COMPARISON OF SOME ADVANCED LINES OF *SORGHUM BICOLOR* L. MONECH FOR GREEN FODDER/DRY MATTER YIELDS AND MORPHO-ECONOMIC PARAMETERS

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ABSTRACT

These studies were conducted at Fodder Research Institute, Sargodha during the year 1999-2001. Five cultivars of sorghum including check (Hegari) were evaluated for plant height, stem thickness, leaf area, number of leaves per plant, sweetness, crude protein, green fodder and dry matter yields. Cultivar JS-88 showed significant differences with higher number of leaves per plant (13.5), stem thickness (1.8 cm) and leaf area (512.5 cm^2) as compared to check (10.6 average number of leaves/plant, 1.3 cm stem thickness and 445.5 cm^2 leaf area). Similarly, JS-88 was superior in green fodder yield, dry matter yield and quality (sweetness and crude protein) to Hegari. On an average JS-88 produced 73.8 tons per hectare green fodder and 12.8 tons per hectare dry matter yield as compared to Hegari (59.6 t/ha green fodder yield and 8.4 t/ha dry matter yield). Early growth stages had high crude protein level than late stages.

KEYWORDS: *Sorghum bicolor;* high yielding varieties; agronomic characters; Pakistan.

INTRODUCTION

Sorghum *(Sorghum bicolor* L.) is an important summer season crop grown both for fodder and grain purposes. It is grown throughout Pakistan under irrigated and rainfed conditions. This crop can also be grown either alone or in mixture with legume fodders for nutritive and palatable fodder production. It can resist drought and hot weather and can be successfully grown on all types of soils except water logged and saline. Mostly tall varieties are sown for fodder production and dwarf varieties for grain production. Average fodder yield at present under local conditions is about 50-60 tons against the potential of 50-100 tons per hectare. Lower yield is mainly due to shortage of quality seed, imbalanced fertilization, poor package of technology and increased damage due to red leaf spot and grain smut. However, Assaeed (1), Chaudhry *et al.* (2, 3), Fulagar *et al.* (8) and Sathe *et al.* (14) reported dry matter yield in sorghum fodder varieties. Chaudhry and Hussain (4), Cruz *et*

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al. (6) and Chaudhry *et al.* (2) and (3) evaluated plant height, stem thickness, leaf area, number of leaves per plant and green fodder yield in Sorghum strains/varieties. Similarly, Gupta *et al.* (9), Luce-C (10), Mendhe *et al.* (11) and Panwar *et al.* (13), reported green fodder yield in different strains of sorghum, Chauhan and Randhawa (5) and Yahya *et al.* (16) reported crude protein and chemical composition of green fodder varieties of sorghum.

The present study was undertaken to screen sorghum varieties for high green fodder and dry matter yields with better quality.

MATERIALS AND METHODS

Four new cultivars of sorghum *(Sorghum bicolor* L.) viz. JS-88, 9601, 9603 and 9706 alongwith a check Hegari were planted at Fodder Research Institute, Sargodha during last week of July, 1999, 2000 and 2001. Layout system was randomized complete block design with three replications (3m x 6m plot size). The sowing was carried out in 30 cm apart rows. Seeding rate was used @ 80 kg per hectare. NPK @ 60-60-0 kg per hectare was applied for better crop stand. All phosphorus and ½ N was applied at planting. Remaining ½ N was side dressed with second irrigation. Four irrigations were applied. The soil was classified as clay loam. Observations on five plants in each repeat were recorded on plant height, stem thickness, leaf area and number of leaves per plant at 50 percent heading stage. Harvesting for green fodder was done during first week of October each year and green fodder yield was recorded. Dry matter yield was also recorded. Data were subjected to analysis of variance as described by Steel and Torrie (15). Chemical analysis of cultivars on dry weight basis was undertaken to observe the fitness of these new entries for animals. The data on quality sweetness was also recorded.

RESULTS AND DISCUSSION

Green fodder yield

The data show (Table 1) that sorghum variety JS-88 significantly ranked first during all years. On an average it produced 73.8 tons per hectare green fodder yield followed by 9601 (68.0 t). The increased yields of JS-88, 9601, 9603 and 9706 were 23.82, 14.09, 8.05 and 3.02 percent, respectively, over check Hegari. The results indicated that new cultivar JS-88 was more stable in performance than local check when tested across the years. These findings agree to those of some earlier researchers (3,4,5,7,9,11,12,13). They reported higher fodder yield while evaluating the performance of sorghum varieties. Chaudhry *et al.* (2) have also reported similar results of berseem varieties.

Table 1. Yearwise green fodder yield performance of sorghum varieties strains.

Variety/strain	Green fodder yield (t/ha)			Average	%age increase over check
	1999	2000	2001		
JS-88	72.2	73.0	76.2	73.8a	23.82
9601	68.8	67.5	67.6	68.0b	14.09
9603	63.6	64.5	65.1	64.4bc	8.05
9706	60.6	62.2	61.5	61.4c	3.02
Hegari	59.3	59.6	59.9	59.6c	
LSD 5%	6.23	4.94	9.50		
LSD 1%	9.07	7.20	13.93		

The higher yields in new cultivars could be attributed to positive contribution of a combination of fodder yield components like number of leaves per plant and stem thickness with additional contribution of other parameters like plant height and leaf area.

It is concluded that new cultivars are better for large scale cultivation under irrigated as well as rainfed conditions of the Punjab province.

Dry matter yield

The data revealed an increase in dry matter yield of JS-88 during 1999, 2000 and 2001 at $P<0.05$ and $P<0.01$ over check (Table 2). JS-88, 9601, 9603 and 9706 produced 52.4, 15.5, 27.4 and 16.7 percent more yield respectively over check. The results agree to those of previous workers (1, 6, 8, 9, 11,14).

Table 2. Yearwise dry matter yield performance of sorghum varieties/strains.

Variety/strain	Dry matter yield (t/ha)			Average	%age increase over check
	1999	2000	2001		
JS-88	13.1	12.8	13.1	12.8a	52.4
9601	8.7	11.7	8.7	9.7cd	15.5
9603	10.4	11.2	10.4	10.7b	27.4
9706	9.7	10.0	9.7	9.8c	16.7
Hegari	8.6	9.3	7.4	8.4e	
LSD 5%	0.97	1.73	0.97		
LSD 1%	1.42	2.52	1.42		

Chaudhry *et al.* (2) also observed similar findings while evaluating berseem varieties.

Economic and quality parameters

All new sorghum cultivars produced significantly more stem thickness and leaf area as compared to Hegari (Table 3). Similar observations were made by other scientists (3, 4, 6, 9, 14). Plant height in new cultivars did not show any significant difference in comparison to check variety Hegari. These results are in accordance with Chaudhry *et al.* (2). Number of leaves per plant also contributed towards yield statistically in new cultivars more than Hegari. Chaudhry *et al.* (2), Chaudhry *et al.* (3) and Chaudhry and Hussain (4) also report similar results.

Table 3. Economic and quality characters comparison of sorghum varieties/strains.

Variety	Plant height (cm)	No. of leaves	Stem thickness (cm)	Leaf area (cm^2)	Sweetness
JS-88	228.9	13.5	1.8	512.5**	Sweet
9601	226.1	11.5	1.5	509.9	Sweet
9603	219.3	11.1	1.4	408.8	Un-sweet
9706	215.8	11.7	1.5	443.4	Sweet
Hegari	203.6	10.6	1.3	445.6	Sweet
LSD 5%	N.S	0.74	0.2	17.6	
LSD 1%	1.10	0.3	25.6		

** Significant at 1% level.

Chemical composition at different growth stages

Forage yield alone is not adequate for measuring the feeding values of the crops. So for determining the palatability and nutritional value, protein contents were determined (Table 4). The chemical analysis of five varieties was carried out at different development stages and values were calculated on dry matter basis. The data revealed that early blooming stage in sorghum varieties had higher essential nutrient content than later stages. There was no noticeable difference among the varieties. The new varieties gave higher crude protein than check variety Hegari. Earlier scientists (2, 5, 8, 9, 11, 16) have reported similar results.

It was concluded that JS-88 is a high green fodder yielding variety with more dry matter, crude protein, leaves per plant, stem thickness and leaf area. It can be considered for general cultivation in the province of Punjab.

Table 4. Chemical composition (%) of sorghum varieties at different growth stages.

Growth stage	Variety	Crude protein	Ether extract	Crude fibre	Crude ash	Nitrogen free extract
Early blooming	JS-88	8.5	3.6	41.5	10.4	33.5
	9601	8.3	3.3	41.4	10.1	33.2
	9603	8.3	3.2	41.3	10.2	32.3
	9706	8.4	3.1	41.0	10.3	33.0
	Hegari	8.1	3.0	42.0	10.0	33.0
Full blooming	JS-88	7.4	2.4	35.8	10.2	43.1
	9601	7.2	2.2	35.2	10.2	42.9
	9603	7.3	2.1	25.0	10.3	43.0
	9706	7.3	2.2	35.0	10.3	43.1
	Hegari	7.2	2.1	35.2	10.4	44.2
Milky stage	JS-88	5.5	2.4	30.5	10.5	48.5
	9601	5.3	2.3	30.4	10.3	48.4
	9603	5.2	2.3	30.3	10.4	48.2
	9706	5.3	2.3	30.2	10.4	48.2
	Hegari	5.2	2.4	30.2	10.0	47.5

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