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EFFECT OF NITROGEN ON YIELD, ECONOMICS AND QUALITY OF FODDER SORGHUM GENOTYPES

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ABSTRACT

A field experiment was undertaken at Udaipur (Rajasthan) to study the effect of nitrogen levels on the productivity and economics of fodder sorghum genotypes. Results showed that genotype SU 1080 recorded significantly higher dry matter accumulation at 30 and 60 DAS and harvest , number and weight of leaves plant $^{-1}$, green and dry fodder, net returns and B/C ratio, crude protein , crude fibre, crude fat, ash, NFE and TDN contents. Among nitrogen levels, 80 kg N ha^{-1} recorded significantly higher plant height at harvest, dry matter accumulation at 30 and 60 DAS and harvest, number and weight of leaves plant^{-1}, green as well as dry fodder yield, net returns and B/C ratio, protein, crude fibre, crude fat, ash, NFE and TDN over 40 kg N ha^{-1} and control. Higher level of nitrogen (120 kg N ha^{-1}) was found at par with 80 kg N ha^{-1} with respect to yield and quality parameters. Application of 80 kg N ha^{-1} recorded 27.0 and 5.9, 25.6 and 6.1 and 28.9 and 5.7 %, respectively higher green as well as dry fodder yield and net returns over control and 40 kg ha^{-1}.

Keywords: Nitrogen, fodder sorghum genotypes, yield, quality, economics

INTRODUCTION

Sorghum is the king of millets. It holds promise for food, feed and fodder for human, poultry and cattle, respectively. Sorghum is one of the most important cereal crop which is largely cultivated throughout the country during the summer, monsoon and winter seasons to meet out both green as well as dry fodder requirement of the livestock. Proper and adequate fertilization, and suitable genotypes are one among the major factors limiting the fodder sorghum production in our country. Therefore, identification of good quality sorghum genotypes and development of location specific production technology offers an excellent opportunity to provide fodder for better nutrition of bovine population .It is a well established fact that nitrogen plays an important role in the growth and development of crop plants. Thus, suitable cultivars and proper nutrition are very important to get higher fodder yield. Hence, the present study was undertaken to find out the response of different elite single cut fodder sorghum genotypes to nitrogen levels.

MATERIALS AND METHODS

A field investigation was carried out during the *kharif* 2004 at the Instructional Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur. The soil of experimental site was clay loam in texture having slightly alkaline (pH 7.9) in reaction, organic carbon (5.5 g kg^{-1}), available nitrogen (284.9 kg ha^{-1}), phosphorus (21.8 kg ha^{-1}) and potassium (358.8 kg ha^{-1}). The experiment consisted of five elite single cut fodder sorghum genotypes *viz*., UTFS 43, S-437-1, SU 1080, SU 1140, and HC 308 assigned in main plot and four nitrogen levels (0, 40, 80 and 120 kg Nha^{-1}) in subplot treatments were tested in a split plot design having three replications. Sorghum genotypes were sown on 7 July 2004 at 30 cm row spacing with a seed rate of about 25 kg ha^{-1}. A uniform dose of 40 kg P_2O_5 ha^{-1} through single super phosphate and half dose of nitrogen was applied as per treatments at sowing time and rest of the nitrogen was top dressed at 30 days after sowing the crop. The crop received 569.6 mm rainfall during crop season. Crop was harvested on 27 September, 2004. Plant heights, dry matter accumulation per plant, number of green and dry leaves were recorded at 60 days after sowing. Crop was harvested at 75 DAS and green fodder yield was recorded. The plants samples collected at harvest were analysed for nitrogen (modified Kjeldahl method). Crude protein content was calculated by multiplying the nitrogen percentage with 6.25. Crude fiber content was determined as per method described by Wright (1939). The ether extract content was determined by Soxhlet apparatus using petroleum ether (B.P. 40-60°C). Mineral ash content was determined by using Muffle furnace as described by AOAC (1975). Total digestible nutrients were calculated by the formula: TDN (%) = Digestible crude protein (%) + Digestible crude fibre (%) +Digestible NFE (%) + [Digestible ether extract (%) x 2.25']

• Digestible fat was multiplied by 2.25 as fat contains 2.25 times more energy than carbohydrate and protein. Nitrogen free extract was calculated by adding together the percentage crude protein, ether extract, crude fibre and mineral matter and then subtracting total from 100.

NFE (%) =100 - [Crude protein (%) + Ether extract (%) + Crude fibre (%) + Mineral matter (%)]

RESULTS AND DISCUSSION

Genotypes: Data (Table 1) clearly indicate that minimum days to bloom, plant height at harvest , dry matter accumulation (g plant $^{-1}$) at 30 and 60 DAS and harvest, number and weight of leaves plant $^{-1}$, was significantly improved by different elite fodder sorghum genotypes. HC 308 recorded minimum days to 50 % flowering, SU 1140 recorded maximum plant height at harvest, SU 1080 rcorded higher dry matter accumulation at 30 and 60 DAS and at harvest, number and weight of leaves plant^{-1} and found closely followed with HC 308. SU 1080 recorded 20.8, 21.3, 21.3 and 21.4 percent higher dry matter accumulation at 30, 60 DAS and at harvest and weight of leaves plant^{-1} over UTFS 43. Data in Table 1 further revealed that maximum green and dry fodder yield (451.03 and 153.27 qha^{-1}) and B/C ratio (6.94:1) was also recorded in SU 1080 which was found at par with HC 308 and recorded significantly higher over UTFS 43 by a margin of 20.7, 20.4, 24.4 and 24.8 percent.

Table 1: Effect of nitrogen level on productivity of forage sorghum genotypes

Treatments	Days to 50% flowering	Plant height (cm)	Dry matter accumulation (g plant^{-1})			Leaves plant^{-1}		Fodder yield (q ha^{-1})		Net returns (Rs ha^{-1})	BC ratio
			30 DAS	60 DAS	At harvest	Number	Weight	Green	Dry		
Genotypes											
UTFS-43	71.50	226.50	10.07	148.03	186.06	11.45	79.16	373.70	127.27	34837	5.56
S-437-1	69.50	289.25	9.82	144.27	181.33	11.16	77.15	367.78	124.03	34186	5.44
SU-1080	69.92	267.17	12.16	179.62	225.77	13.88	96.05	451.03	153.27	43343	6.94
SU-1140	68.83	279.83	11.50	169.04	212.46	13.08	90.39	418.47	145.34	39762	6.32
HC-308	68.08	274.67	12.10	177.82	223.50	13.76	95.09	449.92	152.76	43221	6.89
CD (P=0.05)	0.625	4.787	0.277	4.071	5.116	0.334	2.177	16.488	7.446	2062.6	0.326
Nitrogen (kgha^{-1})											
0	70.87	253.07	9.48	139.63	175.50	10.81	74.67	348.69	120.11	32746	5.84
40	69.87	265.07	11.22	165.33	207.81	12.80	88.41	417.95	142.22	39925	6.60
80	69.13	275.53	11.92	175.57	220.68	13.59	93.89	442.82	150.92	42220	6.51
120	68.70	276.27	11.90	174.49	219.32	13.47	93.31	439.26	148.89	41389	5.97
CD (P=0.05)	0.691	4.320	0.184	2.723	3.422	0.207	1.456	16.738	5.647	725.5	0.109

Likewise other attributes, SU 1080 also recorded higher crude protein, crude fibre, crude fat, mineral ash and lower TDN content as compared to other genotypes tested. The differential behaviour of the genotypes in respect to better dry matter accumulation and plant height and green as well as dry fodder yield could explained solely by their genetic constitution and adaptability of soil and climatic conditions. The higher green and dry fodder yield registered by SU 1080 and HC 308 over rest of genotypes appear to be a resultant of remarkable improvement in different yield components, which was brought about due to adoption of genotypes. The results are in close conformity with the findings of Singh *et al.* (2009) and Sumeriya (2010).

Nitrogen: Data {Table 1 and 2) revealed that nitrogen application had significant influence on growth, yield attributes, yield, quality parameters and economics of sorghum. Application of 80 kg Nha-^{1} recorded minimum days to 50% flowering, higher plant height, dry matter accumulation plant^{-1} at 30 and 60 DAS and at harvest, number and weight of leaves plant^{-1} over control. This level found at par with 120 kg N ha^{-1} for all the said characters. Application of 801 kg N ha^{-1} recorded 8.9, 25.7, 25.0 and 25.7% higher plant height, dry matter accumulation at harvest, number and weight of leaves plant^{-1} over control. Application of 80 kg N ha^{-1} recorded higher green and dry fodder yield and net returns over control and 40 kg N ha^{-1} and the increases were 27.0, 25.7 and 28.9% in green fodder, dry fodder and net returns over control (Table 1).

Data (Table 2) further revealed that application of 80 kg N ha^{-1} recorded higher, crude fat and found at par with 40 kg N ha^{-1}. It is well emphasized that increasing rates of nitrogen improved over all growth of the crop in terms of dry matter production per plant by virtue of its impact on morphological and photosynthetic components along with accumulation of nutrients. This suggests greater availability of nutrients and metabolites for growth and development of reproductive structure, which ultimately led to realization of higher productivity of individual plants. Observed improvement in various characters and monetary returns due to N fertilization is in close conformity with the fmdings of Dixit *et al (2005),* Sumeriya et al. (2007).

Table 2: Effect of nitrogen level on fodder quality parameters of forage sorghum genotypes

Treatments	Crude protein (%)	Crude fibre (%)	Crude fat (%)	Mineral ash (%)	NFE (%)	TDN (%)
Genotypes						
UTFS-43	7.13	31.43	1.70	7.80	51.82	54.51
S-437-1	7.10	31.93	1.73	7.68	51.45	54.59
SU-1080	7.38	31.64	1.80	8.02	51.05	54.38
SU-1140	7.29	32.56	1.70	7.62	50.72	54.58
HC-308	7.23	31.40	1.66	7.82	51.78	54.47
CD (P=0.05)	0.17	0.76	0.05	0.20	NS	0.14
Nitrogen (kgha^{-1})						
0	6.34	32.65	1.67	7.38	51.96	54.88
40	7.06	32.21	1.69	7.53	51.51	54.69
80	7.69	31.43	1.73	7.91	51.24	54.39
120	7.80	30.88	1.78	8.32	50.76	54.07
CD (P=0.05)	0.12	0.48	0.03	0.12	0.73	0.09

Interaction

Data (Table 3) revealed that significantly taller plant was recorded under SU 437-1 with 80 kg N ha^{-1} (294.0 ern), which was found 42.0 percent taller over UTFS 43 with no nitrogen level. The interaction effect between genotypes and nitrogen levels was found to be significant. Among the different genotypes and nitrogen levels, significantly higher green fodder yield of 479.52 qha-^{1} was recorded under genotypes HC 308 with 80 kg N ha^{-1}.

Table 3: Combined effect of genotypes and nitrogen levels on growth and yield of sorghum genotypes

Treatment	Nitrogen levels (kg ha^{-1})			
	0	40	80	120
Plant height (cm)				
Genotypes				
UTFS-43	207.00	228.67	234.67	235.67
S-437-1	277.33	293.67	294.00	292.00
SU-1080	240.33	252.67	288.67	287.00
SU-1140	273.33	279.33	281.00	285.67
HC-308	267.33	271.00	279.33	281.00
CD (P=0.05)	9.660			
Green fodder yield (q ha^{-1})				
Genotypes				
UTFS-43	310.80	392.20	401.08	390.72
S-437-1	303.40	355.20	409.96	402.56
SU-1080	414.40	46620	466.20	457.32
SU-1140	344.84	409.96	457.32	461.76
HC-308	370.00	466.20	479.52	483.96
CD (P=0.05)	37.43			
Dry fodder yield (q ha^{-1})				
Genotypes				
UTFS-43	109.52	133.91	132.98	132.68
S-437-1	103.79	119.95	139.49	132.89
SU-1080	143.12	154.56	158.29	157.13
SU-1140	119.52	144.55	160.45	156.84
HC-308	124.60	158.14	163.39	164.90
CD (P=0.05)	12.63			

Genotypes and nitrogen levels exerted significant difference on dry fodder yield sorghum (Table 3). Significantly higher dry fodder yield of 164.90 q ha-^{1} was recorded under HC 308 with 120 kg N ha^{-1}.

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