EFFECT OF NITROGEN LEVELS ON YIELD AND QUALITY OF *PENNISETUM PEDIACELLATUM* FORAGE IN YOBE STATE, NIGERIA

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ABSTRACT

The experiment was conducted to evaluate the effect of nitrogen fertilizer on forage yield and quality of *Pennisetum pediacellatum* under rainfed in Gashua, Yobe State. The experiment was laid out in Randomized Complete Block Design, with plot divided into three main plots and replicated three times measuring 3 x 2 m^2. The three fertilizer rates are 100kg, 125kg and 150 kg per hectare, respectively. Forage yield and percentage of proximate compositions were significantly ($P < 0.05$) affected by the fertilizer rates. The highest fresh (29,444kg/ha) and dry (3,828 kg/ha) matter yield were recorded in 150kg N/ha fertilizer rates. Similarly, the highest crude protein (19.94%) and ash contents were observed with plots receiving 150kg N/ha rate whereas 100kg N/h fertilizer level had higher values for Crude fibre (32.11%) and ether extract (1.15%). The experiment reveals that among all fertilizer rates, 150kg N/ha had the best forage yield and proximate composition than the other fertilizer rates. It is therefore, recommended that 150kg N/ha fertilizer rate be used for enhanced forage productivity and better animal performance in Gashua, Yobe State.

keywords: *Pennisetum pediacellatum, fertilizer rates, forage yield, proximate composition*

INTRODUCTION

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) which are characterized by poor nutrients and low yield as they grow on infertile and erosion degraded soils (Babayemi and Bamikole, 2006). Since the forages on the rangelands in these areas provide feed which are not adequate for the ruminant animals, the Fulani herdsmen migrate to other places where feed is in abundance. The movement of these Fulani herdsmen on many occasions has resulted in clashes with farmers (Nweze *et al*., 2012).

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). Nitrogen (N) fertilisers application has been shown to increase DM yield, herbage metabolisable energy (ME) and crude protein (CP) and decrease water-soluble carbohydrate (WSC) content (Coblentz *et al*., 2017)). Such effects may be advantageous for the production of higher DM yields for silage, while improving, or at least maintaining herbage nutritive quality.

Pennisetum pedicellatum (Trin.) belongs to the *Poaceae* family and tribe *Paniceae*. It is annual and commonly known as *Kyasuwa* grass. It is also indigenous and occurs naturally in tropical and subtropical Africa (Bogdan, 1977). The grass is palatable and could be fed fresh, as silage or directly grazed on the field (Woodard *et al*., 1991). Information on the yield and nutritive value of this grass as influenced by nitrogen level are not available or scarce in the study area, hence this study was designed to evaluate the effect of nitrogen levels on forage yield and quality of *Pennisetum pedicellatum* (Trin.) in Gashua, Yobe state Nigeria.

MATERIALS AND METHODS

Experimental site

The experiment was conducted during the 2019 rainy season at the Teaching and Research Farm of the Department of Animal Science, Federal University Gashua, Yobe. The major vegetation type of the area is the Sahel savannah, it consists of open thorny savannah with short trees and grasses. It is located between longitudes 10° 02' and 11° 11'E and latitudes 12° 48' and 12° 88' N. The climate is characterized by high temperature and seasonal rainfall and the mean minimum temperature ranges between 10 -12°C in December/January, while the mean maximum is about 34-40°C in March-May. The mean rainfall is between 300-500 mm per annum and is unimodal and lasts mostly from June to September while the dry season starts from October to May (NEAZDP, 2015). The soil characteristic in the study area was sandy loam, very low in organic carbon (1.344 g/kg) an nitrogen (0.21 g/kg), moderate in available phosphorus (9.81 g/kg) and high in exchangeable potassium (1.71 cmol/kg)

Land Preparation, Experimental Layout and Treatments

A land area of 12m x 9m was used for the experiment. The field was cleared, ploughed and harrowed to provide a clean seedbed for the ease of planting and germination. The plot was divided into three main plots and replicated three times measuring 3m x 2m and 1m in-between the plots in a Randomized Complete Block Design (RCBD).

Biomass yield (kg DM/ha)

Plants within 0.5 m^2 quadrant in the plots were cut at 10 cm above the ground level with a sickle to determine the forage yield at eight weeks after sowing. The cut forages were immediately weighed to determine fresh weight after which they were oven-dried at a temperature of 65^oC for 48 h to determine the forage dry matter yields. Forage dry matter yields were calculated using the formula reported by Akpensuen *et al*. (2019) as stated below:

Forage dry matter yield (kg DM ha-1) = Fresh weight (kg) x Oven dried weight (DM%) × 40,000
There are 40,000 quardrat (0.5m-2) per hectare

Chemical analysis

Forage was collected, processed and analysed for dry matter by oven drying at 60^oC for 48hours. Nitrogen Free Extract (NFE) was determined by calculation [NFE = 100 - (%CP + %CF + %EE + %Ash)]. Nitrogen was analyzed by the Kjeldahl method (AOAC, 2005) and crude protein calculated as %CP = %N *6.25, ash by burning in a furnace at 550^oC for 3 hours and crude fat by soxhlet extraction according to A.O.A.C. (2005) method.

Statistical analysis

The results obtained were subjected to analysis of variance using General Linear Model Procedure (Proc. GLM) of SAS (2005). Significant ($P<0.05$) differences among treatment means were compared by using Duncan Multiple Range Test (Duncan, 1955) of the SAS package.

RESULTS AND DISCUSSION

The forage yield of Kyasuwa (*Pennisetum pedicellatum* Trin.) was affected by the application of nitrogen fertilizer (Table 1). Application of 150kg N/ha rate increased ($P<0.05$) forage yield which was 27.17 % higher than with 100kg N/ha. The increase in forage yield with increased nitrogen level could be attributed to the production of taller plants with maximum photosynthetic areas (Mbahi and Gende, 2016; Subrahmanya *et al*., 2017). Kumar *et al*. (2015) reported that fertility level of 150kg N/ha should be used to obtain maximum fodder yield. This agrees with the report of Shahin *et al*. (2013) who recorded increase in fresh and dry forage yield with increasing levels of nitrogen fertilizer application. Similar results were also obtained by Bhilare *et al*. (2010) and Ayub *et al.* (2017). The mean (3408.16 kg/ha) dry matter yield observed in this study was higher than the value (3010kg /ha cut at 8weeks after sowing) reported by Mbahi and Gende (2016).

The crude protein (CP) content increased ($P<0.05$) with increasing level of nitrogen fertilizer with the highest CP value observed (19.94%) in treatment receiving 150kg N/ha (Table 1). It implies that as the level of nitrogen increases the CP content increases, this is because nitrogen promote rapid

growth, chlorophyll formation and protein synthesis. The result corroborates with that reported by Meena *et al.* (2017) who reported that the crude protein content of grasses significantly increases with the addition of urea fertilizer. Crude protein content obtained in this study was higher than the one (7.81%) reported by Mbahi and Gende, (2016).

There was significant (P<0.05) increase in ash concentration as the levels of nutrient increase up to 150kg N/ha. The maximum level of ash (17.54%) was recorded at 150kg N/ha fertility rate. The crude fibre, ether extract and nitrogen free extract concentration within the forage were affected negatively by nitrogen fertilization. The least values for CF (27.58%) and NFE (22.87%) were recorded in plots fertilized with 150kg N/ha. This might be due to higher crude protein content of *Pennisetum pediacellatum* at higher nutrient levels and protein content is negatively correlated with crude fibre. This agrees with reports of VanSoest (1982) and Coblentz *et al*. (2017) that nitrogen fertilizer results in increased concentration of CP with concomitant reductions in water-soluble carbohydrates and crude fibre.

Table 1. Effect of Nitrogen Levels on Forage Yield and Quality

Parameters	**Nitrogen level**			
Forage yield (kg /ha)	**100kg N/ha**	**125kg**	**150kg**	**SEM**
Fresh forage yield	21,444.00^{c}	25,778.00^{b}	29,444.00^{a}	2,276.00*
Dry forage yield	2,788.00^{c}	3,609.00^{b}	3,828.00^{a}	308.84.00*
Proximate compositions (%)				
Dry matter	18.30^{c}	20.17^{b}	21.02^{a}	0.40*
Crude protein	17.19^{b}	17.20^{b}	19.94^{a}	0.34*
Crude Fibre	32.11^{a}	29.91^{b}	27.58^{c}	0.66*
Ether extract	1.15^{a}	1.09^{b}	1.07^{c}	0.01*
Ash content	15.16^{c}	16.96^{b}	17.54^{a}	0.26*
Nitrogen free extract	34.06^{a}	34.84^{a}	22.87^{b}	7.54*

Means followed by similar letters within a row are not significantly different

CONCLUSION AND RECOMMENDATION

The result of this study indicated that application of 150kg N/ha gave highest fresh (29,444kg/ha) and dry (3,827.8kg/ha) weights, crude protein (19.94%) and ash (17.4%) contents whereas 100kg N/ha fertility level had relatively higher crude fibre (32.11%) and nitrogen free extract (34.06%). It is therefore, recommended that 150kg N/ha fertilizer rate be used for enhanced forage productivity and better animal performance in Gashua, Yobe State.

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