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RESPONSE OF GUINEA GRASS (*PANICUM MAXIMUM* JACQ.) TO NITROGEN, FARM YARD MANURE AND HARVEST INTERVALS

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SUMMARY

A field experiment was conducted during 2007-10 on sandy loam soil at Central Research Farm of Indian Grassland and Fodder Research Institute, Jhansi to study the effect of nitrogen, farm yard manure and cutting intervals on growth, forage productivity and quality of Guinea grass (*Panicum maximum* Jacq.) under semi-arid rainfed conditions. Harvesting of Guinea grass at 60 days interval along with application of 80 kg N/ha in combination with 10 t FYM/ha recorded maximum dry forage yield (6.31, 11.59 and 8.17 t/ha) which was significantly higher as compared to 40 and 60 days harvest intervals + lower levels of fertility treatments. Dry forage yield of Guinea grass recorded during 1st, second and third years were 4.25, 8.61 and 5.22 t/ha, respectively. Harvesting at 40 days interval recorded significantly higher crude protein content in Guinea grass than 60 days harvest interval.

Key words : Guinea grass, nitrogen, manure, productivity, quality, rainfed

Guinea grass (*Panicum maximum* Jacq.) is one of the important pasture species suitable for higher forage production from community lands, village grazing lands and marginal lands owned by the farmers. It is a high yielding perennial forage grass that performs well in 900 to 1500 mm rainfall range but can survive even when rainfall is less than 400 mm. It has profuse tillers, quick regeneration and high leaf-stem ratio provides highly nutritious, digestible and palatable forage. It can be easily propagated both by seeds and vegetative means and performs well under shade of trees and saline sodic soil conditions. The productivity of Guinea grass is often below desired level under semi-arid rainfed condition. The main constraints for low productivity of Guinea grass are poor status of soil fertility and lack of cutting management. Harvesting of grasses at an appropriate growth stage results in green forage with acceptable dry matter content and nutrient, particularly protein (Ramamurthy and Vinod Shankar, 1998). Incorporation of farm yard manure in combination with inorganic fertilizer in grasses reduced the requirement of inorganic fertilizer and also maintained the productivity with soil health (Rai and Pahwa, 1996). Therefore, the present experiment was undertaken to study the effect of nitrogen, farm yard manure and cutting intervals on growth, forage productivity and quality of Guinea grass under semi-arid rainfed conditions.

MATERIALS AND METHODS

A field experiment was conducted during 2007-10 at Central Research Farm ($25^0 27'$ N latitude, $78^0 37'$ E longitude and 275 m above mean sea level) of Indian Grassland and Fodder Research Institute, Jhansi to find out the effect of nitrogen, farm yard manure and cutting intervals on forage productivity and quality of Guinea grass and soil nutrients status under semi-arid rainfed conditions. The soil of the experimental field was sandy loam, low in organic carbon (0.470, 0.488 and 0.513) and available nitrogen (212.14, 217.45 and 226.93 kg/ha) and medium in available phosphorus (10.16, 10.27 and 10.41 kg/ha) and potash (157.42, 170.20 and 176.48 kg/ha) during first, second and third years, respectively. The total rainfall received was 553.8, 1267.1 and 544.9 mm in 38, 52 and 33 rainy days during 2007, 2008 and 2009, respectively. There were 18 treatment combinations replicated thrice in split plot design. The treatment comprised two cutting intervals (40 and 60 days), three levels of farm yard manure (0, 5 and 10 t/ha) and three levels of nitrogen (0, 40 and 80 kg/ha).

The seedlings of Guinea grass were transplanted in the month of July. Dry matter content was estimated by drying 500 g plant sample of each treatment and replication in hot-air oven at 70^0C, which led to computation of dry matter yield. The plant samples were analysed for crude protein content according to AOAC (1995).

RESULTS AND DISCUSSION

Effect of Harvest Intervals

Harvesting of Guinea grass at 60 days interval recorded significantly higher height (128.2, 174.4 and 162.6 cm), number of tillers/plant (19.0, 30.5 and 24.6) and tussock diameter (11.2, 19.4 and 17.2 cm) as compared to 40 days harvest interval during first, second and third years, respectively. The higher growth parameters of Guinea grass with 60 days harvest interval might be due to longer duration which increased the growth parameters due to more source available for the synthesis of metabolites. While leaf-stem ratio (0.93, 0.76 and 0.68) increased significantly by harvesting of Guinea grass at 40 days interval as compared to 60 days interval (0.65, 0.58 and 0.52). Green forage (19.11, 33.52 and 21.02 t/ha) and crude protein yields (253.9, 608.8 and 464.5 kg/ha) were also increased significantly when harvesting was done at 60 days interval than 40 days harvest interval. The higher yield with harvest at 60 days interval could be ascribed to optimum period available for the growth of Guinea grass under semi-arid rainfed condition. The increased dry matter yield with harvesting at 60 days interval may be valid reason of increase in crude protein yield. Ramamurthy and Vinod Shankar (1998) reported higher forage yields of *Pennisetum* trispecific hybrid grass by harvesting at 75 days interval and Choubey *et al*. (1999) reported higher forage yields of *Brachiaria mutica* by harvesting at 60 days interval. During second year, 90.84 per cent increase in green forage yield was recorded as compared to 1st year (16.81 t/ha). While during 3rd year 43.61 per cent decrease in green forage yield was observed as compared to second year (32.08 t/ha) due to low rainfall.

Harvesting of Guinea grass at 40 days interval recorded significantly higher crude protein content as compared to 60 days harvest interval (Table 2). The higher crude protein content with the harvesting of Guinea grass at 40 days interval may be ascribed to succulent plants with higher nitrogen content. Sunil Kumar *et al*. (2007) also reported higher crude protein content at shorter harvest interval (30 days) in *Sehima nervosum* than longer harvest interval (60 days).

Effect of Farm Yard Manure

Height (123.5, 170.7 and 157.6 cm), number of tillers/plant (19.8, 30.7 and 25.0), tussock diameter (10.7, 18.2 and 17.9 cm) and leaf-stem ratio (0.83, 0.69 and 0.62) of Guinea grass were increased significantly with the application of 10 t FYM/ha as compared to

TABLE 1
Effect of harvest intervals, farmyard manure and nitrogen levels on growth parameters of Guinea grass

Treatment	Height (cm)			Tillers/ plant			Tussock diameter (cm)			Leaf-stem ratio		
	Yr 1	Yr 2	Yr 3	Yr 1	Yr 2	Yr 3	Yr 1	Yr 2	Yr 3	Yr 1	Yr 2	Yr 3
Cutting intervals (days)												
40	102.0	145.3	130.4	15.6	26.2	22.1	8.6	14.4	15.4	0.93	0.76	0.68
60	128.2	174.4	162.6	19.0	30.5	24.6	11.2	19.4	17.2	0.65	0.58	0.52
C. D. (P=0.05)	2.4	3.0	3.7	0.6	0.7	0.5	0.2	0.4	0.5	0.008	0.004	0.004
Farmyard manure (t/ha)												
0	105.0	147.0	133.5	14.3	25.8	21.5	9.0	15.4	14.5	0.74	0.66	0.57
5	116.9	161.9	148.4	17.8	28.5	23.5	10.0	17.0	16.3	0.80	0.68	0.61
10	123.5	170.7	157.6	19.8	30.7	25.0	10.7	18.2	17.9	0.83	0.69	0.62
C. D. (P=0.05)	3.0	3.7	4.6	0.7	0.8	0.7	0.2	0.5	0.6	0.01	0.005	0.005
Nitrogen levels (kg/ha)												
0	101.8	139.9	124.4	13.0	24.6	20.4	8.6	14.7	13.8	0.71	0.65	0.55
40	118.5	165.8	152.5	18.6	29.3	24.1	10.3	17.4	16.8	0.82	0.68	0.61
80	125.0	173.8	162.5	20.3	31.2	25.5	10.8	18.5	18.3	0.84	0.69	0.64
C. D. (P=0.05)	6.2	7.6	9.5	1.5	1.8	1.4	0.5	1.0	1.2	0.02	0.01	0.01

control treatment and 5 t FYM/ha during first, second and third years, respectively. Application of 5 t FYM/ha was also recorded significantly higher growth parameters of Guinea grass as compared to control treatment (Table 1). The green forage and crude protein yields of Guinea grass were also increased significantly with successive increase in farm yard manure (Table 2). The application of 10 t FYM/ha gave 34.52 and 8.12, 24.27 and 8.32, and 24.27 and 9.54 per cent higher green forage yield as compared to control and 5 t FYM/ha in first, second and third years, respectively. The beneficial effects of organic manure in terms of sustained production could be related to the enhanced biological activities in the rhizosphere, improved soil structure and increased nutrient availability. Green forage yield of Napier bajra hybrid also increased significantly with the application of 10 t dung+urine/ha/year (Ramamurthy, 2002). Application of 10 t farm yard manure/ha also resulted in significantly higher crude protein content in Guinea grass as compared to control treatment during all the three years of study (Table 2). Sunil Kumar *et al*. (2004) also found improvement in crude protein content in forage crop with the use of farm yard manure.

Effect of Nitrogen Levels

Application of 80 kg nitrogen/ha recorded significantly higher height (125.0, 173.8 and 162.5 cm), number of tillers/plant (20.3, 31.2 and 25.5), tussock diameter (10.8, 18.5 and 18.3 cm) and leaf stem ratio

TABLE 2
Effect of harvest intervals, farm yard manure and nitrogen levels on green forage yield, crude protein content and crude protein yield of Guinea grass

Treatment	Green forage yield (t/ha)			Crude protein content (%)			Crude protein yield (kg/ha)		
	Yr 1	Yr 2	Yr 3	Yr 1	Yr 2	Yr 3	Yr 1	Yr 2	Yr 3
Cutting intervals (days)									
40	14.50	30.64	15.15	7.14	7.00	6.82	230.2	525.03	274.35
60	19.11	33.52	21.02	6.72	6.39	6.11	353.9	608.78	464.47
C. D. (P=0.05)	0.48	1.01	0.53	0.10	0.12	0.14	8.45	18.43	12.27
Farmyard manure (t/ha)									
0	14.05	28.39	16.07	6.82	6.58	6.35	248.4	490.40	271.78
5	17.48	32.57	18.23	6.96	6.73	6.48	303.4	579.37	336.71
10	18.90	35.28	19.97	7.01	6.78	6.57	324.2	630.95	378.68
C. D. (P=0.05)	0.59	1.25	0.65	0.12	0.15	0.17	10.40	22.68	15.09
Nitrogen levels (kg/ha)									
0	13.33	26.18	15.04	6.79	6.49	6.22	237.9	439.77	230.01
40	17.82	33.81	18.75	6.97	6.75	6.51	306.7	601.02	355.93
80	19.28	36.25	20.54	7.04	6.85	6.67	331.6	659.94	401.22
C. D. (P=0.05)	1.24	2.60	1.35	0.25	0.31	0.35	21.67	47.26	31.45

TABLE 3
Effect of harvest intervals, farm yard manure and nitrogen levels on dry forage yield of Guinea grass

Treatment	Year 1			Year 2			Year 3		
	Nitrogen levels (kg/ha)			Nitrogen levels (kg/ha)			Nitrogen levels (kg/ha)		
Cutting intervals (days) and **FYM (t/ha)**	N_0	N_{40}	N_{80}	N_0	N_{40}	N_{80}	N_0	N_{40}	N_{80}
$C_{40}FYM_0$	2.33	2.77	3.29	5.58	6.75	7.55	2.33	3.63	4.22
$C_{40}FYM_5$	2.70	3.53	3.72	5.92	8.06	9.22	2.90	4.46	5.12
$C_{40}FYM_{10}$	2.99	3.82	3.92	6.30	9.37	9.47	3.39	5.20	5.32
$C_{60}FYM_0$	3.97	4.60	5.14	7.44	8.85	9.57	4.01	5.77	6.57
$C_{60}FYM_5$	4.49	5.81	6.15	7.86	10.12	11.30	4.77	6.88	7.82
$C_{60}FYM_{10}$	4.83	6.15	6.31	8.51	11.47	11.59	5.47	7.97	8.17
C. D. (P=0.05)		0.60			1.02			0.95	

(0.84, 0.69 and 0.64) of Guinea grass as compared to control treatment during first, second and third years, respectively. The difference between 80 and 40 kg nitrogen/ha was also found significant (Table 1). Patel *et al*. (2007) reported significantly higher growth parameters of *Dichanthium annulatum* with the application of 60 kg nitrogen/ha. The green forage and crude protein yields of Guinea grass also differed significantly with the application of different levels of nitrogen (Table 2). Increasing levels of nitrogen from control to 40 and further to 80 kg/ha significantly increased the green forage yield by 25.35 and 6.97, 31.12 and 7.47 and 48.29 and 8.85 per cent during first, second and third years, respectively. This was because of the fact that nitrogen involved in increasing the protoplasmic constituents and accelerating the process of cell division and elongation which in terms gave luxuriant vegetative growth for higher productivity. The higher crude protein yield might be due to increase in protein content and dry matter yield with increasing levels of nitrogen. The significant increase in forage and crude protein yields was also reported by Patel *et al*. (2007) in *D. annulatum*.

Application of 80 kg nitrogen/ ha also recorded significantly higher crude protein content in Guinea grass as compared to control treatment during all the three years of study (Table 2). The increase in crude protein content of Guinea grass with increasing levels of nitrogen may be attributed to the fact that nitrogen is a main constituent of protein and it involved in the synthesis of amino acids and accumulation of protein in plants. Increase in crude protein content of *Iseilema laxum* grass was also reported by Neel Ratan and Singh (2004).

Interaction Effect

Harvesting of Guinea grass at 60 days interval along with application of 80 kg N/ha in combination with 10 t FYM/ha recorded maximum dry forage yield (6.31, 11.59 and 8.17 t/ha) under semi-arid rainfed condition which were significantly higher as compared to 40 and 60 days harvest intervals+lower levels of fertility treatments and at par with 60 days harvest interval+80 kg N+5 t FYM and 40 kg N+10 t FYM/ha during first, second and third year respectively (Table 3). Ramamurthy and Vinod Shankar (1998) also found higher forage yield of *Pennisetum* trispecific hybrid by harvesting at 75 days interval along with application of 75 kg nitrogen/ha under semi-arid rainfed condition. Dry forage yield of Guinea grass recorded during 1st, second and third years were 4.25, 8.61 and 5.22 t/ha, respectively. During second year 102.59 per cent increase in dry forage yield was recorded as compared to 1st year. While during third year 39.37 per cent decrease in yield was observed as compared to second year. During 3rd year rainfall was less than average rainfall, therefore, the yield obtained with shorter harvest interval (40 days) was less than longer harvest interval (60 days).

Thus, it can be concluded that harvesting of Guinea grass at 60 days interval along with application of 80 kg N in combination with 5 t farm yard manure/ha in sandy loam low fertile soil was found adequate for higher growth, productivity and quality of forage under semi-arid rainfed conditions.

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