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RESEARCH ARTICLE

Influence of Various Types of Organic Manures and Different Levels of Nitrogen Fertilization on the Biomass Yield and Nutrient Content of Napier-Bajra Hybrid Grass

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ABSTRACT

A study was conducted to test the response of Napier-bajra hybrid grass that was subjected to treatment with 3 different types of organic manures and 3 different levels of inorganic nitrogen (20kgN/acre, 40kgN/acre and 60kgN/acre) as fertilizer. Organic manure (farm yard manure, bio digested slurry and poultry manure) @ 4 tons/acre as basal manure increased the fodder biomass in a dose-dependent manner when used in combination with a nitrogen-containing fertilizer. We estimated biomass yield in terms of fresh matter yield and dry matter yield. We estimated the nutrient content in terms of percentages of crude protein and crude fibre in the grass that was subjected to different treatments. Our results show that biomass yield was significantly higher when organic manures were used in combination with maximum level (60 kg/acre) of inorganic nitrogen application. The crude protein content was comparable between the 3 types of organic manures and increased in a dose dependent manner to the level of inorganic nitrogen used. The crude fibre content was significantly ($P<0.05$) higher when poultry manure was used as organic manure and was not influenced by the level of inorganic nitrogen application. There was no significant difference in the palatability of grass fed to the sheep. The cost of production of the grass decreased at higher levels of nitrogen application. From this study, was conclude that inorganic nitrogen @ 60 kg/acre and organic manure @ 4 tons/acre yields significantly higher fodder biomass and that nitrogen- containing fertilizer is a critical component required for economical production of Napier- bajra hybrid grass.

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INTRODUCTION

The Napier-bajra hybrid grass is a popular fodder for rearing the livestock because of its higher biomass yield, and its suitability for feeding the dairy cattle, sheep and goats. However, the biomass yield in the farmer's field is generally lower. This problem arises mainly due to lack of proper knowledge in adopting the recommended cultivation practices. In this context, it is important to note that the effects of the combination of organic and inorganic fertilizers in boosting the fodder biomass yield are well documented (Patel, 2005). Different types of organic manure and urea fertilizer (as the source of inorganic nitrogen) are the popular choices of fertilizers for the farmers. Our goal was to find a suitable combination of organic manure and urea fertilizer for achieving not only higher biomass yields, but also to enrich the nutrient value of Napier-bajra grass. Accordingly we conducted the study by examining the biomass yield, crude protein and crude fibre content of the fodder that was cultivated by applying 3 different types of farm wastes (that serve as sources of organic matter) and 3 different levels of inorganic nitrogen (N).

MATERIALS AND METHODS

The experiment was conducted in a 300 m^2 area of land containing clay loam soil with medium level of available nitrogen (147 kg/acre), low level of available phosphorus (2 kg/acre), low level of available potassium

(23 kg/acre) and slightly alkaline in nature (pH 6.7). The land was divided into 12 equal plots measuring 25 m^2 and the plots were then randomly allotted for the various treatment groups (Table1). The three types of organic manures (Farm yard manure (FYM) - 0.47% N; Biodigested slurry (BDS)- 2.17% N; Poultry manure (PM)-2.23% N) were applied as a basal manure at the rate of 4 tons/acre and the land was ploughed twice before planting the stems of the Napier-bajra hybrid grass (Co-3 variety). The stems were planted at 50x50 cm spacing. The first irrigation was done on the same day of planting and thereafter as and when required. Weeding was also performed as and when required. Fertilizer grade urea, as a source of nitrogen, was applied at three different levels as on 30th day of planting. Fodder was harvested on 86th day at 3 different points of one square meter area in each experimental plot and the weight of fresh fodder biomass was measured using digital electronic weighing balance and sampling for estimation of moisture was done (AOAC, 2005) on the experimental plots itself. The dry fodder biomass yields were estimated by applying formula based on the moisture content of respective treatment group fresh fodder biomass yields. The crude protein and crude fibre contents were estimated as per the methods described previously. A trial to assess the palatability of the grass that was cultivated under different manurial regimes was carried out using 12 sheep in a switch over design by feeding the experimental animals only with the grass that was cultivated subjecting to respective treatments as described above (also see Table 1). A total of 12 treatments were included in the experiment and Napier-bajra hybrid fodder was cultivated accordingly. The cost of fodder production was evaluated based on the prevailing market prices during the year 2012. The data obtained on various parameters were analysed statistically by two -way ANOVA as per the methods described in Snedcor and Cochran (1994).

Table 1: Experimental designs

No.	Treatment
T_1	No Organic manure (OM) + 20 kg N/acre.
T_2	No OM + 40 kg N/acre.
T_3	No OM + 60 kg N/acre.
T_4	Farm yard manure (FYM) @ 4 tons + 20 kg N/acre.
T_5	FYM + 40 kg N/acre.
T_6	FYM + 60 kg N/acre.
T_7	Bio digested slurry (BDS) @ 4 tons + 20 kg N/acre
T_8	BDS + 40 kg N/acre.
T_9	BDS + 60 kg N/acre.
T_{10}	Poultry manure (PM) @ 4 tons + 20 kg N/acre
T_{11}	PM + 40 kg N/acre.
T_{12}	PM + 60 kg N/acre.

Table 2: Influence of organic and inorganic fertilizers on the Fodder biomass yield (tons / acre)

Manure	Nitrogen (kg / acre.)			Mean
	20	40	60	
Fresh matter yield				
No OM	15.23^{b}	18.41^{b}	20.65^{b}	18.10^{c}
FYM	16.93^{ab}	19.29^{ab}	24.01^{a}	20.08^{b}
BDS	18.24^{a}	20.49^{ab}	24.89^{a}	21.20^{ab}
PM	18.56^{a}	20.65^{a}	25.56^{a}	21.59^{a}
Dry matter yield				
No OM	3.67^{c}	5.02^{b}	5.25^{b}	4.65^{b}
FYM	4.23^{b}	5.42^{ab}	6.68^{a}	5.44^{a}
BDS	4.59^{ab}	5.37^{ab}	7.01^{a}	5.66^{a}
PM	4.92^{a}	5.81^{a}	7.14^{a}	5.96^{a}

In a column, the mean values that are accompanied by a common letter are not significantly different (P<0.05) from each other.

Table 3: Effect of organic and inorganic fertilizers on the crude protein and crude fibre content (expressed as %) of Napier-bajra hybrid grass

Manure	Nitrogen (kg / acre.)			Mean
	20	40	60	
Crude protein (%)				
No OM	6.63^{a}	7.13^{a}	8.63^{a}	7.46^{b}
FYM	7.00^{a}	7.88^{a}	8.81^{a}	7.90^{ab}
BDS	7.44^{a}	8.06^{a}	9.06^{a}	8.19^{ab}
PM	8.23^{a}	8.63^{a}	9.19^{a}	8.46^{a}
Crude fibre (%)				
No OM	31.23^{b}	30.53^{b}	32.27^{b}	31.34^{b}
FYM	32.14^{b}	29.26^{b}	31.86^{b}	31.09^{b}
BDS	31.06^{b}	30.82^{b}	32.64^{ab}	31.51_{b}
PM	33.73^{a}	33.90^{a}	33.99^{a}	33.87^{a}

In a column, the mean values that are accompanied by a common letter are not significantly different (P<0.05) from each other.

RESULTS

Fodder biomass yield

The fresh fodder biomass (fresh matter yield) was significantly (P<0.05) lower at all levels of nitrogen application when no organic manure was used. The application of FYM resulted in higher fodder fresh biomass yields when compared to the treatment in which no organic manure was used. On the other hand, the biomass yield of FYM treatment was lower when compared to that of the bio digested slurry/poultry manure applications (Table 2).

The biomass yield, in terms of dry matter fodder, also showed similar trends as that of fresh matter biomass in which a high level of inorganic nitrogen application yielded higher biomass values (Table 2). Our results show that at least one type of organic manure (OM) is essential to produce higher fodder biomass. The high level of inorganic nitrogen application @ 60 kg/acre along with BDS/PM as source of organic manures resulted in higher fodder biomass when compared to FYM or no OM application. These results might be due to differences in the amount of nitrogen content among the organic manures used in this study.

Nutrient content

The nutrient content was estimated by measuring the percentages of crude protein and crude fibre in the fodder. Increased crude protein content was observed as the level of nitrogen increased either by inorganic nitrogen or through different types of organic manures used in this study.

The crude fibre content was significantly (P<0.05) higher when poultry manure was used as the organic manure and the crude fibre content was not influenced by the level of inorganic nitrogen application (Table 3).

Palatability

The palatability values of the grass fed to sheep were estimated in terms of g of dry matter intake per kg

metabolic body weight. The palatability values were 70.3, 71.2, 70.9, 70.5, 71.6, 72.1, 68.4, 69.1, 68.2, 70.3, 72.4 and 74.6 for the T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9, T_{10}, T_{11} and T_{12} groups, respectively. Thus, there were no significant differences in the palatability across different treatments.

Economics

The costs of production of kilogram of fresh fodder were 1.51, 1.27, 1.14, 1.58, 1.40, 1.14, 1.46, 1.32, 1.10, 1.44, 1.31 and 1.07 Indian rupees for the T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9, T_{10}, T_{11} and T_{12} groups, respectively. Thus, our results demonstrate that the cost of production was decreased as the level of nitrogen fertilization increased an effect that was observed irrespective of the types of organic manure used.

DISCUSSION

The levels of available nitrogen content in the soils of our experimental plots were lower when compared to normal range recommended for crop cultivation and hence we used nitrogen rich organic manure. Our results demonstrate that at higher levels of nitrogen application, the fodder biomass yield was higher (Table 2). Similar results were also reported by Sharma et al. (2012), Patel (2005) and Tiwana et al. (2004) in hybrid Napier grass subjected to different levels organic and inorganic fertilizer. The mean values of the crude protein content were significantly higher when poultry manure was used as organic manure (Table 3) and this result might be due to higher nitrogen content in the poultry manure. Further, the higher crude fibre content upon treatment with poultry manure might be due to fact that the growth of the thick stems part of the grass may be influenced by higher nitrogen content in the poultry manure. The palatability of the grass was not influenced by the either different types of manure or fertilizer applications which indicated that the nutrients supplied through organic and inorganic fertilizers were utilized only for the synthesis of nutrient-rich substances in the grass and not for the production of toxic substances. High financial returns in term of higher net income can be attributed to higher fodder biomass yield at high levels of nitrogen fertilizer application. In this context, it is important to note that Sharma et al. (2012) also reported that higher net returns and benefit cost ratio were obtained at highest doses of nitrogen application as observed in our study.

Conclusion

From this study, we conclude that Napier-bajra hybrid grass responds well to nitrogen fertilization of soil. Based on our results, we recommend the combination of poultry manure as source of organic manure and urea fertilizer as a source of inorganic nitrogen @ 60 kg/acre is recommended for economical cultivation of Napier-bajra hybrid grass. Our results have significant implications for the economical production of nutrient-rich Napier-bajra grass.

REFERENCES

AOAC, 2005. Official Methods of Analysis, Association of Official Analytical, Chemists, 18th edition. Wahington, DC, USA.

Patel, JR, 2005. Response of fodder napier to organic and inorganic fertilizer. Forage Res, 31: 62-63.

Sharma, AK, AK Sharma, RK Sharma, Rajeev Bharat and PK Rai, 2012. Effect of Different levels of nitrogen, organic manure and planting time on yield and quality of hybrid Napier. Indian J Anim Nutr, 1: 33-39.

Snedecor GW and WG Cochran, 1994. Statistical Methods. 7th edition. Iowa State University Press, Ames, IA.

Tiwana, MS, KP Puri, US Tiwana and A Singh, 2004. Forage production potential of napier-bajra hybrid varieties under different nitrogen levels. Forage Res, 30: 80-85.