EFFECT OF DIFFERENT FERTILIZERS ON THE CHEMICAL AND MINERAL COMPOSITIONS OF NAPIER GRASS UNDER IRRIGATION SYSTEM

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ABSTRACT
The experiment was conducted to evaluate the effect of different fertilizers on the chemical and mineral compositions Napier grass (Pennisetum puerperium) under irrigation system in Yola, Adamawa State. The experiment was laid out in Randomized Complete Block Design, having three treatments, replicated three times and each plot measuring 3x3m. The experiment was carried out between December 2021 to April 2022 and irrigation system was practiced. The three treatments were NPK fertilizer (T_1) applied 30 DAP (days after planting) at 250 kg/ha, cow dung (T_2) applied after plotting at 7 ton/ha and no fertilizer (T_3). Based on the laboratory results of the chemical composition, the dry matter (DM), crude fibre (CF), organic matter (OM), acid detergent fibre (ADF) and neutral detergent fibre (NDF) increased with maturity. However, crude protein (CP), ether extract (EE), ash and nitrogen free extract (NFE) decreased with maturity. Consequently, the mineral composition of the grass followed the trend of its ash content. That is, with increased maturity, the mineral contents reduced. The experiment reveals that among the three different treatments, organic fertilizer (cow dung) had better chemical and mineral compositions. It is therefore, recommended that cow dung at 7 ton/ha be used for better chemical and mineral compositions and also, earlier harvesting stage should be prioritized in order to have Napier grass with high CP and low fibre.
Keywords: Napier grass, N.P.K., Cow dung, Irrigation, Fertilizer

INTRODUCTION

Livestock production is an important tool in the economy of developing countries (Hyelda, 2017) and the development of the Nigerian animal production industry is of serious importance (Bamaiyi, 2013). In most of the tropical regions of the world, strategic provision of feed to meet up with the nutrient requirement of livestock animals have been a major problem faced by ruminant animal keepers, especially during the dry season. In the small farmers' perspective, this requirement is provided through the basal supply of natural pasture grasses (Odedire and Babayemi, 2016). These grasses are mostly characterized by inadequate nutrients and low herbage yield as they grow on lands that are often short of the required soil nutrients. Since the forages on the rangelands in these areas provide feed which are not adequate for the ruminant animals, there is the need for improving their all-round productivity. Tropical grasses have the ability for high yield and the nutrients are simultaneously enhanced when treated with organic or inorganic fertilizers or established with nitrogen-fixing shrubs or tree legumes (Abdullahi *et al*., 2018). Unfertilized grasses had been described to be less nutritive as forage for ruminant animals (Bamikole *et al*., 2004). Napier grass (*Pennisetum purpureum* Schummach) is native to Sub-Saharan Africa from where it is believed to have been distributed to other tropical and subtropical regions around the world (Negawo, *et al*., 2017). It is one of the most important forage species in the world. It has been grown in almost all tropical and subtropical regions of the globe due to its high potential for forage accumulation, nutritive value, acceptability by different animal species, vigor and persistence (Pereira *et al*., 2021). The grass is a major tropical grass and it is one of the highest yielding tropical grasses (Singh *et al*., 2013). The aim of carrying out this research was to evaluate the effect of different fertilizers on the chemical and mineral compositions of Napier grass cultivated under irrigation system.

MATERIALS AND METHODS

Experimental site

The experiment was carried out on a research farm in Nyibango, Army Barracks Road, Yola. It is located within latitude 9° 13'-9° 37'N and longitude 12° 16' - 12° 42'E at an altitude 185.9m above sea level and it lies within the Northern Guinea Savannah zone of Nigeria, the soil is sandy loam, it has a tropical type of climate with distinct dry and wet seasons with annual rainfall of 956 mm. It has average minimum temperature of 20.8°C and maximum of 33.9°C (Adebayo *et al*., 2020).

Experimental design

The experiment had three treatments and each treatment was replicated three times in a Randomized Complete Block Design. The three treatments were; T_1 = inorganic fertilizer (N.P.K) at 250 kg/ha, T_2 = organic fertilizer (cow dung) at 7 ton/ha and T_3 = no fertilizer

Agronomic practice and layout

Obstacles were cleared before ploughing the land. The land was divided into nine plots. Each plot size was 3x3m. A total of 36 stem cuttings were planted per plot with an intra and inter row spacing of 0.5m and 1m respectively. There was an alleyway of 2m width between blocks and 2m width between plots. Stem cuttings having three nodes were planted in a slanting position, at an angle of 30-45^{o}, with two nodes buried in the soil.

Before planting, the plots were thoroughly irrigated to filled capacity for five days. For T_1, N.P.K was applied 30 DAP, cow dung (T_2) was applied at after plotting. The established plots were irrigated in the evening after every two days. Weeds were controlled by hand pulling. The experiment was carried out between December 2021 to April 2022.

Chemical and mineral analysis

The chemical composition was determined following standard methods of the Association of Official Analytical Chemists (AOAC, 2019). Neutral detergent fibre and acid detergent fibre were determined according to Van Soest *et al*. (1991) procedure.

Dry ashing technique as described by AOAC (2019) was used for the mineral analysis. After ashing, 2ml of concentrated nitric acid (HNO_3) was used to dissolve each sample. Buck Model 210 VGP Atomic Absorption Spectrophotometer was used to measure, potassium, zinc, copper and manganese. JENWAY PFP7 Flame Photometer was used to measure sodium and phosphorus.

RESULTS AND DISCUSSION

Chemical composition

The chemical composition (%DM) of Napier grass as affected by different fertilizer application, analyzed at different growth stages is presented in Table 1. Similar to yields, the nutrient content of forage is an essential element to consider in selection of fodder varieties for livestock production (Maleko *et al*., 2019) and pant maturity is considered the primary factor that affects the nutritive value of forages (Rambau *et al*., 2016). At 60 DAP, Napier grass cultivated using organic fertilizer had higher DM than the Napier grass cultivated using inorganic fertilizer and no fertilizer. As the grass mature further, Napier grass cultivated using inorganic fertilizer and no fertilizer had higher DM than the Napier grass cultivated using organic fertilizer. Crude protein, EE, ash and NFE decreased with increase in maturity, while CF, OM, ADF and NDF increased as the grass further mature. The findings in this study collaborate with those of Kamaruddin *et al*. (2018), Rahman *et al*. (2016) and Bayble *et al*. (2007) who all reported similar trends.

Mineral composition

The mineral composition (%DM) of Napier grass at different growth stages, cultivated using different fertilizers is shown in Table 2. It was observed that at organic manure generally produced Napier grass with better mineral composition than inorganic fertilizer. Also, using fertilizer (either organic or inorganic) gives better results than cultivating Napier grass with no fertilizer. According to NRC (2001), minerals are very essential for ruminant animal reproduction (conception, gestation and calving), growth, maintenance and production (e.g. milk, beef and wool). In this study, it was observed that minerals decrease with maturity, following the trend of the ash content, which also decreased with increase in maturity. Rambau *et al*. (2016) and Kamaruddin *et al*. (2018) observed the same trend in their different studies on Napier grass. Heuze *et al*. (2020) compiled a range of macro (g/kg) and micro nutrients (mg/kg), 0.0-0.8 for Na, 0.7-6.6 for P, 4.9-68.0 for K, 20-129 for Zn, 5-24 Cu and 19-238 for Mn. All the minerals measured in this study are within these ranges except sodium, which had higher contents at 60 and 90 DAP.

Table 1: Chemical composition of Napier grass at different growth stages under different fertilizers

Stage	Fertilizer	DM	CP	EE	CF	Ash	NFE	OM	ADF	NDF
	NPK	17.12	11.65	2.08	26.34	11.66	48.27	88.34	41.87	67.09
60DAP	Cow dung	18.34	11.64	2.45	23.77	11.97	50.17	88.03	38.34	64.54
	No fertilizer	17.95	10.22	2.01	23.86	10.45	53.46	89.55	37.86	66.38
	NPK	21.33	9.88	1.35	31.75	9.77	47.25	90.23	46.64	71.34
90DAP	Cow dung	20.65	10.45	2.05	29.76	10.42	47.32	89.58	44.98	66.99
	No fertilizer	22.08	8.54	1.12	32.33	9.12	48.89	90.88	45.03	70.56
	NPK	26.64	8.76	1.11	37.33	8.44	44.36	91.56	47.12	72.98
120DAP	Cow dung	24.56	9.35	1.74	35.62	9.96	43.33	90.04	45.57	68.23
	No fertilizer	27.28	6.54	1.01	39.67	7.23	45.55	92.77	48.29	76.45

Table 2: Mineral composition of Napier grass at different growth stages under different fertilizers

Stage	Fertilizer	Na	K	P	Cu	Mn	Zn
		Macro-nutrients (g/kg)			Micro-nutrients (mg/kg)		
60DAP	NPK	1.23	22.03	2.13	10.12	43.65	20.87
	Cow dung	1.34	21.14	2.04	10.32	44.25	21.09
	No fertilizer	1.03	17.97	1.68	9.67	39.01	20/05
90DAP	NPK	0.92	18.25	1.75	8.65	38.22	17.54
	Cow dung	1.16	20.00	1.87	7.24	40.25	18.13
	No fertilizer	0.86	16.43	1.44	7.46	35.57	15.76
120DAP	NPK	0.55	15.98	1.43	7.12	33.96	13.98
	Cow dung	0.87	17.45	1.66	7.01	36.24	14.54
	No fertilizer	0.69	15.46	1.22	6.28	32.57	12.44

CONCLUSION AND RECOMMENDATION

The results of this experiment reveal that organic fertilizer (cow dung) is a better fertilizer for Napier grass than inorganic fertilizer (N.P.K) but the latter is better off than cultivating Napier grass with no fertilizer in terms of chemical and mineral compositions. It is therefore, recommended that cow dung at 7 ton/ha be used for better chemical and mineral compositions.

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