi	99.67ab
13.	85-G-83	4250a	36efg	113h	64h	101ab
14.	86-G-87	3722ab	32fg	117h	62i	99b
15.	84-G01/BONUS	3638abc	36efg	110h	62hi	102.7ab
16.	S-2244	1722fg	60b	108d	82a	115ab
17.	Enforcer	3695ab	38efg	117h	63hi	100.3ab
18.	Liberty	3472bc	28g	123h	73ef	110ab
	LSD (0.05)	760	12.33	18.25	2.28	18.51
	CV (%)	16.94	16.74	5.85	1.90	1.56

Days to 50 percent flowering

Variety and hybrids differed significantly in days to 50 percent flowering. RIS-102 took maximum days (82) to 50 percent flowering followed by RS-29 (81 days). Hybrid 86-G-87 lowered earlier with minimum days to 50 percent flowering (62). Hybrids 84 G01, MR-Buster, Enforcer and 85-G-83 took 62-64 days to 50 percent flowering and proved as early maturing. Among varieties, DS-97-1 developed at ARI D.I.Khan took minimum period (67 days) to 50

percent flowering and significantly differed from other varieties included in study. Similar results were reported by Alagar Swamy (1) and Sousa *et al.* (9).

Days to maturity

Days to maturity usually follows the flowering pattern. These results showed that days to maturity significantly differed in varieties and hybrids. Maturity period ranged from 99 to 118 days. The hybrid 86-G-87 showed earliness as it took only 99 days to mature followed by MR-Buster (99.7 days), Enforcer (100 days) and 85-G-83 (101 days). RIS-102 and RS-29 were found late and matured in 118 days. Rest of hybrids and varieties differed non-significantly from each other statistically (Table 2). Yaqoob *et al.* (12) reported similar findings.

CONCLUSION

Among hybrids, 85-G-83 topped in grain yield (4250 kg/ha) while variety CSV-15 outyielded (3611 kg/ha) among varieties of sorghum. The other hybrids/varieties with significant grain yield were; MR-Buster, 86-G-87, 84-G-01, Liberty, PARC-SS-1 and DS-97-1. These hybrids and varieties have great yield potential and are recommended for general cultivation under irrigated conditions of D. I. Khan.

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