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EFFECT OF DIFFERENT NITROGEN LEVELS ON PRODUCTIVITY OF PERENNIAL GRASSES UNDER MID HILL CONDITION OF NAGALAND

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SUMMARY

A field experiment was conducted during *kharif* season of 2010 -11 to ascertain the effect of different treatment combinations having four levels of nitrogen and three perennial grasses on productivity and quality parameters of green fodder production. N was applied at the rate of 0, 60, 80, 100 and 120 kg ha^{-1}. The three perennial grasses were Hybrid Napier, Congosignal and Setaria. Among the three perennial grasses, Congosignal resulted in highest number of tillers/tussock, leaf-stem ratio and percent dry matter content at all the three cuts in a year. It also resulted in highest green forage yield at all the three cuts (195.82, 238.18 and 258.00 q ha^{-1}) respectively. Among the different N levels application of 120kgN ha^{-1} recorded in highest forage yield (168.36 q ha^{-1}) at first cut. Green forage yield was highest with 120kgNha^{-1} which was at par with 80 and 100 kg Nha^{-1}, but significantly superior over the lower dose of 0 and 60 kgNha^{-1}, both at second and third cut respectively. The crude protein yield was found to be highest in 120 kg N ha^{-1} at all the three cuts. The N uptakes by plants at all the individual cuts were increased significantly with increasing levels of N.

Key words **:** Nitrogen, Productivity, Perennial, Grasses

Among the different agronomic factors which govern the productivity of crops, fertilizer management is one of the most important one that significantly influences the plant growth and development. Judicious application of nitrogen is very important for obtaining higher green biomass from forage crops per unit area per unit time. Nitrogen supply to grasses is a major limitation in forage production since almost all the soils do not contain sufficient amount of available nitrogen for high yield of forage crops. Among the major effects of nitrogen on the crop, increased meristematic activity and induced vegetative growth are more apparent and most important from the point of forage production. Application of nitrogen not only increased yield but also improves quality of forage. Sharma (2009) reported that 150kgNha^{-1} significantly increased the crude protein yield in fodder oat. Three important perennial cultivated forage crops for North-East regions are Hybrid Napier, Setaria and Congosignal grass. The production potentiality of these grasses ranges from 900-1200 q$ha^{-1}year^{-1}$. These forage crops can be grown in all types of soil in tropics and sub-tropics. Green forage is the cheapest source of balanced nutrients for livestock. So, growing of these perennial fodder crops are of greater importance. Livestock plays an important role in the agrarian economy of the hill people. Green forage production has to be augmented for higher productivity and economic returns from the livestock. Opportunities for forage production on arable lands are limited. Only 10-18% of the geographical area in various states in this NE region is cultivated. Hence, non-available lands and non competitive land use strategies are the twin options for enhancing availability of green forage for the livestock (Singh *et al.* 1999). In low to mid hills, most of the sub-tropical and tropical grasses were found suitable. There are very few scientific information on forage crops for the state of Nagaland. Therefore, the present investigation was conducted to find out suitable perennial grasses with suitable nitrogen dose under mid hill condition of Nagaland.

MATERIALS AND METHODS

Field experiments were conducted during *Kharif* 2010 and continued for the second year 2011 at the research farm of School of Agricultural Sciences,

Nagaland University, Medziphema, Nagaland. The treatments consisted of three different perennial grasses *i.e.* Hybrid Napier, Setaria and Congosignal and five levels of nitrogen (0, 60, 80, 100 and 120 kg N ha^{-1}) The experiment was laid out in factorial randomized design. These treatments were replicated thrice. The soil of the experimental site was sandy loam, low available nitrogen (210kg ha^{-1}), and phosphorous (20.5kg ha^{-1}) while medium in available potassium (190 kg ha^{-1}) with pH 4.5. The crop was planted in rows 30cm apart using rooted slips/ tillers. Half dose of nitrogen as per treatments along with 60 kg P_2O_5 and 40 kg K_2O ha^{-1} was applied as basal. The remaining half dose of nitrogen was top dressed at two equal doses after each cut. The crop was harvested three times in first year and four cuttings in the second year. The data pertaining to biometrical observations as well as green fodder and dry matter yields were recorded at harvest of the crop.

RESULTS AND DISCUSSION

Response of perennial Grasses

The perusal of data (Table 1) indicated that among the different perennial grasses Hybrid Napier performed well and produced taller plants (130.06cm) over Setaria (128.83cm) and Congosignal (115.10cm). However, Congosignal recorded highest number of tillers/tussock (66.72) than other two grasses. Hybrid Napier recorded lowest number of tillers/tussock (25.31). Congosignal was found superior in leaf:stem ratio, dry matter content (%) and crude protein yield (qha^{-1}) than Hybrid Napier and Setaria respectively. The high yield of Congosignal (692 q ha^{-1}) was mainly due to its more number of tillers per tussock.

Effect of Nitrogen

Data in relation to growth characters *viz.*, plant height, tiller/tussock significantly affected due to nitrogen application and showed increasing trend with increasing levels of nitrogen from 0 to 120 kg ha^{-1}. The application of 120 kg N ha^{-1} produced significantly taller (131.97cm) and more number of tillers/tussock (55.98). The beneficial effect of nitrogen on growth parameters might have resulted from its effect on increasing protoplasmic content, cell division, expansion and differentiation as reported by Thakuria and Singh (1988) and Tripathy, (1998). Similarly, levels of N positively affected the yield as each incremental level produced higher yield of green

TABLE 1

Growth, yield and quality of different perennial fodder grasses as influenced by different levels of nitrogen (Average data of two years)

Treatments	Plant height (cm)	Tillers/ tussock	Leaf : stem ratio	Dry matter content (%)	Crude protein yield (q/ha)
Perennial grasses					
Hybrid Napier	130.06	25.31	1.21	12.00	2.55
Setaria	128.83	51.69	1.32	11.70	5.81
Congosignal	115.10	66.72	1.42	12.76	9.54
S. Em±	4.35	2.11	0.006	0.09	1.32
C. D. (P=0.05)	12.61	6.12	0.019	0.27	2.71
Nitrogen (kg/ha)					
0	120.39	33.01	1.28	11.37	4.53
60	119.78	45.46	1.31	11.70	5.16
80	123.40	51.56	1.33	11.61	6.06
100	127.77	53.53	1.33	11.96	6.41
120	131.97	55.98	1.34	12.16	7.68
S. Em±	5.62	2.73	0.008	0.12	1.71
C. D. (P=0.05)	16.28	7.90	0.025	0.35	3.50

TABLE 2
Green herbage and dry matter production (q/ha) of different perennial grasses under different nitrogen levels (Average data of two years)

Treatments	Green harvest production (q/ha)				Dry matter yield (q/ha)			
	1st cut	2nd cut	Final harvest	Total	1st cut	2nd cut	Final harvest	Total
Perennial grasses								
Hybrid Napier	84.83	104.09	106.17	295.09	11.77	12.59	11.82	36.18
Setaria	143.84	172.23	174.37	490.44	17.67	24.04	21.16	62.87
Congosignal	195.82	238.18	258.00	692.00	27.53	34.85	31.81	94.19
S. Em±	0.50	0.71	0.52	0.52	2.04	0.10	0,10	0.09
C. D. (P=0.05)	1.47	2.07	1.51	1.06	5.92	0.31	0.30	0.20
Nitrogen (kg)								
0	111.62	137.43	140.02	394.07	13.11	19.61	18.55	51.27
60	133.56	162.45	173.26	469.27	27.83	21.29	18.322	62.39
80	138.55	172,62	180.91	492.08	22.88	24.40	21.55	63.78
100	155.37	181.08	194.25	530.70	19.41	24.54	23.47	67.42
120	168.36	203.90	209.13	581.39	21.72	29.28	26.20	77.20
S. Em±	0.65	0.92	0.67	0.67	2.64	0.13	0.13	0.12
C. D. (P=0.05)	1.90	2.68	1.94	1.37	7.65	0.40	0.38	3.50

fodder and dry matter over preceding level. Application of 120 kg N ha^{-1} recorded maximum yield of 581.39 q ha^{-1} green fodder and 77.20 q/ha dry matters respectively (Table 2). Increased fodder yield with increasing levels of nitrogen was due to its beneficial effect on plant height, more number of tillers per tussock and more number of green leaves. These results are in conformity with the findings of Magalhaer *et al.* (2009); Wijitphan and Lorwilai (2009); Wnxi *et al.* (2010).

Quality parameters in respect of crude protein and leaf stem ratio, which are nutritional as well as palatable aspects, both were positively enhanced due to nitrogen application (Table 1). It was clear from the data that 120 kg N ha^{-1} produced higher crude protein of 7.68 q ha^{-1} which was significantly superior over rest of the levels except 100 kg N ha^{-1}. These findings are in agreement with those of Hedge and Relwani (1974) and Desai and Deore (1983). Leaf stem ratio also increased with

TABLE 3
Interaction effect of levels of nitrogen (N) on yields different perennial fodder grasses (q/ha) (Average of three cuts)

	N-level (q/ha)					
	0	60	80	100	120	Mean
Perennial Grasses						
Hybrid Napier	79.25	81.98	96.61	115.20	118.78	98.36
Setaria	117.84	147.63	169.43	172.41	210.08	163.48
Congosignal	190.31	218.80	238.07	250.04	256.12	230.67
Mean	129.13	149.47	168.04	179.22	194.99	164.17
	Nitrogen		Grasses		Nitrogen x Grasses	
S. Em±	0.75		0.60		1.30	
C. D. (P=0.05)	2.17		1.68		3.77	

TABLE 4
Interaction effect of nitrogen (N) and perennial grasses on dry matter yield (q ha^{-1}) (Average of three cuts)

	N-level (q/ha)					
	0	60	80	100	120	Mean
Perennial Grasses						
Hybrid Napier	8.53	8.88	11.56	13.38	17.94	12.06
Setaria	14.38	14.38	17.24	22.19	23.09	27.90
Congosignal	24.13	29.06	30.96	35.70	37.15	31.40
Mean	15.68	18.39	21.57	24.06	27.66	
	Nitrogen		Grasses		Nitrogen x Grasses	
S. Em±	0.75		0.97		1.68	
C. D. (P=0.05)	2.18		2.81		4.87	

TABLE 5
Interaction effect of nitrogen (N) and perennial grasses on crude protein yield (q ha^{-1}) (Average of three cuts)

	N-level (q/ha)					
	0	60	80	100	120	Mean
Perennial Grasses						
Hybrid Napier	58.42	61.32	73.81	108.17	122.56	84.86
Setaria	126.12	155.09	206.03	212.80	268.42	193.69
Congosignal	234.42	275.63	313.11	376.74	391.22	318.22
Mean	139.65	164.01	197.65	232.57	260.73	
	Nitrogen		Grasses		Nitrogen x Grasses	
S. Em±	1.25		0.97		1.68	
C. D. (P=0.05)	2.18		4.69		8.12	

the increasing levels of nitrogen upto 120 kg ha^{-1}, however, similar results were recorded at 80 and 100 kg N ha^{-1}. Similar results were also reported by Singh (1999).

Interaction Effect

Interaction between nitrogen fertilization and different perennial grasses on productivity of green forage, dry matter yield and crude protein yield was significant (Table 3, 4 & 5)). The highest yield of green fodder, dry matter and crude protein yield was recorded under Congosignal grass at 120 kg N ha^{-1}, which was significantly superior over rest of the treatment combinations but at par with 100 kg N level. Further, it was noticed that even though 120 kg N ha^{-1} recorded highest value, 20 kg N ha^{-1} can be saved applying 100 kg N ha^{-1} to get similar result as 120 kg N ha^{-1}.

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