

EVALUATION OF SOME FORAGE SORGHUM VARIETIES UNDER THE CONDITION OF CENTRAL REGION, SAUDI ARABIA

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ABSTRACT

A study involving Piper Sudangrass, sudangrass hybrid variety Super Dan and two sorghum × sudangrass hybrid varieties, Jumbo and Speed Feed was conducted for two consecutive years at the Agricultural Research and Experiment Station near Riyadh. The aim of the study is to evaluate the forage production potential of these varieties under the climatic conditions of the central region of Saudi Arabia. Results revealed significant differences in yield and other agronomic traits among varieties. Super Dan gave the highest dry matter production. Also, it was high in average rate of forage production, and low in stem thickness. Jumbo was next to Super Dan in terms of dry matter production. Further, it had the highest leaf-stem ratio and high leaf area per plant. Piper was less productive than Super Dan and Jumbo, but was high in tillering and had the least stem thickness. Speed Feed was inferior to all varieties in terms of productivity.

Key Words: Sorghum, Sudan grass

INTRODUCTION

Rangeland productivity in Saudi Arabia is generally low and tremendous variation occurs in forage availability between spring and autumn, due to a flourishing vegetation of annuals in spring (Tag El-Din, 1983). To ease the pressure on rangelands, and maintain livestock production, expansion in irrigated forage crop production is needed.

Sorghum *Sorghum bicolor* (L.) Moench has long been in cultivation for grain and fodder in Saudi Arabia. Sudan grass, *Sorghum sudanense* (Piper)

Stapf., and sorghum-sudan grass hybrids have recently been introduced to the country as forage crops (Farnworth and Robinson, 1972). Several varieties of forage sorghum were tried along with other introduced forage crops in Saudi Arabia, mostly in the Eastern part of the country (Farnworth, 1973). Little is known about the performance of forage sorghum hybrid varieties especially under the condition of the central region of Saudi Arabia. This study aimed to evaluate three forage sorghum hybrid varieties for yield and some agronomic traits compared to Piper, a widely cultivated sudan grass variety.

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MATERIAL AND METHODS

The experiment was conducted for two consecutive summer seasons (1990 and 1991) at the Agricultural Research and Experiment Station near Riyadh (Dirab, 24 42 N, 44 46 E, 600 m Alt.). Sudangrass, Sorghum sudanense (Piper) Stapf., variety Piper, sudangrass (sudangrass × sudangrass) hybrid variety Super Dan and two Sorghum bicolor × Sorghum sudanense hybrid forage varieties, namely Jumbo and Speed Feed were used in the experiment in a randomized complete block design with four replicates.

Table (1) shows the experimental and management details. Seeds were evenly distributed in rows. Cutting was done manually at about 10 cm above soil surface when approximately 50% of the plants reached flag leaf stage and about every 35 days thereafter. A total of four and five cuts was taken in 1990 and 1991, respectively. An area of 7.2 m² per plot was used to determine green forage production and a sub-sample of three representative whole plants weighing between 300-500 g was taken for the determination of dry matter percentage by oven drying at 70° C for 72 hours.

Table 1. Experimental and management details in 1990 and 1991 seasons

	1990	1991
Seeding time	17 April	13 April
Seeding rate (kg/ha)	40	40
Spacing (cm)	40	40
Plot size (m)	4 × 4	4 × 4
Fertilizers:		
N rate (kg/ha) and time	100, three weeks after sowing 50, following cutting	
P rate (kg/ha) and time	200, at sowing time	
Weeding	manually	
Irrigation	as needed	

Agronomic traits, namely plant height, stem diameter at 25 cm above soil surface, leaf number and area per plant, leaf to stem weight ratio and number of primary stems and associated tillers per square meter, were taken at the first cut. Average rate of forage production was calculated by dividing total seasonal dry matter production by number of days from sowing to final harvest.

RESULTS AND DISCUSSION

Sorghum varieties varied significantly ($P < 0.001$) in their fresh yield in both years and in dry yield ($P < 0.001$ in 1990 and $P < 0.01$ in 1991), (Table 2). Super Dan and Jumbo gave higher fresh yield than Piper and Speed Feed in both years although variety ranking was not consistent. In terms of dry forage yield, variety ranking was as follows: Super Dan, Jumbo, Piper

and Speed Feed, although Super Dan was not statistically different from Jumbo and Piper in 1990 or from Jumbo in 1991. Variety Super Dan gave 25% and 27% increase in dry yield over the lowest yielding variety, Speed Feed in 1990 and 1991 respectively. Considering the

multiple cuts achieved in this study, forage yield was higher than that reported for Abu 70, a forage sorghum variety by Farnworth and Ruxton, (1974), Osman and Osman, (1982) and EI-Hag et al (1989).

Table 2. Fresh forage yield (t/ha), dry forage yield (t/ha), leaf-stem ratio and average rate of forage production of four forage sorghum varieties in 1990 and 1991 seasons

Variety	Forage yield (t/ha) ¹				Leaf-stem ratio ²		Rate of forage Production kg/ha/day	
	Fresh		Dry					
	1990	1991	1990	1991	1990	1991	1990	1991
Piper	95.258	107.550	16.505	18.334	0.434	0.487	105.8	94.5
Speed Feed	92.258	111.295	14.009	16.180	0.507	0.561	89.9	83.4
Jumbo	121.828	136.803	16.692	18.899	0.643	0.613	103.0	86.3
Super Dan	120.907	139.733	17.512	20.471	0.473	0.513	108.1	93.5
LSD _(0.05)	9.668	9.147	1.130	1.817	0.056	0.044	6.5	8.6

1. Cumulative yield of 4 and 5 cuts in 1990 and 1991 respectively

2. Taken at the first cut

Leaf-stem ratio differed significantly ($P < 0.001$) among varieties (Table 2). It was highest in Jumbo followed by Speed Feed, Super Dan and least in Piper in both seasons, indicating the leafiness of Jumbo. Jumbo is thus expected to be more nutritious and more readily digestible than the other varieties as leaves are known to be more nutritious and less lignified than stems (Reid, 1973). Average seasonal rates of forage production were statistically significant ($P < 0.001$ in 1990 and $P < 0.05$ in 1991). Speed Feed had the lowest rate of forage production. Rate of forage production for Speed Feed was 17% and

12% lower than Super Dan and Piper in 1990 and 1991 respectively. The average rates of forage production for the tested varieties in general and Piper in specific, were comparable to the findings by Koller and Scholl (1968) under three-cut system and similar row spacing and seed rate in Wisconsin, U.S.A.

Variety recommendation can not only be based on yield. Leafiness, stem thickness and tillering habit are among other characteristics considered in variety recommendation. Table(3) shows some morphological traits were significantly

different ($P < 0.001$) among varieties with the exception of number of leaves per plant in both seasons and plant height in 1991 season. Variety ranking for leaf area per plant was as follows: Jumbo, Speed Feed, Super Dan and Piper and was consistent in both years. As number of leaves per plant was not significantly different among varieties, leaf area was therefore a function of leaf size.

Stem diameter as an indicator of stem size, followed the same pattern as leaf area, suggesting vigorous growth of both Jumbo and Speed Feed. Piper had the smallest stem diameter in both seasons. However, it was thicker than those reported by Burger et al. (1961) under lower seeding rate (27kg/ha) but with narrower row spacing (20 cm). This

indicates that Piper and may be the other tested varieties could respond to higher seeding rate and/or narrower row spacing. Variety Piper was the tallest while Jumbo has the shortest plants in both years, although no significant differences were detected in 1991 among varieties. Variety ranking for number of culms per square meter was as follows:

Piper, Super Dan, Jumbo, Speed Feed. This ranking was consistent in both seasons. Tillering is an important factor in determining yield of a variety, it is reported that tillering is inversely related to stem thickness (Miller, 1984). In this regard, Speed Feed had thick stems associated with less culms per unit area which might have contributed to low forage yield,

Table 3. Some agronomic traits of forage sorghum varieties in 1990 and 1991 seasons

Variety	Leaf area per plant (cm ²)		Number of leaves per plant		Stem diameter (mm)		Plant height (cm)		Number of tillers per m ²	
	90	91	90	91	90	91	90	91	90	91
Piper	466	524	7.057	6.950	4.925	5.175	128.03	125.18	163.36	184.02
Speed Feed	1151	1314	7.050	7.775	7.750	7.600	116.53	117.58	94.40	91.86
Jumbo	1201	1431	7.375	7.325	8.500	8.200	106.58	114.25	100.48	98.58
Super Dan	824	1091	6.750	7.100	5.750	5.900	111.50	119.65	158.65	135.96
LSD _(0.05)	103.4	155.4	NS	NS	0.801	0.484	7.016	NS	12.61	16.38

and suggests that its potential may be enhanced by increasing the seed rate over what has been done in this experiment.

In conclusion, Super Dan gave the highest yield since it had average rate of forage production and high tillering potential. However, it has low leaf stem ratio which probably resulted from low leaf area combined with high number of stems per

unit area. Jumbo ranked the second in terms of dry matter production which was largely contributed by large leaf size. Although it had the highest leaf-stem ratio, thick stems may cause drying problems if intended for hay processing. Piper was inferior to Super Dan in dry matter production. Although it has good tillering habit and thin stem diameter, low rate of forage production and low leaf area may have contributed to its low

dry matter production. The least productive variety in terms of dry matter, Speed Feed, has high average rate of forage production. Poor tillering habit may have been responsible for its low productivity. Further studies are needed to determine the best seeding rate, row spacing and cutting frequency that gives balance between yield and feed value of the two superior varieties.

REFERENCES

Burger, A.W.; C.N. Hittle and D.W. Grams (1961). Effect of variety and rate of seeding on drying rate of sudangrass herbage for hay. *Agron. J.* 53: 198-201.

El-Hag, G.A.; Y.M. Makki; H.O. Burhan and M.S. Humaydan (1989). Agronomic and nutritional evaluation of some selected forage crops grown in Al-Hassa, King Abulaziz City for Science and Technology. Report No. AR-5-159, p. 112.

Farnworth, J. (1973). A trial of introduced and local forage species as pioneer crops for summer reclamation of sandy, saline high carbonate soil at Hofuf, Saudi Arabia. Univ. Coll. N. Wales and Min. of Agric. and Water, Saudi Arabia. Joint Agric. Res. and Develop. Proj. Publ. No. 10. p. 12.

Farnworth, J. and W.I. Robinson (1972).

A review of research on animal and forage production in Saudi Arabia. Univ. Coll. N. Wales and Min. of Agric. and Water, Saudi Arabia. Joint Agric. Res. and Develop. Proj. Publ. NO.1. p. 23.

Farnworth, J. and I.B. Ruxton (1974). A comparison of graminaceous forage species sown in mid-summer for saline soil reclamation under irrigated arid zone conditions. Univ. Coll. N. Wales and Min. of Agric. and Water, Saudi Arabia. Joint Agric. Res. and Develop. Proj. Publ. No. 38. p. 11.

Koller, H.R. and J.M. Scholl (1968). Effect of row spacing and seeding rate on forage production and chemical composition of two sorghum cultivars harvested at low cutting frequencies. *Agron. J.* 60: 456-459.

Miller, D.A. (1984). Forage crops. Mc Graw-Hill Book Co., New York, pp.486-499.

Osman, A.E. and A.M. Osman (1982). Performance of mixtures of cereal and legume forages under irrigation in the Sudan. *J. Agric. Sci. Cam.* 98: 17-21.

Reid, J.T. (1973). Quality of hay. In: Forages, Iowa State Univ. Press, Ames, IA. 3rd Ed. pp. 532-548.

Tag El-Din, S.S. (1983). Range resources of Hamad basin in Saudi Arabia (Arabic) ACSAD, HAMAD, Report No. 21. p. 162.

تقويم عدد من أصناف سورجم العلف تحت ظروف المنطقة الوسطى بالمملكة العربية السعودية

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في تجربة حقلية لمدة عامين تمت مقارنة أربعة أصناف من سورجم العلف من حيث الإنتاج العلفي وهي بايبر من حشيشة السودان و صنف سوبر دان هجين حشيشة السودان و صنفان هجينان بين الذرة الرفيعة وحشيشة السودان هما جامبو وسبيد فيد في محطة الأبحاث والتجارب الزراعية، جامعة الملك سعود قرب مدينة الرياض.

أشارت النتائج إلى وجود اختلافات معنوية بين الأصناف من حيث كمية المادة العلفية الجافة وبعض صفات المحصول ذات العلاقة بالإنتاج العلفي. أعطى صنف سوبر دان أعلى كمية من المادة الجافة وكان ذا متوسط عالٍ من معدل الإنتاج العلفي (كيلو غرام / هكتار / يوم) وامتاز بسوق دقيقة، تلاه في الإنتاج صنف جامبو الذي أعطى أعلى نسبة من وزن الأوراق إلى السوق. كما امتاز بانتساع المساحة الورقية للنبات. أعطى صنف بايبر إنتاجاً علفياً أقل من سوبر دان وجامبو ولكنه امتاز بقدرته على تكوين الأشطاء وانخفاض سمك سوقه. وقد كان صنف سبيد فيد أدنى الأصناف إنتاجاً من المادة الجافة.