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Title: Production Performance of Red Napier Grass (Pennisetum Purpureum) Applied with Different Animal Manure as Biofertilizers

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ABSTRACT

The study was conducted to test the potential of different animal manure as biofertilizers to the production of napier grass in terms germination rate, number of tillers, plant height, fresh weight, dry weight, and dry matter percentage. It was laid out in a randomized complete block design (RCBD) with 3 treatments, and 4 replicates. Treatments are A – 5 tons of Chicken dung per hectare. B- 5 tons of cattle manure per hectare, and C- synthetic fertilizer. Data collected were subjected to analysis of variance (ANOVA) in randomized complete block design, while significant result was subjected further to Duncan's Multiple Range Test (DMRT). Results revealed that application of 5 tons per hectare of chicken dung, and cattle manure positively improved the production performance of red napier grass. On the other hand, application of 5 tons per hectare of cattle manure significantly influenced the number of tillers of red napier grass. Based on the findings of the study, the use of 5 tons per hectare of chicken dung, and cattle manure as biofertilizer are recommended as it positively improved the production of red napier.

INTRODUCTION

Background of the study

A shortage of forage during dry spells is a significant problem in ruminant husbandry, resulting in nutritional deficits that impact ruminant output and health. Another problem identified is the underutilization of animal manure as biofertilizer in forage production. A study of Grossi et al., (2019), stated that about 14.5% of total anthropogenic greenhouse gas emissions in 2005 equivalent to 7.1 Gigatons of carbon dioxide.

The availability of feed resources frequently hinders smallholder farmers, particularly those in rural areas, who mainly rely on antiquated and ineffective feeding techniques.

Among the most crucial feed sources for ruminants worldwide are forages (Dynes et al., 2023). 70% of agricultural land and 26% of the world's land area are made up of forage grasslands, which are utilized to feed cattle (FAO 2010). Commonly grown grasses such as Napier grass (*Pennisetum purpureum*) are significant feed sources in the tropics.

Napier grass (*Pennisetum purpureum*), widely known for its high biomass production, has garnered attention for its potential as a sustainable forage crop, particularly in systems that incorporate organic fertilizers. According to Chabbi et al., (2019), Napier grass can produce up to 80-100 tons of fresh biomass per hectare per year, making it one of the most productive forage crops. According to Karanja et al., (2020), Napier grass contains an average of 8-12% crude protein (CP) on a dry matter (DM) basis, which is critical for animal growth and milk production. The crude protein content can be influenced by the age

of the grass at harvest, with younger shoots typically containing higher CP levels compared to older, more fibrous stems (Mutau et al., 2021).

Integration of biofertilizer approach led to 30% higher biomass yields and improved forage quality, with increased crude protein and mineral content in the Napier grass compared to conventional fertilizer treatments. Kimani et al., (2023), reported that biofertilizers enriched with plant growth-promoting rhizobacteria (PGPR) enhanced the microbial biodiversity in the rhizosphere of Napier grass.

Thus, the researchers prompt to explore the use of different animal manure as biofertilizers to the production of red napier.

Objectives

Generally, the study aims to determine the production performance of red napier applied with different animal manure as biofertilizers.

Specifically, sought to

1. Determine the growth performance of red napier species applied with animal manure in terms of germination rate, number of tillers, and plant height;
2. Determine the yield of red napier grass applied with animal manure in terms of fresh weight, dry matter yield, and dry matter percentage;
3. Determine if there is a significant difference on the production performance of red napier applied with animal manure as biofertilizers.

Significance

This study adds opportunity to the ruminant raisers and local farmers, as it highlights practical solutions to improve productivity through testing of different animal manure as biofertilizer to red napier adaptable to local condition with high nutritional value, which can enhance ruminant's health and production, ensuring better livelihood that emphasizes sustainable farming practices that can minimize environmental degradation caused by livestock manure, contributing to environmental conservation and resource management.

METHODOLOGY

Materials

Materials used were chicken dung, cattle manure, gardening tools such as rake, trowel and red Napier as experimental unit.

Methods

This section includes the experimental design and treatments, cultural management practices and procedures, instruments for data collection, methods of data collection, and statistical tools and analysis.

Experimental Design and Treatments

The study was laid out in randomized complete block design (RCBD) with 3 treatments, replicated 3 times. Treatments are: A – 5 tons of Chicken dung per hectare. B- 5 tons of cattle manure per hectare, and C- synthetic fertilizer. The experimental layout of the study is shown in Figure 1.

Cultural Management Practices and Procedures

This includes the site selection, preparation of different animal manure, preparation of soil media mixture, preparation of planting materials, transplanting, watering,

Site Selection

The study was conducted at the Livestock area of Iloilo State University of fisheries Science and Technology - San Enrique Campus, San Enrique, Iloilo. The area was cleared and enclosed with net to av-

oid any external destructions.

Preparation of Animal Manure

The different animal manure such as chicken dung, and cattle manure were collected from the production area of the Institution. These manures were placed in a DIY-composting facility until fully decomposed.

Preparation of experimental area and treatments

A total of 12 plots with a dimension of $1m^2$ was prepared based on the layout of the study, and applied with different animal manure at a rate of 5 tons per hectare as basal.

Preparation of Planting Materials and planting

A matured red Napier stem was harvested and cut it with 3 nodes per stem and was used as experimental unit of the study. Planting was done late in the afternoon to avoid wilting.

Fertilization

The first fertilizer application was done in a basal method until the first harvest of the forage, second application was done after the first harvest to replenished the lost nutrients.

Instruments for Data Collection

The following are the instruments used in the collection of data includes; Meter stick to measure the plant height, and weighing scale to measure the weight of forage harvested.

Methods of Data Collection

Germination rate (%). This was determined by subtracting the total number of plants germinated to the mortality and multiplied by 100.

Number of tillers. The number of tillers was determined by counting the tillers and divided by the number of plants per plot.

Plant Height. The plant height was determined by measuring from the base to the topmost part of the plants.

Fresh weight (kg). this was determined by summing up the total weight of the samples.

Dry matter Yield (kg). This was determined by weighing the fresh harvested forage and subtracted to the dry harvested forage after drying.

Dry Matter percentage. was determined by dividing the dry weight to the fresh weight of forage and multiplied by 100%.

Statistical Tool and Analysis

Data on the performance of red napier applied with different animal manure was analyzed using Analysis of Variance (ANOVA) while significant results will be subjected to Duncan's Multiple Range Test (DMRT).

RESULT AND DISCUSSIONS

Germination Rate

Data on the germination rate is presented in Table 1. The result shows that among the treatments, those plants applied with 5 tons of cattle manure per hectare as fertilizer have the highest rate of germination rate with 92.19% compared to those plants applied with other fertilizers. Analysis of variance revealed no significant difference among treatments, which implies that application of 5 tons of different animal manure is comparable to those plants applied with synthetic fertilizer.

Number of tillers

Result on number of tillers is presented in Table 1. Data shows that among the treatments, napier grass applied with 5 tons of cattle manure per hectare and applied with synthetic fertilizers were mathematically

greater in terms of number of tillers during the first and 2nd harvests. Based on analysis of variance, those plants applied with 5 tons per hectare of cattle manure are comparable to those plants applied with synthetic fertilizer but significantly differ from those plants applied with 5 tons of chicken dung per hectare.

Plant Height (m)

Data on the plant height is presented in Table 1. The result shows that plants applied with 5 tons of cattle manure were numerically tallest among the treatments from the first harvest to the second harvest of the red napier. Analysis of variance revealed no significant difference among treatments, which implies that application of different animal manure at 5 tons per hectare is comparable to the performance of forage applied with synthetic fertilizer.

Fresh weight of napier (kg)

Data on fresh weight is shown in Table 1. Based on the result, red napier grass applied was the heaviest average in terms of fresh weight compared to the other treatments. Analysis of variance revealed that all treatments are comparable, which means that the application of 5 tons of chicken dung and 5 tons of cattle manure can compete with the performance of synthetic fertilizer.

Dry Weight (kg)

Data on the dry weight of napier is presented in Table 1. Based on the data presented, those napier applied with 5 tons of cattle manure per hectare has a mathematically higher dry weight compared to the other treatments. Analysis of variance shows that all treatments are comparable with each other which implies that the application of 5 tons of chicken dung and 5 tons of cattle manure can compete with the performance of synthetic fertilizer.

Dry Matter Yield (DM%)

Data on the dry matter yield is presented in Table 1. The data shows that among the treatments, those plants applied with 5 tons of chicken dung per hectare have the highest dry matter yield. Based on the analysis of variance, the application of 5 tons per hectare of different animal manure did not significantly differ from each other, including those applied with synthetic fertilizer.

CONCLUSION

Based on the discussion, the researchers concluded that 5 tons per hectare of chicken dung, and cattle manure can be applied to the red napier production as it positively improved the growth performance and DM yield of the forage.

RECOMMENDATION

Based on the findings of the study, the use of 5 tons per hectare of chicken dung, and cattle manure as organic fertilizer are recommended as it positively improved the production of red napier. Furthermore, similar study on the use of the different animal manure as organic fertilizer, and nutrient analysis of the dry matter yield are recommended.

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Table 1. summary of the performance of red napier applied with different animal manure

PARAMETERS	TREATMENTS			Level of Sig.	CV %
	A	B	C		
Germination Rate (%)	90.63	92.19	84.38	ns	11.87
Number of Tillers					
1st harvest	9.00[b]	11.00[a]	11.00[a]	*	28.33
2nd harvest	12.00	14.00	15.00	ns	20.22
Plant Height (m)					
1st harvest	1.54	1.57	1.26	ns	33.66
2nd harvest	1.44	1.45	1.41	ns	13.53
Fresh Weight of Napier (kg)					
1st harvest	0.09	0.10	0.09	ns	33.63
2nd harvest	0.13	0.16	0.13	ns	20.06
Dry Weight of Napier (kg)					
1st harvest	0.011	0.012	0.10	ns	28.41
Dry Matter Yield (%)					
1st harvest	12.38	11.63	11.00	ns	6.76

abc – means with the same letter superscript are not significantly different
* - significant at 5% level of probability
ns – not significant at 5% level of probability

REPLICATION

I	II	III	IV
C	A	C	A
B	C	B	C
A	B	A	B

Figure 1. Experimental Lay-out of the Study

Legend:
Treatment: A- 5 tons of Chicken Dung per hectare
B- 5 tons of Cattle Manure per hectare
C- Synthetic Fertilizer