Indian Journal of Agricultural Sciences **81** (6): 575–7, June 2011

Impact of plant geometry and fertilizer levels on Bajra Napier hybrid grass*

K VELAYUDHAM[1], C BABU[2], K IYANAR[3] and A KALAMANI[4]

Tamil Nadu Agricultural University, Coimbatore 641 003

Received: 14 December 2010; Revised accepted: 15 February 2011

Key words: Bajra Napier hybrid grass, Benefit: cost ratio, Fertilizer levels, Green fodder, Plant geometry

The economically competitive and productive yield potential of crossbred milch animals could be exploited through feeding adequate nutritious green fodder round-the-year. The average milk yield of Indian cow is estimated to be 1 087 kg/lactation, whereas it is 9 583 kg in Israel, 9 118 kg in USA and 8 131 kg in Denmark (Statinfo.biz 2006). The green fodder requirement (622 million tonnes) and availability (224 million tonnes) in India do not match and leaves a shortfall of 63%. In Tamil Nadu, the area under fodder crops is 1.72 lakh ha, from which 12.7 million tonnes of green fodder is supplied against the requirement of 83.8 million tonnes. The area under permanent pastures and other grazing land is 0.11 lakh ha and declining gradually (season and crop report 2007–08). The current rate of milk production is 4%. In future, the desired rate is 7–8%. Bajra Napier hybrid grass is a potential perennial source of green fodder. It is popular owing to high yield, palatability and adaptability to varying soil and climatic conditions (Faruqui *et al.* 2009). Bajra Napier hybrid 'CO (CN)4' is found to tiller profusely and yield more than previous varieties.

Thus, agronomic requirement like plant geometry and fertilizer levels may vary for the new Bajra Napier hybrid grass. The low productivity of Bajra Napier hybrid grass is due to little fertilization. On an average, one tonne of dry perennial grass removes 9.4 kg N, 1.45 kg P, 1.4 kg K, 4.61 kg Ca, 2.65 kg Mg and 1.85 kg S (Bose and Balakrishnan 2001). Experimental results indicate that plant height, leaf stem ratio, green fodder yield, dry matter yield and crude protein increased significantly with increase in N levels. The present study was initiated to find out the optimum spacing and fertilizer level for the Bajra Napier hybrid 'CO (CN)4' which was released in 2008 by Tamil Nadu Agricultural University, Coimbatore for general cultivation.

The field experiment was conducted at Forage Farm, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu under irrigated conditions during winter (*rabi*), summer and rainy (*kharif*) seasons of 2008–09. The soil is sandy clay loam (typic Haplustaff) and having *p*H 7.9, organic carbon 0.49%, available N, P and K were 233, 21.4 and 640 kg/ha, respectively. The experiment consisted of four spacings, viz 50 cm×50 cm, 60 cm×50 cm, 75 cm×50 cm and 75 cm×60 cm and three fertilizer levels, viz 150 : 50 : 40, 175 : 60 : 50 and 200 : 70 : 60 kg N, P and K/ha. The experiment was laid out in split-plot design with three replications. The two budded stem cuttings of Bajra Napier hybrid 'CO (CN)4' were used for planting. At the time of planting, 50% of N and full doses of P and K were applied and the remaining 50% of N was top-dressed 25 days after planting. Other package of practices was adopted uniformly to all the treatments (Crop Production Guide 2004). The growth parameters, viz plant height, number of leaves, length of leaves, number of tillers, leaf stem ratio and quality parameters, viz crude protein and crude fibre were recorded. Totally, seven harvests were taken from the crop. The first cut was made 80 days after planting and subsequent harvests at every 45 days interval. The data on growth, green fodder yield and quality parameters from different cuts were pooled and subjected to statistical analysis as per the standard procedures. The crude protein content was estimated following microkjeldahl method (Jackson 1973) and crude fibre content as per Goering and Vansoest (1970). The expenditure on inputs and income from sale of green fodder were worked out based on prevailing market rates and the economic analysis was made.

Adopting different spacing did not significantly influence the height of plants (Table 1). Whereas application of higher dose of NPK 200: 70: 60 kg/ha had a marked effect on the growth and the plants grew taller (247.76 cm) under this treatment. Similar result was observed in fodder sorghum (Gupta *et al*. 2008). An adequate supply of nitrogen is essential for vigorous vegetative growth and a deep green colour. Tillering ability of plants was influenced positively due to adoption of different spacing. Adoption of 60 cm×50 cm and 75 cm×50 cm had significantly enhanced the number

*Short note

[1]Professor (Agronomy) (e mail : velakum@gmail.com), [2]Associate Professor (e mail: babutnau@gmail.com), [3]Assistant Professor (e mail: iyanark2@rediffmail.com), [4]Professor and Head (e mail: kalamaniforage@gmail.com), Department of Forage Crops

of tillers/clump. Application of 200: 70: 60 kg NPK/ha had profound effect and produced a maximum of 25.33 tillers/ clump. This result was in accordance with the findings of Gupta *et al*. (2008) in sorghum.

The leaf stem ratio was not influenced significantly due to different spacing while application of varied levels of fertilizers influenced this trait. Application of 200: 70: 60 kg NPK/ha had recorded a higher value (0.61). Significantly more number of leaves/stem (13.66) was recorded due to adoption of wider spacing, viz 75 cm×60 cm but it is at par with 60 cm×50 cm and 75 cm×50 cm. Application of higher dose of 200: 70: 60 kg NPK/ha had a profound effect on enhancing the number of leaves/stem (14.15). Similar trend was also observed with leaf length. The interaction effect was absent for all the growth parameters studied.

Discernible variations in green fodder yield have been observed due to adoption of various spacings and fertilizer levels (Table 1). Significantly more quantity of green fodder yield was obtained (271.30 tonnes/ha) due to adoption of 60 cm × 50 cm. Application of 200:70:60 kg NPK/ha had a significant effect on green fodder yield to the tune of 260.52 tonnes/ha. The interaction effect is so vivid that a maximum green fodder yield of 291.25 tonnes/ha was recorded due to adoption of 60 cm×50 cm spacing and 200 : 70 : 60 kg NPK/ ha. Shading or reduction in leaf area under the closer spacing of 50 cm×50 cm would have reduced the green fodder yield substantially. Pathan and Bhilare (2008) also obtained higher green fodder yield of Bajra Napier hybrid grass with higher spacing and fertilizer level; Shekara *et al.* (2008) realized maximum green fodder yield with higher dose of N in oats and Gupta *et al.* (2008) in sorghum. With enhanced nitrogen supply carbohydrates are converted into proteins, more protoplasm is formed, and, because protoplasm is highly hydrated, a more succulent fodder results (Tisdale and Nelson 1975). Significantly superior quantities of dry matter yield (6.92 tonnes/ha) was obtained due to adoption of 60 cm×50 cm spacing. Similarly, application of 200: 70: 60 kg NPK/ha had a marked effect on dry matter yield (6.59 tonnes/ha). Interaction effect is absent. Similar result was also obtained by Pathan and Bhilare (2008); Shekara *et al*. (2008) in oats and Gupta *et al.* (2008) in sorghum.

Varied spacing adopted did not positively influence the crude protein content. Higher crude protein content (8.34%) has been recorded due to application of 200: 70: 60 kg NPK/ ha, whereas it was at par with 175: 60: 50 kg NPK/ha, (8.16%). Interaction effect is absent. When nitrogen supply is adequate and other conditions are favourable for growth, protein is formed from the manufactured carbohydrates. Higher crude protein yield was achieved with the adoption of 60 cm×50 cm. Application of 200: 70: 60 kg NPK/ha recorded a maximum of 3.89 tonnes/ha. Application of higher level of NPK produced more green fodder yield and accumulation of more dry matter and crude protein in plants which would have resulted in crude protein yield (Shekara *et al.* 2008). Interaction effect is absent. The results are also in agreement with Pathan and Bhilare (2008) and Gupta *et al*. (2008) who observed higher crude protein yield in Bajra Napier hybrid grass and in sorghum, respectively. Adoption of varied levels of spacing and fertilizer levels did not influence the crude fibre content of fodder during the course of study.

Net returns were higher due to adoption of 60 cm×50 cm spacing and 200:70:60 kg NPK/ha. The same trend is applicable with benefit: cost ratio also (Table 2). Higher dose of nitrogen used in conjunction with phosphorus and

Table 1 Growth and green fodder yield as influenced by varied spacing and fertilizer levels

Treatment	Plant height (cm)	No. of tillers/ clump	No. of leaves/ stem	Leaf length (cm)	Leaf stem ratio	GFY (tonnes/ ha)	DMY (tonnes/ ha)	CP (%)	CPY (tonnes/ha)	CF (%)
Spacing (cm)										
S_1 - 50×50	231.07	23.42	12.06	57.85	0.55	252.30	6.30	8.30	3.71	27.95
S_2 - 60×50	241.86	24.26	13.26	61.90	0.59	271.30	6.92	7.92	3.88	28.02
S_3 - 75×50	241.15	24.46	13.13	61.36	0.55	227.45	5.69	8.06	3.26	28.03
S_4 - 75×60	240.58	23.94	13.66	61.50	0.58	227.91	5.76	7.76	3.17	27.97
SE±	3.52	0.26	0.22	0.71	0.01	3.51	0.14	0.18	0.10	0.17
CD (*P*=0.05)	NS	0.64	0.53	1.73	NS	7.29	0.28	NS	0.21	NS
Fertilizer (NPK kg/ha)										
F_1 - 150 : 50: 40	227.55	22.62	12.03	57.57	0.52	231.07	5.84	7.53	3.12	27.95
F_2 - 175 : 60: 50	240.70	24.11	12.90	60.65	0.57	242.62	6.08	8.16	3.50	27.96
F_3 - 200 : 70: 60	247.76	25.33	14.15	63.74	0.61	260.52	6.59	8.34	3.89	28.06
SE±	1.90	0.31	0.13	1.07	0.01	3.04	0.12	0.17	0.09	0.13
CD (*P*=0.05)	4.04	0.65	0.29	2.26	0.02	6.31	0.24	0.37	0.18	NS
Interaction										
SE±	4.7	0.56	0.31	1.88	0.02	6.08	0.24	0.33	0.18	0.27
CD (*P*=0.05)	NS	NS	0.70	NS	NS	12.62	NS	NS	NS	NS

GFY, Green fodder yield; DMY, dry matter yield; CP, crude protein; CPY, crude protein yield; CF, crude fibre

Table 2 Economic evaluation of various spacings and fertilizer levels to Bajra Napier hybrid grass - CO (CN) 4

Treatment	Av. cost (₹/ha)	Av. gross returns (₹/ha)	Av. net returns (₹/ha)	Benefit: cost ratio
Spacing (cm)				
S_1 - 50×50	92 362	252 230	159 868	2.73
S_2 - 60×50	92 362	271 230	178 868	2.94
S_3 - 75×50	92 362	227 440	135 078	2.46
S_4 - 75×60	92 362	227 900	135 538	2.47
Fertilizer (NPK kg/ha)				
F_1 - 150 : 50: 40	91 753	231 100	139 347	2.52
F_2 - 175 : 60: 50	92 361	242 620	150 259	2.63
F_3 - 200 : 70: 60	92 972	260 520	167 548	2.80

Cost of urea: ₹ 5.02/kg; SSP: ₹ 4.20; MOP: ₹ 4.63;
Labour charge: ₹100/day
Price of green fodder of Bajra Napier hybrid grass: ₹ 1 000/ tonne

potassium in a sound crop management programme greatly increase the green fodder yield and net income.

Growing of Bajra Napier hybrid grass 'CO (CN)4' with 60 cm×50 cm and 200 : 70 : 60 kg NPK/ha is reported to be economically competitive and productive under irrigated conditions. Hence, raising Bajra Napier hybrid grass CO (CN)4 is sustainable and lucrative fodder crop system which will ensure green fodder supply round-the-year and help achieving desired growth rate in milk production.

SUMMARY

Field experiment was conducted to assess the impact of plant geometry and levels of N, P and K fertilization on the performance of Bajra Napier hybrid grass CO (CN)4 during *rabi*, summer and *kharif* seasons of 2008–09. Discernible variations in number of tillers/clump, number of leaves, length of leaves and dry matter yield have been observed due to adoption of varied spacing and fertilizer levels. From the pooled analysis of data from seven harvests, it was observed that adoption of 60 cm×50 cm spacing recorded 271.30 tonnes/ha and 7.53% higher green fodder yield than the recommended spacing of 50 cm×50 cm. Application of 200 + 70 + 60 kg of N + P +K/ha had strikingly enhanced the green fodder yield to 260.52 tonnes/ha/year. Consequently adoption of 60 cm×50 cm spacing and application of 200 + 70 + 60 kg of N + P +K/ha were found profitable for Bajra Napier hybrid grass 'CO (CN) 4' under irrigated conditions.

REFERENCES

Bose S C and Balakrishnan V. 2001. *Forage Production Technologies*, 253 pp. South Asian Publishers, New Delhi.

Crop Production Guide 2004, 300 pp. TNAU and Directorate of Agriculture, Chennai.

Faruqui S A, Sunilkumar T and Singh D N. (Eds). 2009. *Napier Bajra Hybrid: Excellent Perennial Fodder*, 16 pp. AICRP on FC, IGFRI, Jhansi.

Goering H K and Vansoest P J. 1970. *Forage Fibre Analysis. Agricultural Handbook No. 397*, USA.

Gupta K, Rana D S and Sheoran R S. 2008. Response of nitrogen and phosphorus levels on forage yield and quality of sorghum. *Forage Research* **34** (3): 156–9.

Jackson M L. 1973. *Soil Chemical Analysis*, 452 pp. Prentice - Hall of India Pvt. Ltd, New Delhi.

Pathan S H and Bhilare R L. 2008. Influence of varying spacing and fertilizer levels on yield performance of hybrid Napier varieties. *Forage Research* **34** (1): 60–1.

Season and Crop Report 2007–08, pp 173–5. Department of Economics and Statistics, Chennai.

Shekara B G, Lohithaswa H C, Sreedhar D and Saritha K S. 2008. Response of single cut oat genotypes to nitrogen levels. *Forage Research* **34** (3): 199 –0.

Statinfo.biz. 2006. Milk Yield per cow *http://statinfo.biz/Geomap.aspx*

Tisdale S L and Nelson W L. 1975. *Soil Fertility and Fertilizers*, 694 pp. Macmillan Publishing CO., Inc, New York.