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Influence of Nitrogen on Yield and Quali y of Forage Sorghum Genotypes

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ABSTRACT

A field experiment was conducted with four nitrogen levels (0, 40, 80 and 120 kg N/ha) and six forage sorghum genotypes (PC-6, SU-45, AS-14, AS-15, Imp. Ramkel and HC-136) at Forage Research Farm, Anand (Gujarat). Genotypes PC-6, AS-14, AS-15 and Imp. Ramkel were found promising to obtain higher green and dry matter yields with better quality. Increasing N application from 0 to 40, 80 and 120 kg N/ha increased green fodder production by 20.3, 21.6 and 24.9 and dry matter by 22.6, 22.7 and 26.3 per cent, respectively. Crude protein content and crude protein yield increased markedly with the successive increase in nitrogen levels. The netural detergent fibre (NDF) content, however, reduced markedly with the successive increase levels. From the economic point of view, an application of 120 kg N/ha showed the maximum total returns. However, maximum net ICBR was obtained from the application of 40 kg N/kg.

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INTRODUCTION

Jowar (*Sorghum bicolor* (L.) Moench) s essentially a crop of the dry farming areas nd withstands heat and drought. This rop is grown for green as well as dry forage roduction over wider areas, particularly luring the *kharif* season. It is admirably daptted to varying soil and climatic condiions. Nitrogen fertilizer plays an important ole in increasing forage production of sorghum with better nutritive value. Keeping his point in view, six genotypes of forage orghum were evaluated under four levels of itrogen fertilizer application at Forage Research Farm, Gujarat Agricultural University, Anand.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* seasons of 1985, 1986 and 1987 on sandy loam soils, low in available nitrogen (158.8 kg/ha) and medium in available P_2O_5 (45 kg P_2O_5/ha) and K_2O (199 kg/ha) The soil pH was 8.8. There were six forage sorghum genotypes (PC-6, SU-45, AS-14, AS-15, Imp. Ramkel and HC-136) and four levels of N (0, 40, 80 and 120 kg/ha) forming twenty four treatment combinations. This trial was carried out with three replications using factorial randomised block design. The gross plot size was 5 x 3.6 m^2 and net 4 x 2.4 m^2. Half of the required N in the form of urea, entire quantity of P_2O_5 (single

superphosphate) @ 30 kg/ha and carbofuran 3 G @ 20 kg/ha were applied in the furrows. The seeds were drilled in rows 30 cm apart on 22nd July, 1985; 18th July, 1986 and 27th July, 1987 using 30 kg seed/ha. The remaining half of the N was topdressed one month after sowing. Other cultural practices were followed per recommendations. The crop was harvested at 50 per cent flowering stage which occured between 67 to 91 days after sowing depending on genotypes.

The harvested green forage was weighed immediately and 500 g sample from each treatment were collected randomly for dry matter estimation. Green samples were cut into small pieces and first air dried and then over dried at 70:C. The dry matter weight was separately recorded for each treatment. The total N was estimated by conventional Kjeldhal's method.

RESULTS AND DISCUSSION

Green forage and dry matter yield

The results (Table 1) indicated that green forage yields of genotypes HC-136, Imp. Ramkel, AS-14 and AS-15 were not significant, however, dry fodder yields were higher from PC-6 followed by Imp. Ramkel, AS-15, HC-136 and AS-14. Variety SU-45 gave minimum green and dry fodder yields during all the three years. So far as green and dry fodder production per unit time is concerned, it was maximum in AS-14 (6.0 x 1.36 q|ha|day), followed by AS-15 (4.85 x 1.30 q|ha|day) and PC-6 (4.26 x 1.42 q|ha|day) due to less number of days taken by these genotypes for harvesting stage.

Increasing level of N application from 0 to 40, 80 and 120 kg/ha increased the green forage production by 20.3/21.6 and 24.9 per cent, respectively, on pooled basis. The corresponding increases in dry matter production were recorded to the level of 22.6, 22.7 and 26.3 per cent, respectively. The increased yields of green forage and dry matter with nitrogen application were due to increased vegetative growth of plants (Table-1). Cooper (1956) and Patel (1958) reported that green forage and dry matter yields of forage sorghum increased with nitrogen application probably due to increased vegetative growth of plants. The maximum net Incremental Cost Benefit Ratio (ICBR) of 1:1.91 was obtained with an application of 40 kg N/ha.

The interaction of genotype x nitrogen levels were found non-significant for green forage and dry matter yields on pooled basis. So it is recommended that the farmers of Middle Gujarat region are advised to use 40 kg N/ha to forage sorghum for obtaining higher forage yields and net realization.

Crude protein and natural delergent fibre content

The highest crude protein content (Table-2) was synthesized by the genotype HC-136 (6.17%) followed by AS-14 (6.11%) and Imp. Ramkel (6.10%). The highest crude protein content was synthesized by the highest level of N during all the individual years as well as on an average of three years (Table 2). The crude protein content of sorghum increased from 5.50 to 6.10 per cent to 6.28 and 6.36 at 0 to 40 to 80 and 120 kg N/ha. Increased crude protein content of sorghum by increasing N application was also observed by Desai and Deore (1980) and Hussein *et al.* (1980).

Genotypes AS-14 and Imp. Ramkel showed lowest NDF (69.0%) as compared

TABLE I

Green forage and dry matter yields of forage sorghum genotypes as influenced by nitrogen.

Treatments	*Green forage yield q/ha*				*Dry matter yield q/ha*				*Yield in q/ha/day Av. of three years*		*Average of three years*	
	1985	*1986*	*1987*	*Pooled*	*1985*	*1986*	*1987*	*Pooled*	*GF*	*DM*	*Plant height (cm)*	*No. of leaves plant*
Genotype (G)												
PC-6	348	324	323	332	109.3	105.9	117.5	110.9	4.26	1.42	221.2	10.9
SU-45	286	276	286	283	74.6	77.5	100.5	84.2	3.99	1.19	212.3	11.2
AS-14	398	333	477	402	83.8	75.3	115.0	91.4	6.00	1.36	226.3	11.1
AS-15	401	340	394	378	92.7	91.6	119.6	101.3	4.85	1.30	209.7	11.4
Imp. Ramkel	396	349	324	356	102.5	106.4	98.5	102.5	4.19	1.20	187.2	11.4
HC-136	443	328	379	383	98.2	88.6	99.8	95.5	4.45	1.11	203.5	12.3
S. Em ±	12	23	14	21	2.8	6.1	3.9	5.4				
C. D. at 5%	33	NS	40	66	7.8	17.4	11.1	NS				
Nitrogen (N) (kg/ha)												
0	327	257	331	305	80.2	71.6	96.7	82.8			194.2	10.9
40	377	342	381	367	91.8	94.9	117.6	101.5			206.5	11.0
80	392	355	366	371	100.1	99.5	105.3	101.6			216.3	11.7
120	419	346	377	381	102.0	97.4	114.4	104.6			223.1	11.8
S. Em. ±	9	19	12	8	2.2	5.0	3.2	3.1				
C. D. at 5	27	53	33	22	6.4	14.2	9.1	10.7				
Int. G. x N	NS	NS	NS	NS	NS	NS	Sig.	NS				

TABLE 2

Quality parameters of forage sorghum genotypes as influences by nitrogen.

Treatments	Crude Protein (%)				Crude Protein yield (q/ha)				Neutral Detergent Fibre Content (%)			
	1985	1986	1987	Mean	1985	1986	1987	Mean	1985	1986	1987	Mean
Genotypes												
PC-6	6.31	6.06	5.36	5.91	6.91	6.36	6.29	6.53	77.4	69.1	67.7	71.4
SL-45	6.87	6.32	4.91	6.03	5.20	4.89	4.99	5.03	72.3	69.5	69.5	70.4
AS-14	6.46	6.32	5.54	6.11	5.54	4.79	6.38	5.57	67.1	71.4	68.4	69.0
AS-15	7.07	6.09	4.94	6.03	6.53	5.59	5.90	6.01	73.0	72.3	63.3	69.5
Imp. Ramkel	7.13	5.51	5.67	6.10	7.35	5.90	5.63	6.29	72.7	71.3	62.9	69.7
HC-136	6.69	5.28	6.55	6.17	6.57	4.72	6.59	5.96	70.7	67.7	69.7	69.4
Nitrogen (kg/ha)												
0	5.79	5.67	5.05	5.50	4.75	4.06	4.88	4.56	72.9	70.8	66.8	70.2
40	7.04	5.70	5.55	6.10	6.37	5.37	6.48	6.07	72.9	69.9	66.6	69.8
80	7.00	6.15	5.69	6.28	6.93	6.02	5.98	6.31	72.5	68.7	66.6	69.3
120	7.19	6.20	5.70	6.36	7.35	6.06	6.51	6.64	70.5	71.4	67.8	69.9

to other genotypes on an average of three years while the highest NDF (71.4%) was obtained in PC-6. Gupta *et al.* (1983) also reported such type of variation in sorghum genotypes. The NDF content was reduced as the successive increase of nitrogen from 0 to 80 kg N/ha although the differences were marginal. Similar type of results were also obtained by Oberoi (1981) in oats.

Crude protein yield

Genotype PC-6 produced the highest crude-protein yield (6.53 q/ha) followed by Imp. Ramkel (6.29 q/ha) and AS-15 (6.01 q/ha). The variation in the yield of crude protein could be attributed to differential potentially of genotypes to synthesize protein and variation in the dry matter production. Increaseing trend of crude protein yield was observed with successive increments of N. The higher level of nitrogen (120 kg/ha) produced the highest crude protein yield (6.64 q/ha) an average of three years than other levels of nitrogen. Increasing level of N application from 0 to 40, 80 and 120 kg N/ha increased the crude protein yield by 33.1, 38.4 and 45.6 per cent, respectively, on an average of three years. The results are in accordance with the results obtained by Hegde and Relwani (1974).

TABLE 3

Economics of forage sorghum as influenced by nitrogen levels.

Treatment	*Pooled green forage yield (q/ha)*	*Total return Rs./ha*	*Additional return over control Rs./ha*	*Additional cost Rs./ha*	*Gross ICBR*	*Net ICBR*
Nitrogen levels						
0 kg N/ha	305	3050	—	—	—	—
40 kg N/ha	367	3670	620	212.80	1:2.91	1:1.91
80 kg N/ha	371	3710	660	425.60	1:1.55	1:0.55
120 kg N/ha	381	3810	760	638.40	1:1.19	1:0.19

Selling price of green forage of sorghum Rs. 10/q.
Cost of nitrogen @ Rs. 5.32 per kg of nitrogen from urea.

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