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EFFECT OF NITROGEN FERTILIZATION AND CUTTING INTERVALS ON YIELD AND QUALITY OF NAPIER BAJRA HYBRID

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Abstract

A field experiment was conducted during 1997 and 1998 at G.B. Pant University of Agriculture and Technology, Pantnagar to study the effect of nitrogen fertilization and cutting intervals on forage yield and quality of Napier Bajra hybrid (N.B. 21) under the tarai condition of U.P. (Kumaon). Data of both the years and pooled data indicated that dry matter, crude protein, digestible dry matter yield and dry matter content increased with delay in cutting from 5 to 7 weeks interval, however, crude protein, digestibility (%) and L : S ratio decreased with delay in cutting. Increase in nitrogen application from 0 to 150 kg/ha increased dry matter, crude protein and digestible dry matter yield and their respective contents, however, L : S ratio had negative correlation with increase in nitrogen level.

Introduction

Low productivity and fertility of Indian livestock is matter of great concern that is mainly due to low production and feeding of poor quality forage that too in inadequate amounts. Forage and feed are the major inputs in animal rearing. Napier Bajra (N.B.) hybrid, an interspecific cross between napier (*Pennisetum purpureum,* Schumach) and pearl millet (*Pennisetum americanum* (Burm) S & H), is an important perennial forage grass with high yield potential. It is more palatable and nutritious and acceptable by the cattle on account of its non-hairy forage and thin stem (Gupta, 1975). Beside other agronomic management practices, the positive effect of nitrogen on green forage, dry matter and crude protein content of NB hybrids has been reported. In perennial grasses, optimum cutting interval also plays a significant role in increasing the yield and quality of forage. The information regarding the effect of cutting interval and its interaction with nitrogen fertilization on yield and quality of this grass are, however, limited. Keeping these points in view, the present study was undertaken to study the effect of nitrogen fertilization and cutting frequency on yield and quality of hybrid napier.

Materials and Methods

A field experiment was conducted at the Livestock Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar during the year 1997 and 1998 to study the effect of cutting intervals and nitrogen levels on yield and quality of N.B. hybrid forage (N.B. 21). The soil of the experimental plot was well drained, loam in texture with 6.9 pH. The soil contained 55.6 kg extractable P_2O_5/ha, 338 kg K_2O/ha and 1.89 per cent organic carbon. Treatments comprised of three cutting intervals (5, 6 and 7 week) and four levels of nitrogen (0, 50, 100 and 150 kg/ha) were laid out in a randomized block design with four replications.

The experiment was planted through rooted slips at 90 x 45 cm spacing during rainy season of 1996. Crop was fertilized with nitrogen as per treatment through urea (46.4 % N). During both the years, first dose of nitrogenous fertilizer was applied at the time of uniform cutting (i.e. on 22nd March'97 in the first year and on 11th April'98 in the second year of experimentation) according to nitrogen treatment. Subsequent nitrogen doses were top-dressed after each cut except the last.

The crop was harvested to a height of 10 cm from the soil surface. A total of 5, 5 and 4 cuttings were taken from the 5, 6 and 7 week cutting intervals, respectively during both the years. At each cutting, 500 g fresh samples were collected randomly from each plot and were dried in hot air oven at 70 °C till constant weight was attained to estimate dry matter content. The above dried samples were ground and utilized for the estimation of crude protein by micro-kjedhal method (Jackson, 1973) and *in vivo* digestibility by nylon bag method developed by Mehrez and Orskov (1977).

Results and Discussion

Yield

Data presented in table 1 revealed that the green forage yield increased significantly with increase in cutting intervals from 5 to 6 weeks and then decreased with further increase in cutting interval to 7 week. Whereas, dry matter yield increased significantly with increase in cutting interval from 5 to 7 weeks during both the years. These results are in conformity with the findings of Chapparo *et al.* (1995). On the basis of pooled data, 6 week cutting interval recorded 18.64 and 3.61 per cent higher green forage yield in comparison to 5 and 7 week cutting intervals, respectively. Considerable variation in green forage yield with extended cutting interval from 5 to 7 weeks might be attributed to the improvements in the yield attributes such as plant height, leaf number, leaf area index and dry matter accumulation. However, the higher green forage yield

obtained at 6 week cutting interval in comparison to 7 week cutting interval was due to the fact that one extra cut was obtained at 6 week cutting interval during both the years of experimentation. Variation in dry matter yield with extended cutting interval from 5 to 7 weeks might be due to yield attributes and dry matter content (table 2). These results are in conformity with the findings of Oakes (1966) and Chapparo *et al.* (1995).

Data presented in table 1 also revealed that during both the years, green forage and dry matter yields increased significantly with increase in nitrogen levels upto 150 kg/ha. These results are in conformity with the finding of Khokar *et al.* (1988). Increase in forage yield with increase in nitrogen application might be due to high photosynthetic activity in plant resulting into increase in vegetative growth and more dry matter content which in turn increased the yield of dry matter. Tateno and Iida (1978) also reported that a positive correlation existed between rate of photosynthesis and leaf nitrogen content.

Crude protein and digestible dry matter yields are the overall effects of dry matter yield (t/ha) and respective contents (%). Data presented in table 1 revealed that delay in cutting upto 6 week stage significantly increased crude protein and digestible dry matter yield, however, further delay in cutting upto 7 week stage had no significant effect. Oakes (1966) also obtained maximum crude protein yield at 6 week cutting interval, however, Singh *et al.* (1995) reported increase in digestible dry matter yield from 5 to 7 weeks stage. In the present study, crude protein and digestible dry matter contents were maximum at 5 week stage (table 2) but these could not compensate the dry matter yields. Data presented in table 1 also revealed that increase in nitrogen application from 0 to 150 kg/ha significantly increased crude protein and digestible dry matter yield. Similar results were also reported by Oakes (1966) and Singh *et al.* (1988). In present study higher the nitrogen supply, more readily the synthesized carbohydrates were converted to protein and protoplasm and smaller proportion was left available for cell wall material, because carbohydrate and nitrogen provide skeleton for protein synthesis. Due to higher crude protein content and dry matter yield recorded at 150 kg N/ha, the crude protein yield was also significantly higher at same nitrogen level.

Quality

In the present course of study, dry matter content increased with delay in harvesting the forage from 5 to 7 weeks during both the years (table 2). Increase in dry matter content with delay in cutting may be explained that early stage consists of the formation and growth of new leaves, stems and roots, plants with abundance of nitrogen utilize carbohydrates for the synthesis of nucleic acids and proteins as well. However,

Table 1: Effect of cutting intervals and nitrogen levels on yield and quality of N.B. hybrid

Treatments	Green forage (t/ha)			Dry matter (t/ha)			Dry matter content (%)			L : S		
	1997	1998	Pooled	1997	1998	Pooled	1997	1998	Pooled	1997	1998	Pooled
Cutting intervals (week)												
5	49.97	55.82	52.90	6.61	8.19	7.37	12.91	14.41	13.66	1.23	1.07	1.15
6	60.23	69.81	65.02	9.26	11.67	10.47	15.13	16.45	15.79	1.18	1.02	1.10
7	57.78	67.56	62.67	10.23	12.27	11.25	17.34	17.90	17.63	1.10	1.01	1.05
CD at 5 %	2.99	3.28	2.18	0.48	0.61	0.38	0.44	0.42	0.30	0.08	0.04	0.04
Nitrogen levels (kg N/ha)												
0	41.18	48.66	44.92	5.46	7.04	6.25	13.23	14.34	13.79	1.21	1.07	1.14
50	50.64	58.05	54.35	7.39	9.11	8.25	14.57	15.62	15.09	1.19	1.04	1.11
100	60.41	67.70	64.06	9.48	11.41	10.45	15.60	16.80	16.20	1.14	1.02	1.08
150	71.74	83.17	77.46	12.48	15.28	13.88	17.14	18.25	17.70	1.13	1.00	1.06
CD at 5 %	3.45	3.79	2.51	0.56	0.71	0.44	0.51	0.48	0.34	0.09	0.04	0.05

Table 2: Effect of cutting intervals and nitrogen levels on yield and quality of N.B. hybrid

Treatments	Crude protein content (%)			Crude protein (t/ha)			Digestibility (%)			Digestible dry matter (t/ha)		
	1997	1998	Pooled	1997	1998	Pooled	1997	1998	Pooled	1997	1998	Pooled
Cutting intervals (week)												
5	9.72	6.88	8.30	0.660	0.591	0.625	70.4	68.0	69.2	4.67	5.65	5.16
6	9.01	5.47	7.24	0.857	0.654	0.755	68.6	64.8	66.7	6.43	7.69	7.06
7	8.09	4.88	6.48	0.865	0.620	0.742	64.3	61.4	62.7	6.67	7.61	7.14
CD at 5 %	0.41	0.36	0.27	0.064	0.055	0.041	0.8	1.4	0.2	0.33	0.43	0.09
Nitrogen levels (kg N/ha)												
0	7.61	4.81	6.21	0.411	0.330	0.370	63.7	59.6	61.7	3.44	4.16	3.80
50	8.52	5.35	6.94	0.625	0.482	0.552	66.6	63.4	65.0	4.61	5.74	5.32
100	9.17	6.18	7.68	0.861	0.692	0.777	68.8	66.7	67.5	6.49	7.51	7.00
150	10.45	6.63	8.54	1.278	0.984	1.131	71.9	69.3	70.6	8.86	10.52	9.69
CD at 5 %	0.48	0.41	0.31	0.074	0.064	0.048	0.9	1.4	0.2	0.38	0.49	0.30

as vegetative growth proceeds, photosynthates is used in the synthesis of storage material leading to increase in dry matter content. Similar results were also observed by Singh *et al.* (1988). Increase in dry matter content with increase in nitrogen might be due to more accumulation of dry matter in plant. Reasons for higher dry matter content with increase in nitrogen may be similar to that of cutting interval.

Crude protein content decreased with delay in cutting during both the years (table 2). This is in conformity with the finding of Oakes (1966) and Singh *et al.* (1995). Decrease in crude protein content with increased cutting interval may be explained by the increased accumulation of carbohydrates and other structural materials such as lignin and silica with maturity of the crop and reduction in leaf to stem ratio. In the present investigation, increase in nitrogen level increased crude protein content significantly during both the years. These results are in agreement with the finding of Khokar *et al.* (1988) and Singh *et al.* (1988). Increase in crude protein content with increase in nitrogen might be due rapid conversion of carbohydrates into amino acids (Srivastava and Chatterjee, 1970).

Data presented in table 2 revealed that delay in cutting from 5 to 7 weeks interval decreased digestibility significantly. Similar results were also reported by Singh *et al.* (1995). Decrease in dry matter digestibility with delay in cutting might be due to low leaf: stem ratio and crude protein content and higher lignin content in plant. Leon *et al.* (1984) also reported almost similar reasons for low digestibility with delay in cutting.

Data presented in table 2 showed that digestibility (%) increased significantly with increase in nitrogen level up to 150 kg/ha. Similar results were also reported by Singh *et al.* (1988). Increased digestibility with increase in nitrogen level may be due to increased protein content. These parameters have a very high positive correlation with each other (Richards and Reid, 1953).

Data presented in table 2 showed that delay in cutting decreased L:S ratio, however, significant decrease in L:S ratio was found from 5 to 6 week interval during 1997, 6 to 7 week interval during 1998 and from 5 to 7 weeks interval in pooled data. Decrease in L:S ratio with delay in cutting may be due to decreased proportion of leaf lamina with increased cutting intervals. Similar reasons were also given by Santana *et al.* (1989). In the present study, increase in nitrogen levels also showed decrease in L:S ratio. This may be due to increase in dry matter content with increasing nitrogen levels. Similar reasons were also given by Ishii (1991).

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