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Performance of Hybrid Fodder Sorghum (Sugargraze)

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A B S T R A C T

A field experiment was conducted during two consecutive years from 2017 and 2018at Agricultural Research Station Ummedganj, Kota (Rajasthan), sowing of hybrid fodder sorghum (sugargraze) by different seed rates viz. 3.5, 5.5,7.5, 9.5, 11.5 kg/ha and local chari 10.0 kg/ha. The fodder yield of sugargraze was significantly influenced by sowing of different seed rate. Pooled data of two years gave significantly higher green fodder yield(898 q/ha) and dry fodder yield (241 q/ha) were observed by sowing of sugargraze 9.5 kg seed/ha over local chari sowing by 10.0 kg seed/ha green fodder yield (659 q/ha) and dry fodder yield (166 q/ha). However, it was found at par with sowing of sugargraze by 7.5 kg seed/ha green fodder yield (887 q/ha) and dry fodder yield (238 q/ha).

Introduction

Sorghum [*Sorghum bicolor* (Linn.) Moench] is an important crop in the world, used for food (as grain or sorghum molasses), fodder, the production of alcoholic beverages and biofuels. Most varieties are drought and heat tolerant, and are especially important in arid regions, where the grain is one of the staple food for poor and rural people. It is an important food and fodder crop grown in India, and among cereals, it is the fourth most important crop after rice, wheat and maize (Dehinwal *et al.*, 2016). Sorghum grain is used as staple food by millions of people and is grown for grain in southern and central states of India, whereas in northern states of the country (Punjab, Haryana, Uttar Pradesh, Rajasthan, etc.) it is mainly grown as fodder during *summer* and *kharif* seasons as a single as well as multicut crop. Among forage crops, forage sorghum could be a strategic option because of the crop's xerophytic characteristics, adaptation potential, quick

growing habit, good ratoon ability, palatability, digestibility and wide range of potential uses as green fodder, dry roughage, hay and silage (Kumar and Chaplot, 2015).

Among crop management practices seeding densities or plant population greatly affect crop growth and then finally grain yield. Therefore seeding density is a key factor in assessing the flexibility and yielding ability of cultivars. Both over and substandard plant population is the major cause of low yield (Jan *et al.*, 2000).

Optimum seed rate plays an important role in contributing to the high yield because in case of thick plant population, most plants remain sterile, easily attacked by diseases as compared to normal population(Robert and Singh, 1981).To obtain high quality preserved forage (silage or hay), harvest sugargraze at knee height stage. For silage, let plants wilt prior to ensiling and lower moisture content will reduce effluent losses from silage. In the India, two to three subsequent harvests are possible. To stimulate recovery growth, fertilize with nitrogen immediately following the initial harvest (Smith *et al.*, 2005).

Materials and Methods

Field experiment was conducted during two consecutive years from 2017 and 2018 at Agricultural Research Station Ummedganj, Kota. The research station is situated in Agro-Climatic Zone V (Humid South-Eastern Plain) of Rajasthan.

It is located between $25^0$13´ N latitude and 75^0 25´ E longitudes at an altitude of 258 m above MSL. The average rainfall of both the years during crop growing season were 496.1 and 545 mm and means maximum and minimum temperatures 34.6 & 37.1 ^{0}C and 16.9 & 20.6^0 C, respectively. Experimental field was well prepared by two ploughing followed by harrowing & cultivator and one planking for uniform leveling , etc. were performed for sowing of sugargraze crop. Experiment was laid-out in Randomized Block Design with four replications and six treatments viz. T_1: Sugargraze (seed rate 3.5 kg/ha), T_2: Sugargraze (seed rate 5.5 kg/ha), T_3: Sugargraze (seed rate 7.5 kg/ha), T_4: Sugargraze (seed rate 9.5 kg/ha), T_5: Sugargraze (seed rate11.5 kg/ha) and T_6: Local chari (seed rate 10.0 kg/ha).

The bulk density, pH and cation exchange capacity of these soils varies between 1.30-1.60 Mg/m^3, 7.75-8.50 and 30-40 Cmol/kg, respectively. The soils of the region are poor in organic carbon (0.50±0.08) and available nitrogen (275±5 kg/ha) but are low to medium in available P_2O_5 (24.2± 1.0 kg/ha) and medium to high in available K_2O (290 ± 8 kg/ha).The recommended dose of nitrogen, phosphorus & potash *i.e.*125 kg N/ha, 60 kg P_2O_5 / ha and 60 kg K_2O /ha were given in the form of urea, di-ammonium phosphate (DAP) and muriate of potash (MOP). Full dose of DAP and MOP and half N were drilled just before sowing and remaining half-N was applied in two split doses as per recommendation.

Results and Discussion

First cutting

The plant population and growth parameters of sugargraze were significantly influenced by sowing of different seed rate (Table 1). Pooled data of two years showed that the significantly higher plant population (491765/ha) of sugargraze was recorded by sowing of 11.5 kg seed/ha which was significantly superior over rest of the treatments. The maximum plant height (153.51 cm) was recorded in the first cutting by sowing of sugargraze by 3.5 kg seed/ha over local chari plant height (131.98 cm).

However, it was found at par with sowing of sugargraze by 5.5 and 7.5 kg seed/ha. These results are in close proximity with those of Dehinwal *et al.,* 2016, Smith *et al.,* 2005 and Jan *et al.,* 2000. Two years data indicated that the maximum leaf weight/plant (93.65 g) and stem weight/plant (280.10 g) were recorded in the first cutting of sugargraze by sowing 3.5 kg seed/ha but it was found at par with sowing of sugargraze by 5.5 and 7.5 kg seed/ha over local chari leaf weight/plant (70.5 g) and stem weight/plant (214.05 g) by sowing of 10 kg seed/ha in the pooled analysis.

The higher leaf: stem ratio (0.37) was observed in the pooled data of sugargraze by sowing of 3.5 kg seed/ha over rest of the treatments. These results are in close proximity with those of Satpal *et al.,* 2016, Kumar and Chaplot (2015).

Pooled data of dry matter content was significantly influenced by sowing of different seed rate of sugargraze (Table 2). Sowing of sugargraze by 9.5 kg seed/ha was recorded maximum dry matter (26.70 %) but it was found at par with the sowing of sugargraze by 7.5 kg seed/ha over local chari sowing by 10.0 kg seed/ha dry matter (26.53 %). Significantly influenced quality parameters of sugargraze by sowing of 9.5 kg seed/ha, cruid protein (7.14) and cruid fibre (24.90) per cent over local chari sowing by 10.0 kg seed/ha. However, it was found at par with the sowing of different seed rate of sugargraze 3.5,5.5,7.5 and 11.5 kg seed/ha, respectively.

Two years pooled data indicated that significantly influenced ash content (15.01) per cent in sugargraze by sowing of 9.5 kg seed/haover local chari (13.99) per cent sowing by 10.0 kg seed/ha. These results are in close proximity with those of Satpal *et al.,* 2016, Kumar and Chaplot (2015).

Second cutting

During second cutting plant growth was significantly influenced (Table 3) by sowing of different seed rate of sugargraze. The maximum plant height (133 cm) of sugargraze was recorded by sowing of 3.5 kg seed/ha over local chari plant height(117 cm) sowing by 10 kg seed/ha. However, it was found at par with sowing of sugargraze by 5.5 and 7.5 kg seed/ha, respectively in the pooled analysis.

The maximum leaf weight/ plant (66.17 g) and stem weight/ plant (160.25 g) of sugargraze were recorded by sowing of 3.5 kg seed/ha over local chari leaf weight/ plant (51.85 g) and stem weight/ plant (119.05 g) by sowing of 10 kg seed/ha. However, it was found at par with sowing of sugargraze by 5.5 and 7.5 kg seed/ha, respectively**.** Pooled data of two years shows that the significantly higher leaf: stem ratio (0.35) was observed by sowing of sugargraze 3.5 kg seed/ha over rest of the treatments. These results are in close proximity with those of Dehinwal *et al.,* 2016, Smith *et al.,* 2005 and Jan *et al.,* 2000.

Significantly influenced dry matter (26.94) per cent under sowing of sugargraze by 9.5 kg seed/ha but it was found at par with the sowing of sugargraze by 7.5 kg seed/hadry matter (26.73) per cent over rest of treatments (Table 4). Pooled data indicated that the quality parameters of sugargraze cruid protein (6.96) and cruid fibre (24.44) per cent were significantly influenced by sowing of 9.5 kg seed/ha over local chari sowing by 10.0 kg seed/ha.

However, it was found at par with the sowing of different seed rate of sugargraze 3.5,5.5,7.5 and 11.5 kg seed/ha, respectively. The maximum ash content (14.94) per cent was observed in sugargraze by sowing of 9.5 kg seed/ha over local chari sowing by 10.0 kg

seed/ha. However, it was found at par with the sowing of different seed rate of sugargraze 3.5,5.5,7.5 and 11.5 kg seed/ha, respectively in the pooled analysis. These results are in close proximity with those of Satpal *et al.*, 2016, Kumar and Chaplot (2015). Significantly higher green fodder yield (898 q/ha) and dry fodder yield (241 q/ha) were observed with sowing of sugargraze by 9.5 kg seed/ha over local chari sowing by 10.0 kg seed/ha green fodder yield (659 q/ha) and dry fodder yield (166 q/ha). However, it was found at par with sowing of sugargraze by 7.5 kg seed/ha green fodder yield (887 q/ha) and dry fodder yield (238 q/ha). These results are in close proximity with those of Satpal *et al.*, 2016, Kumar and Chaplot (2015).

Table.1 Pooled data of plant population, growth parameters, fodder yield and quality of sugargraze during first cutting (2017 and 2018)

Treatments	Plant population (000/ha)	Plant height (cm)	Weight of leaves/ plant (g)	Weight of stem/ plant (g)	Leaf : Stem ratio
T_1: Sugargraze (seed rate 3.5 kg/ha)	157440	153.51	93.65	280.10	0.37
T_2: Sugargraze (seed rate 5.5 kg/ha)	246240	152.39	92.65	279.45	0.36
T_3: Sugargraze (seed rate 7.5 kg/ha)	329643	150.97	92.35	278.40	0.34
T_4: Sugargraze (seed rate 9.5 kg/ha)	409765	142.23	91.25	275.55	0.33
T_5: Sugargraze (seed rate 11.5 kg/ha)	491765	136.01	73.5	253.05	0.31
T_6: Local chari (seed rate 10.0 kg/ha)	418000	131.98	70.5	214.05	0.26
SEm ±	1003	1.10	0.67	1.15	0.002
CD at 5 %	2906	2.80	1.92	3.34	0.008

Table.2 Pooled data of dry matter content and quality of sugargraze during first cutting (2017 and 2019)

Treatments	Dry matter (%)	Crude protein (%)	Crude fibre (%)	Ash content (%)
T_1: Sugargraze (seed rate 3.5 kg/ha)	27.62	7.15	24.88	15.05
T_2: Sugargraze (seed rate 5.5 kg/ha)	26.72	7.16	24.85	15.03
T_3: Sugargraze (seed rate 7.5 kg/ha)	26.71	7.17	24.89	15.03
T_4: Sugargraze (seed rate 9.5 kg/ha)	26.70	7.14	24.90	15.01
T_5: Sugargraze (seed rate 11.5 kg/ha)	25.99	7.11	24.86	14.95
T_6: Local chari (seed rate 10.0 kg/ha)	26.53	6.37	23.36	13.97
SEm ±	0.11	0.037	0.15	0.03
CD at 5 %	0.36	0.105	0.45	0.09

Table.3 Pooled data of plant growth parameters of sugargraze during second cutting

Treatments	Plant height (cm)	Weight of leaves/plant (g)	Weight of stem/ plant (g)	Leaf : Stem ratio
T_1: Sugargraze (seed rate 3.5 kg/ha)	133	66.17	Pooled	0.35
T_2: Sugargraze (seed rate 5.5 kg/ha)	132	65.89	160.25	0.33
T_3: Sugargraze (seed rate 7.5 kg/ha)	131	64.88	157.60	0.32
T_4: Sugargraze (seed rate 9.5 kg/ha)	126	62.08	156.50	0.30
T_5: Sugargraze (seed rate 11.5 kg/ha)	120	55.53	156.10	0.29
T_6: Local chari (seed rate 10.0 kg/ha)	117	51.85	135.80	0.25
SEm ±	0.67	0.90	119.05	0.003
CD at 5 %	2.01	2.69	1.33	0.010

Table.4 Pooled data of fodder dry matter content and quality of sugargraze during second cutting

Treatments	Dry matter (%)	Crude protein (%)	Crude fibre (%)	Ash content (%)
T_1: Sugargraze (seed rate 3.5 kg/ha)	25.14	6.97	24.44	14.98
T_2: Sugargraze (seed rate 5.5 kg/ha)	25.63	6.99	24.44	14.97
T_3: Sugargraze (seed rate 7.5 kg/ha)	26.73	6.99	24.46	14.96
T_4: Sugargraze (seed rate 9.5 kg/ha)	26.94	6.96	24.44	14.94
T_5: Sugargraze (seed rate 11.5 kg/ha)	25.05	6.80	24.46	14.91
T_6: Local chari (seed rate 10.0 kg/ha)	22.64	5.97	23.00	13.95
SEm ±	0.18	0.024	0.077	0.063
CD at 5 %	0.52	0.067	0.23	0.18

Table.5 Pooled data of green fodder and dry fodder yield of sugargraze during first and second cutting

Treatments	Green fodder yield (q/ha)		Total yield (q/ha)	Dry fodder yield (q/ha)		Total yield (q/ha)
	Ist Cutting	IInd Cutting		Ist Cutting	IInd Cutting	
T1: Sugargraze (seed rate 3.5 kg/ha)	382	244	626	106	61	167
T2: Sugargraze (seed rate 5.5 kg/ha)	421	260	681	113	67	180
T3: Sugargraze (seed rate 7.5 kg/ha)	556	331	887	149	89	238
T4: Sugargraze (seed rate 9.5 kg/ha)	564	334	898	151	90	241
T5: Sugargraze (seed rate 11.5 kg/ha)	514	262	776	134	66	200
T6: Local chari (seed rate 10.0 kg/ha)	409	250	659	109	57	166
SEm ±	3.58	2.68	-	1.00	0.59	-
CD at 5 %	10.41	7.77	-	2.90	1.69	-

Sowing of sugargraze by 9.5 kg seed/ha gave higher fodder yield over local chari sowing by 10.0 kg seed/ha. Sugargraze also recorded better quality in term of cruid protein, cruid fibre and ash and it may be suitable for green fodder purpose.

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