Indian Journal of Agronomy 47 (3) : 455–459 (September 2002)

Response of napier bajra hybrids to integrated nitrogen management

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Received: October 2001

ABSTRACT

In an experiment effects of organic materials, viz. dung + animal urine (OM), chemical fertilizer and biofertilizers, on productivity of napier bajra hybrids and soil fertility were studied in a transitional tract of hot semi-arid, agroecological region of Karnataka, India. Total green forage yield of napier bajra hybrids increased significantly with the application of 10 tonnes dung + animal urine/ha/ year and *Azospirillum* inoculation. Significant variations in number of tillers and leaf : stem ratio (LSR) was observed among the different hybrids and it was not significantly influenced by application of organic matter, *Azospirillum* inoculation and N levels. However, *Azospirillum* inoculation showed significant increase in LSR in the first year. Among the hybrids tested 'IGFRI 7' was superior to 'Co 2' and 'PBN 16' in relation to green forage yield. At the end of 2 year cycle of napier bajra hybrids (after 11 cuts) there was an improvement in the soil available N content due to application of 10 tonnes OM + 150 kg N and *Azospirillum* inoculation.

Key words : Organic matter, *Azospirillum*, Napier bajra hybrids, Integrated nitrogen management

In recent years, intensive dairy farming is becoming more and more remunerative and is emerging as a major agro-based enterprise among the medium and big farmers of the transitional tract of hot semiarid agro ecological region of India. The favourable climate and soils of this tract encourages the dairy farming by growing forages throughout the year. Manure from the confined animal-feeding units is an important on-farm resource for crop production and soil sustainability, in that it is a source of all essential plant nutrients. This manure also provides an excellent source of organic matter when added to soils.

It is a common practice among the dairy farmers to grow napier bajra hybrids for feeding milch animals, with the top-

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dressing of urea alone, which creates imbalance of nutrients. Due to this imbalance of nutrients (supplied) productivity and quality of fodder is affected. Integrated nitrogen supply system offers new vista to utilize natural resources available with farmers for intensive fodder production of napier hybrids. This study was initiated to know the response of napier bajra hybrids to organic sources (animal waste), chemical fertilizers and bio fertilizers and also to identify the suitable napier bajra hybrid for intensive dairy unit.

MATERIALS AND METHODS

This investigation was carried out on the Tegur Research farm of Regional Research Station. Indian Grassland and Fodder Research Institute (IGFRI), Dharwad. The mean annual rainfall is about 1,100 mm, of which 80–85% occurs during rainy season (May to September). The soils are mixed red and black, flat and sandy clay loam and acidic (pH 5.8), having 225 kg available N, 2.6 kg P and 150 kg K/ha. The experimental design used was split plot, 2 levels of organic matter [control and 10 tonnes OM/ha/year dung + animal urine] and 3 napier bajra hybrids ('PBN 16', 'Co 2' and 'IGFRI 7') constituted as a main plot and 3 levels of N (100, 150 and 200 kg N/ha/year) and *Azospirillum* inoculation (control and inoculation) as a subplot treatment. Total there were 36 treatment combinations tried in 3 replications.

As per the treatments organic matter having 1.2% N, 0.95% P and 0.85% K in the first year (1996–97) and 1.1% N, 0.90% P and 0.80% K in the second year (1997–98) was applied and incorporated 2 weeks before planting immediately after first rains in June. The root slips of different napier bajra hybrids were planted in 60 cm apart rows and 50 cm between the plants in the row. The recommended dose of fertilizer was 250, 60 and 60 kg N, P and K/ha. The 25% of N (as per the treatment schedule) and full dose of P (60 kg/ha) and K (60 kg/ha) were applied basal. Remaining 75% N was equally divided in 5 split doses in the first year and 6 in the second year and applied immediately after each cut. Before planting of root slips, roots were dipped in *Azospirillum* culture as per the treatments and planted.

Observations on tillers/tussock, leaf : stem ratio (LSR) and total biomass production were recorded at each cut. The available N, P and K before initiation of studies and the available N after 2 years of study was estimated as outlined by Jackson (1967).

RESULTS AND DISCUSSION

Effect on tillers and leaf : stem ratio

The physical quality of forage is judged by its leaf: stem ratio (LSR), succulence and palatability. An application of organic matter and chemical N fertilizer did not show any significant difference for tillers and LSR. However, *Azospirillum* inoculation significantly increased LSR of napier hybrids in the first year (1.32). This indicates that efficiency of N fixation by *Azospirillum* was more in the first year resulting in leafiness of hybrids.

Among the hybrids, 'PBN 16' recorded significantly more tillers/ tussock at 75 days after planting, fifth cut and sixth cut of second year and LSR than 'Co 2' and

Table 1. Effect of organic matter, nitrogen fertilizer and *Azospirillum* inoculation on number of tillers and leaf:stem ratio of napier bajra hybrids

Treatment	Tillers/tussock at				Leaf : stem ratio	
	75 DAP	5th cut of 1st year	2nd cut of 2nd year	6th cut of 2nd year	1st year	2nd year
Organic matter						
Control	17.1	29.3	32.2	50.7	1.22	1.30
10 tonnes/ha	18.1	29.7	32.8	52.6	1.23	1.32
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Napier bajra hybrids						
'PBN 16'	20.7	30.3	43.1	64.3	1.41	1.45
'Co 2'	16.4	30.9	30.8	46.5	1.12	1.20
'IGFRI 7'	15.7	26.2	33.5	44.2	1.14	1.22
CD (P=0.05)	1.6	NS	2.3	9.6	0.09	0.09
N (kg/ha)						
200	17.2	28.4	32.2	51.4	1.25	1.35
150	18.1	28.6	34.2	54.0	1.22	1.30
100	17.5	30.5	31.0	49.7	1.22	1.28
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Azospirillum						
Control	17.3	28.8	31.9	52.1	1.13	1.24
Inoculation	17.9	29.5	33.1	51.2	1.32	1.26
CD (P=0.05)	NS	NS	NS	NS	0.05	NS

DAS, Days after planting

Table 2. Total green forage yield (tonnes/ha/year) of napier bajra hybrids as influenced by organic matter, chemical N fertilizers and *Azospirillum* for 3 varieties of hybrid napier (pooled data)

N kg/ha	Treatment *Azospirillum*	'PBN 16'		'Co 2'		'IGFRI 7'		Mean	Mean
		Control	10 t OM/ha	Control	10 t OM/ha	Control	10 t OM/ha		
100	Control	150.7	162.4	166.6	166.0	178.1	177.0	166.8	168.7
	Inoculation	157.8	160.5	172.2	179.1	179.2	175.2	170.7	
150	Control	162.4	170.7	168.5	173.2	166.7	176.5	169.7	172.8
	Inoculation	167.8	192.1	164.1	168.1	178.2	185.0	175.9	
200	Control	177.5	169.1	173.3	176.3	175.5	184.6	176.0	175.5
	Inoculation	173.0	166.8	175.2	178.0	175.6	180.9	174.9	
	Mean	164.9	170.3	170.0	173.4	175.5	179.9		
Mean		167.6		171.8		177.7			

C,D for interaction of Hybrids × N levels at 5% 7.3

Except interaction effect of hybrids and N levels all other interactions are statistically non-significant (Author; this is not clear at all; make it easy)

'IGFRI 7' (Table 1). Gupta and Bhardwaj (1975) also observed significant difference between hybrids for tillers/tussock. Number of tillers is a genetic make up and cannot be altered significantly due to agronomic manipulations but LSR of a hybrid can be improved by agronomic management, especially with nitrogen application.

Effect on biomass production

Green forage yield of napier bajra hybrids in individual cuts was not markedly influenced by application of organic matter and *Azospirillum* inoculation in both the years. However, application of 10 tonnes OM/ha and *Azospirillum* inoculation recorded higher green forage yield. Pooled analysis over 2 years indicated that an application of 200 kg N/ha/year recorded significantly higher green forage yield of 175.5 tonnes/ha/year over 100 kg N (168.7 tonnes/ha/year) but was on a par with 150 kg N (Table 2). The decrease in green forage yield due to application of 150 kg N/ha and 100 kg N/ha over 200 kg N/ha was 1.5 and 3.9% respectively. This indicates that 150 kg N/ha/year in conjunction with organic matter and *Azospirillum* was the optimum combination. The interaction effects between hybrids and nitrogen levels was found significant. Significant difference in forage yield was observed among the hybrid to N levels. 'IGFRI 7' showed similar response in all the levels and there was no significant difference (Table 2). But 'Co 2' showed higher response at 200 kg N and 'PBN 16' at 150 kg N/ha/year. The nitrogen requirement varies with the hybrids including the forage crops and similar observation was reported by Singh (1997).

Effect on soil fertility

An application of 10 tonnes OM/ha with

Table 3. Available N status of soil as influenced by organic matter, N fertilizer levels and *Azospirillum* inoculation

Treatment	Soil available N status (kg/ha)	
	Before initiation	After 2 years
100 kg N alone	225	239
150 kg N alone	225	250
200 kg N alone	225	234
10 tonnes OM + 100 kg N/ha	225	287
10 tonnes OM + 150 kg N/ha	225	302
10 tonnes OM + 200 kg N/ha	225	282
10 tonnes OM + 100 kg N/ha + *Azospirillum*	225	307
10 tonnes OM + 150 kg N/ha + *Azospirillum*	225	321
10 tonnes OM + 200 kg N/ha + *Azospirillum*	225	302
100 kg N alone + *Azospirillum*	225	259
150 kg N alone + *Azospirillum*	225	274
200 kg N alone + *Azospirillum*	225	254

OM, Dung + animal urine

150 kg N/ha/year and *Azospirillum* inoculation helps harvest optimum biomass of napier hybrids and also sustain the soil fertility or improve the N status of soil (Table 3).

The long-term fertilizer experiments on fodder crops conducted in India also showed neither the chemical fertilizer alone nor the organic manures were found effective in maintaining sustainable forage production under intensive cropping systems (Singh, 1997). Thus, integrating both chemical fertilizers with organic manures and biofertilizers was found to be satisfactory in enhancing fodder productivity, sustaining the soil fertility and reducing the wastage of feed unit manure for crop production.

Based on the present investigation, it can be concluded that 'IGFRI 7' was more productive than 'Co 2' and 'PBN 16', but physical quality (LSR indicates more leafiness)-wise 'PBN 16' was superior. Application of 10 tonnes OM + 150 kg N + *Azospirillum* inoculation to napier bajra hybrids was found superior to harvest maximum green forage and to sustain the soil fertility under irrigated intensive fodder production system. By following integrated nitrogen management, one could reduce nearly 100 kg chemical N fertilizer application and animal waste can be utilized efficiently.

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