GAU Res. J. 1993. 19 (1) : 10-14

Influence of Bio-Fertilizers and Nitrogen Levels on Forage Sorghum

J. R. Patel, A. C. Sadhu, P. C. Patel and K. R. Thaker

A.I.C.R.P. on Forage Crops, Gujarat Agricultural University, Anand Campus, Anand

ABSTRACT

A field experiment was conducted on forage sorghum for three years at Anand to study the influence of biofertilizers and nitrogen levels on yield of forage sorghum variety S.S.G. 59-3. The results revealed that treatment of Azotobacter produced the maximum green forage production. It also gave significantly higher dry matter production (67.1 q/ha) than no bio-fertilizer and treatment of Azospirillum. Increasing N application from 0 to 25, 50 and 75 kg N/ha increased green forage production by 19.1, 32.8 and 36.1 per cent and dry matter yield by 22.4, 35.0 and 45.9 per cent respectively, on pooled basis. The successive increase in N levels also increased the crude protein yield of forage sorghum and application of 75 kg N/ha produced the highest crude protein yield (5.81 q/ha) on average of three years. However, application of 50 kg N/ha to forage sorghum was found better for getting economic and higher green forage, dry matter and crude protein production in single cut management.

(Received on 30th July, 1991)

INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench) is grown for green as well as dry forage production over wider areas, particularly during *kharif* season in Gujarat State. Nitrogen fertilizers plays an important role in increasing forage production of sorghum with better nutritive value. As the cost of nitrogenous fertilizers is very high, it becomes imperative to study the optimum requirement of nitrogen of forage sorghum alongwith bio-fertilizer treatments. The efficacy of two bio-fertilizers i.e. Azotobacter and Azospirillum were evaluated alongwith four levels of nitrogen on forage sorghum variety S.S.G. 59-3 at Forage Research Farm, Gujarat Agricultural University, Anand.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* seasons of 1988, 1989 and 1990 on alluvial soils, low in available nitrogen (169 kg N/ha) and medium in available P_2O_5 (47.1 kg P_2O_5/ha) and K_2O (233 kg K_2O/ha). The soil pH was 8.3. Twelve treatment combinations comprising three treatments of bio-fertilizers (No bio-fertilizer, Azotobacter and Azospirillum) and four levels of N (0, 25, 50 and 75 kg/ha) were tested in randomized block design with three replications.

The crop was sown with recommended package of practices on 1st August in 1988 and 11th and 10th July in 1989 and 1990, respectively. Half of the required N in the form of urea

TABLE 1

Green forage, dry matter and crude protein yields of forage sorghum as influenced by bio-fertilizers and nitrogen levels.

Treatments	*Green forage yield (q/ha)*				*Dry matter yield (q/ha)*				*Crude protein yield (q/ha)*			
	1988	*1989*	*1990*	*Pooled*	*1988*	*1989*	*1990*	*Pooled*	*1988*	*1989*	*1990*	*Mean*
Bio-fertilizers (B)												
No bio-fertilizer	129	236	298	221	40.1	71.1	75.5	62.2	2.88	5.81	5.57	4.75
Azotobacter	146	235	295	225	45.8	74.0	81.5	67.1	3.06	6.28	5.92	5.09
Azospirillum	128	235	306	223	40.5	68.3	78.8	62.5	2.80	6.20	5.89	4.96
S. Em. ±	8	7	9	5	2.6	2.1	2.4	1.4	–	–	–	–
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	3.9	–	–	–	–
Nitrogen levels (N) (kg/ha)												
0	79	201	269	183	23.1	60.2	69.2	50.8	1.63	5.47	4.36	3.82
25	122	225	307	218	37.8	66.9	81.7	62.2	2.23	5.50	6.12	4.62
50	157	258	314	243	49.0	77.8	79.2	68.6	3.28	6.83	6.35	5.49
75	180	258	309	249	58.5	79.6	84.3	74.1	4.50	6.59	6.33	5.81
S. Em. ±	9	8	10	8	3.0	2.5	2.7	3.1	–	–	–	–
C.D. at 5%	27	24	30	29	8.7	7.3	8.0	10.8	–	–	–	–

and entire quantity of P_2O_5 (Single superphosphate) @40 kg/ha were applied at the time of sowing and the remaining half of the N was topdressed one month after sowing. The crop was harvested at 50 per cent flowering stage which occured between 65 to 70 days after sowing. Nitrogen content of plant was estimated by conventional Kjeldhal's method and crude protein content was worked out on dry weight basis.

RESULTS AND DISCUSSION

Effect of bio-fertilizer

The results (Table 1) indicated that the seeds of forage sorghum inoculated with Azotobacter produced the highest green forage yield during 1988 as well as on pooled basis, however, the differences were not significant. The dry matter yield of forage sorghum was also the highest due to Azotobacter inoculation during all the individual years. Azotobacter inoculum produced significantly higher dry matter yield (67.1 q/ha) than the treatments of no bio-fertilizer and Azospirillum inoculum on pooled basis. Inoculation of Azotobacter also synthesized the meximum crude protein yield followed by Azospirillum inoculum. The leaf to stem ratio due to Azotobacter treatment was markedly reduced as compared to that of no bio-fertilizer treatment during all the individual years as well as on an average of three years (Table 3). Tilak *et al.* (1982) reported that inoculation of sorghum seeds with Azotobacter gave higher dry matter yield of 75 days old plants of sorghum than uninoculated control. Inoculation of Azotobacter in forage sorghum also increased green forage and dry matter accumulation at IGFRI, Jhansi (Anonymous, 1985).

TABLE 2

Economics of forage sorghum as influenced by nitrogen levels.

Treatments	*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	183	5490	—	—	—	—
25 kg N/ha	218	6540	1050	133.75	1:7.85	1:6.85
50 kg N/ha	243	7290	1800	267.50	1:6.73	1:5.73
75 kg N/ha	249	7470	1980	401.25	1:4.93	1:3.93

Selling price of green forage of sorghum Rs.30/q.

Cost of nitrogen @S.5.35 per kg of nitrogen from urea.

TABLE 3

Crude protein content and ancillary observations of forage sorghum as influenced by bio-fertilizers and nitrogen levels.

Treatments	Crude protein content (%)				Plant height (cm)				Tillers/M row				Leaf-stem ratio			
	1988	1989	1990	Mean	1988	1989	1990	Mean	1988	1989	1990	Mean	1988	1989	1990	Mean
Bio-fertilizers																
No bio-fertilizer	7.03	8.21	7.33	7.52	164.7	179.2	190.6	178.2	39.8	21.5	37.3	32.9	1.42	1.51	0.93	1.29
Azotobacter	6.64	8.44	7.25	7.44	177.3	180.0	190.1	182.5	39.5	22.3	37.3	33.0	1.07	1.26	0.88	1.07
Azospirillum	6.88	9.14	7.46	7.83	167.5	181.1	192.6	180.4	35.0	22.8	40.3	32.7	1.06	1.33	0.94	1.11
Nitrogen Levels (N) (kg/ha)																
0	7.05	9.13	6.31	7.50	151.3	177.6	192.7	173.9	33.3	21.7	38.3	31.1	1.33	2.21	1.22	1.59
25	5.91	8.17	7.46	7.18	172.4	178.2	192.5	181.0	35.7	22.3	41.7	33.2	1.17	1.19	0.99	1.12
50	6.68	8.80	8.06	7.85	177.6	182.9	191.9	184.1	42.0	22.0	36.0	33.3	1.10	1.31	0.83	1.08
75	7.76	8.28	7.55	7.86	178.0	181.7	187.3	182.3	41.3	22.7	37.0	33.7	1.14	0.75	0.61	0.83

Effect of nitrogen

Increasing levels of nitrogen increased the green forage and dry matter yields. Application of 50 and 75 kg N/ha produced significantly higher green forage yield over 0 and 25 kg N/ha during 1988 and 1989 and both the levels were also significantly superior than control (0 kg N/ha) during 1990 and on pooled basis. The differences between 50 and 75 kg N/ha were at par for green forage production. The dry matter yield increased significantly with increasing nitrogen application from 0 to 25, 50 and 75 kg N/ha during 1988. Application of 50 and 75 kg N/ha being at par produced significantly higher yield during 1989, than other levels of nitrogen. During 1990, application of 25, 50 and 75 kg N/ha produced significantly higher yield over control. Application of 50 and 75 kg N/ha being at par with each other produced significantly higher dry matter yield over control when results were pooled. The highest level of nitrogen also produced significantly higher yield than 25 kg N/ha. The successive increments of nitrogen application increased the crude protein yield and decreased the leaf to stem ratio. The highest level of N (75 kg N/ha) synthesized the highest crude protein yield (5.81 q/ha) and recorded the lowest leaf to stem ratio (0.83) on an average of three years. Increasing level of N application from 0 to 25, 50 and 75 kg N/ha increased the crude protein yield by 20.9, 43.7 and 52.1 per cent, respectively. The results are in agreement with the results obtained by Hedge and Relwani (1974) Patel *et al.* (1990) and Sadhu *et al.* (1991). The higher net ICBR of 1:6.85 and 1:5.73 were obtained with an application of 25 kg and 50 kg N/ha, respectively (Table 2). The results indicated that seeds of forage sorghum variety S.S.G. 59-3 should be treated with Azotobacter to produce higher dry matter and crude protein production in single cut management and an application of 25 to 50 kg N/ha should be given for getting higher forage production with better nutritive value.

REFERENCES

Anonymous, 1985. Annual report of Indian Grassland and Fooder Research Institute; Jhansi : 93.

Hedge, B. P., and L. L. Relwani, 1974. Effect of different levels of nitrogen and zinc on yield and quality of jowar (*Sorghum bicolor*) fodder. *Indian J. Agric. Res.* **8** : 17-24.

Patel, J. R., P. C. Patel and B. G. Patel, 1990. Influence of nitrogen on yield and quality of forage sorghum genotypes. *Res. J. G.A.U.* **16** : 11-16.

Sadhu, A. C., J. R. Patel, P. C. Patel and B. G. Patel, 1991. Effect of bio-fertilizers and nitrogen levels on cereal fodder crops. *Forage Res.* **17** : 59-64.

Tilak, K. V. B. R., C. S. Singh, N. K. Roy and N. S. Subba Rao, 1982. *Azospirillum brasilense* and *Azotobacter Chroococcum* inoculum : Effect on yield of maize (*Zea mays*) and sorghum (*Sorghum bicolor*). *Soil Biol. Biochem.* **14** : 417-418.