



Effect of spacing and nitrogen levels on performance of hybrid napier in semi-arid ecosystem of Gujarat

B S KHADDA¹, KANAK LATA², RAJ KUMAR³, A K RAI⁴ and J K JADAV⁵

Krishi Vigyan Kendra-Panchmahal (CIAH), Vejalpur, Godhra, Gujarat 389 340

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ABSTRACT

The present study was undertaken during 2011-12 at Krishi Vigyan Kendra, Panchmahal to find out the effect of spacing and nitrogen levels on performance of hybrid napier in semi-arid ecosystem of Gujarat. The results revealed that the different spacing could not exert significant effect on the plant height, whereas nitrogen levels significantly influenced the plant height. The application of higher dose of nitrogen (200 kg/ha) significantly exhibited higher plant (132.25 cm) followed by 175 and 150 kg/ha N. Tillers/clump and leaf stem ratio was influenced significantly owing to different spacing and levels of nitrogen. The highest leaf stem ratio and more number of leaves/stem were recorded with the spacing of 75 cm × 60 cm and application of 200 kg/ha. The green fodder yield was increased significantly with increasing the spacing and levels of nitrogen. Interaction effect of adoption of spacing and levels of nitrogen indicate that the treatment combination having spacing 75 cm × 60 cm and nitrogen level 200 kg/ha recorded significantly highest green fodder yield. Higher gross returns, net return with maximum benefit cost ratio were recorded when the clumps were planted at the spacing 75 cm × 60 cm with of 200 kg/ha N.

Key words: Benefit: cost ratio, Green fodder, Hybrid Napier, Nitrogen, Spacing

Livestock are one of the most important components of the farming systems of central Gujarat. Dairy animals feed accounts for 60-70% of the total cost of milk production and the cost of feed concentrate is increasing and becoming costlier than green fodder. Inadequate and uncertain availability of green fodder are mainly responsible for low productivity of the livestock of the region. Hybrid Napier is a perennial grass which can be retained on field for 2-3 years. It produces numerous leaves with large, soft and less persistent hairs than the napier grass. The stems are also less fibrous than napier. The tillers are produced numerous and grow faster. During recent years, Panchmahals district of central Gujarat has emerged as the leading district in milk production in the state. Farmers of the area are preferring hybrid napier for green fodder than other crops owing to its adaptability with higher green fodder productivity. However, the productivity of hybrid Napier (green fodder) in the district is very low as compared to average state productivity. Lacks of suitable high yielding varieties and poor knowledge about production practices are ascribed as main reasons for low productivity of green fodder. The productivity of green fodder per unit area could be increased by adopting scientific and sustainable management practices using a suitable high yielding variety, proper irrigation, suitable spacing and adequate supply of fertilizers. In view of the above factors,

the present study was undertaken at Krishi Vigyan Kendra, Panchmahal to the effect of spacing and nitrogen levels on performance of hybrid napier in semi-arid ecosystem of Gujarat.

MATERIALS AND METHODS

The present study was conducted at Krishi Vigyan Kendra, Panchmahal during 2011-12 in Panchmahal district of central Gujarat situated at latitude 22°- 41' 38" N and longitude 73°-33' 22" E and AMSL 113 m. The area of study is characterized as hot semi-arid climate. The mean summer temperature is 34.9°C while the mean winter temperature is 21.3°C indicating that the area falls under hyperthermic soil regime. The annual water needed or potential evapotranspiration of the area ranges between 1 500 to 1 600 mm, whereas actual mean usual precipitation is about 831 mm thus causing an annual water deficit of nearly 769 mm, rain is confined to three months (July to September) with average rainy days about 31. The mean monthly maximum temperature ranges from 26° and 40°C, while the minimum monthly temperature varies between 09°C and 26°C. The soil was black cotton in texture and initial content of pH 8.2, organic matter 0.26%, available N, P and K was 148.02, 19.25 and 276.2 kg/ha, respectively. The experiment laid in three time replicated split plot design assigning tree level of spacing in main plot, viz. 50 cm × 50 cm, 60 cm × 50 cm and 75 cm × 60 cm and three level of nitrogen, viz. 150, 175, 200 kg/ha subplots. The slips of

^{1,3,4,5}Subject Matter Specialist (e mail: khadda74@gmail.com), ²Programme coordinator.

hybrid napier APBN-1 were planted as per treatments in the month of July. At the time of planting, 50% of nitrogen was applied and the remaining dose of nitrogen was top-dressed in three equal splits at 30 days after planting, after first and second cuts. Recommended package of practices was adapted uniformly to all the treatments. In totally, six harvests were taken to complete the yield. The first cut was made at 75 days after planting and subsequent harvests were done at every 45 days interval. The data on growth parameters (plant height, number of tillers/clump, number of leaves/plant, length of leaves, leaf stem ratio) and yield were recorded as per standard procedures. For dry matter and quality analysis the plant samples drawn out were first air-dried and put in to oven allowing the temperature to reach up to 75°C until the constant weight obtained. The reduction in weight was treated as moisture content in sample and rest was recorded as dry matter. Similarly dry matter yield of plot was worked out by subtracting moisture from green fodder yield. This dry matter was converted into tonnes/ha and recorded as dry matter yield. Air-dried samples were grounded finely for estimation of nitrogen by following standard method. Crude protein content in plant was computed by multiplying nitrogen content of plant with 6.25. Protein content thus obtained was multiplied with dry matter yield for the estimation of protein yield. The crude fiber content was estimated as per method given by Goering and Vansoest (1970). The expenditure of inputs and income from sale of green fodder were worked out on the basis of prevailing market rates. All the data obtained from 2011-12 was pooled and subjected to analysis of variance as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Productive and quality

A comparison of productivity levels of hybrid napier

grass among the different treatments is shown in Table 1. The results of the study revealed that the spacing did not significantly influence the height of plants, whereas nitrogen levels significantly influence the plant height. The application of higher dose of nitrogen (200 kg/ha) recorded significantly highest plant height (132.25 cm) followed by 175 kg and 150 kg nitrogen/ha under this experiment. The results of the study are in consonance with the findings of Purushotham (1998) and Velayudham *et al.* (2011). The increase in plant height with increasing level of nitrogen is quite obvious because nitrogen influences favourably meristematic activity, which increased the number and length of internodes, ultimately resulted in to better growth. However, number of tillers/clump was influenced significantly owing to adoption of different spacing. Hybrid napier planted at the spacing of 75 cm × 60 cm had significantly enhanced the number of tillers/clump followed by 60 cm × 50cm and 50 cm × 50 cm, spacing. Application of nitrogen at the rate of 200 kg/ha had positive effect and produced the maximum of 32.75 tillers/clump. These findings are in the agreement with the results as reported by earlier workers (Purushotham 1998 and Velayudham *et al.* 2011) for napier bajra hybrid grass. The leaf stem ratio was influenced significantly due to different spacing and levels of nitrogen. The application of nitrogen 200 kg/hr with the plant spaced at 75cm × 60 cm recorded the highest leaf stem ratio. Significantly, more number of leaves/stem (14.50) was recorded with wider spacing (75 cm × 60 cm). The different level of nitrogen fertilizers exhausted was produces significant effect on average number of leaves/stem. Application of higher dose of nitrogen fertilizers @ 200 kg/hr recorded the highest number of leaves per stem (14.25). Similar trend was also observed with respect to leaf length. The increase in average number of leaves per stem and leaf length might be due to better availability of nitrogen and its translocation. The significant differences in green fodder yield have been observed from

Table 1 Growth and yield as influenced by varied spacing and nitrogen level

Treatment	Plant height	No. of tillers/clump	No. of leaves/stem	Leaf length (cm)	Leaf stem ratio	GFY (tonnes/ha)	DMY (tonnes/ha)	CP (%)	CPY (q/ha)	CF (%)
<i>Spacing (cm)</i>										
S ₁ -50×50	124	24.75	12.50	55.50	0.53	17.85	2.90	8.95	25.90	27.10
S ₂ -60×50	125.5	26	13.75	60.50	0.58	18.27	2.98	8.55	25.4	28.19
S ₃ -75×60	127	31.50	14.50	62.25	0.62	18.97	3.16	8.75	27.60	27.75
SEm±	1.62	1.52	0.61	0.64	0.03	3.61	5.57	0.27	0.43	0.13
CD (P=0.05)	NS	5.26	2.13	2.21	0.04	12.52	19.29	NS	0.96	NS
<i>Nitrogen levels(kg)</i>										
N ₁ -150	117.75	20.75	11.50	54.50	0.52	15.82	2.56	8.58	21.90	27
N ₂ -175	125.75	26	13	59.75	0.57	17.83	2.88	8.75	25.20	27.75
N ₃ -200	132.25	32.75	14.25	63.50	0.62	20.25	3.30	9.31	30.72	28.20
SEm±	1.05	0.72	0.41	0.84	0.01	2.02	4.23	0.170	0.48	0.16
CD (P=0.05)	3.64	2.49	1.44	2.92	0.06	7.02	11.45	0.60	1.30	ND
<i>Interaction</i>										
SEm±	4.30	2.13	0.94	1.28	0.04	5.17	1.06	0.52	0.54	0.02
CD (P=0.05)	NS	4.62	1.98	NS	NS	11.58	9.32	NS	NS	NS

GFY- Green fodder yield, DMY- dry matter yield, CP- crude protein, CPY- crude protein yield, CF- crude fiber.

spacing and fertilizer levels (Table 1). During the period under study, it was observed that the green fodder yield was increased significantly with increasing the spacing and levels of nitrogen. The highest green fodder yield (18.97 tonnes/ha and 20.25 tonnes/ha) was recorded from the spacing (75 cm × 60 cm) with higher dose of nitrogen fertilizers (200 kg/ha) in six cuttings, respectively. Interaction effect of spacing and levels of nitrogen indicated that the treatment combination, spacing, 75 cm × 60 cm and nitrogen level 200 kg/ha recorded significantly highest green fodder yield. The increase in green fodder yield could be attributed due to positive effect of nitrogen on plant growth. Nitrogen is used largely in synthesis of protein, but structurally it is constitute of chlorophyll molecule combined with carbohydrates and fatty acids. The other reason increasing the green fodder yield might be due to maximum utilization of nutrients, water, solar radiation and an increase metabolic activity. Pathan and Bhilare (2008) and Velayudham *et al.* (2011) also obtained higher green fodder yield of bajra napier hybrid grass with higher spacing and fertilizer level. Similar results were also reported by Gupta *et al.* (2008) and Kumar and Rajput (2014). Significantly, higher dry matter yield (3.16 tonnes/ha) was obtained from 75 cm × 60 cm spacing. Similarly, application of 200 kg nitrogen/ha had a marked effect on dry matter yield (3.30 tonnes/ha). These results were supported by the findings of Pathan and Bhilare (2008) and Velayudham *et al.* (2011). Adopting different spacing did not significantly influence the crude protein content, whereas higher crude protein content (9.31%) was recorded because of application of 200 kg nitrogen/ha. When nitrogen supply is adequate and other conditions are favorable for growth, protein is formed from the manufactured carbohydrates. Higher crude protein yield was recorded with the adoption of 75 cm × 60 cm spacing and application of 200 kg nitrogen/ha. Application of higher level of nitrogen 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). The results are in close agreement with Pathan and Bhilare (2008) and Velayudham *et al.* (2011) who observed higher crude protein yield in bajra napier hybrid. Adopting different spacing and nitrogen levels did not influence the crude fiber content of the fodder during present study.

Economics

Critical appraisal of data (Table 2) indicates that the higher gross returns (284.55×10^3 ₹/ha and 303.75×10^3

Table 2 Economic analysis of irrigation scheduling, varied spacing and nitrogen levels

Treatment	Av. cost of cultivation (10 ³ ₹/ha)	Av. gross income (10 ³ ₹/ha)	Av. net income (10 ³ ₹/ha)	Benefit cost ratio
<i>Spacing (cm)</i>				
S ₁ -50×50	82.30	267.75	185.45	3.25
S ₂ -60×50	82.30	274.05	191.75	3.32
S ₃ -75×60	82.30	284.55	202.25	3.45
<i>Nitrogen levels(kg)</i>				
N ₁ -150	81.65	237.30	155.65	2.90
N ₂ -175	81.98	267.45	185.46	3.26
N ₃ -200	82.30	303.75	221.45	3.69

₹/ha), net return (202.25×10^3 ₹/ha and 221.45×10^3 ₹/ha) with higher benefit cost ratio (3.45 and 3.69) were recorded from 75 cm × 60 cm spacing with 200 kg/ha N, respectively.

On the basis of above results planting of hybrid napier APBN 1 at 75 cm × 60 cm spacing with 200 kg/ha N recommended for higher yield and quality under semi-arid ecosystem.

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