HP
Hummingbird Publications
Journal of Agriculture & Agricultural Technology
www.hummingpubng.com
JAAT 2019
© December, 2019
Vol. 19 No. 1

Effect of Nitrogen Fertilization and Spacing on Growth (Plant Height) of Rhodes Grass (*Chloris Gayana* Tan) in the Dry Sub Humid Zone of Sokoto Nigeria

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Keyword: *CAPAR, Plant height, Rhodes grass, Nitrogen fertilizer and inter row spacing*

Abstract

Ruminant livestock in Nigeria depends largely on natural grasslands that are nutritionally poor due to low potential for natural forage production. Therefore, in order to meet the feed requirements of the ruminants animals in Nigeria; there is need to increase the forage production in the savanna zones of the country. A field experiment was conducted during the 2016 and 2017 rainy seasons at Centre for Agriculture and Pastoral Research (CAPAR) of the Usmanu Danfodiyo University Sokoto, Nigeria to study the effect of nitrogen fertilizer and inter row spacing on growth of Rhodes grass. Five nitrogen fertilizer levels (0, 100, 120, 140 and 160 kgNha^{-1}) and three inter row spacing (30, 50 and 70cm) were used, making fifteen treatments combinations, which were laid out in a RCBD replicated four times. The result reveals that application of 160 kgNha^{-1} consistently recorded higher values (P<005) for the plant height of Rhodes grass in the study area as compared to 0 kg Nha^{-1} which produces significantly (P>005) lower plant heights. Inter-row spacing of 70cm showed superiority among the treatments on the

plant heights measured compared to 50 and 30cm spacings. It can be concluded that application of 160 kgNha-^{1} and 70 cm spacing gave higher ($P<0.05$) plant height of Rhodes grass in the study area and thus it's believe that increase in plant height is accompanied with an increase in number of leaves, leave width, number of leaves and the herbage yield respectively.

Introduction

Forage production is gaining more attention in the tropics and subtropics; in both the developed and the developing countries. New species, varieties and cultivers of forage and pasture plant have been introduced from areas and countries rich in forage and pasture species to a distant areas where they are scarce. Forage production is very important because it is a basic source of energy for growth maintenance and production of livestock and livestock products. In Nigeria ruminant livestock includes; 52.5 million Cattle, 33 million Sheep and 16.2 million Goat, (FAO 2009a).

Ruminant livestock in Nigeria depends largely on natural grasslands that are nutritionally poor. The savanna zone of Nigeria, characterised by low annual rainfall of shorter duration, lighter sandy soils and longer dry season, has low potential for natural forage production (Umunna and Iji 1993; Adamu and Odion, 2002).

Therefore, in order to meet the feed requirements of the ruminants animals in Nigeria; there is need to increase the forage production in the savanna region of the country. Thus dependence on natural pasture that provides the cheapest source of nutrients for ruminants has resulted in failure to meet the nutritional demands of livestock throughout the year.

The increasing demand for animal and animal related products can be met through the use of improved pasture species to satisfy animal's dietary requirements.

Rhodes grass (*Chloris gayana Kunth*) is a summer growing, stoloniferous perennial whose runners provides herbage from infertile sand to fertile Brigalow clays. It is difficult to establish and persistent on heavy cracking

clay soil (Reed 1976). It grows on a wide range of soils and is found in open woodland and grassland, riverine, lake margin and seasonality waterlogged plains (FAO 2009b). Rhodes grass is one of the best grasses for rotation land in tropical and subtropical areas, useful for establishment of pasture lays. It is suitable for silage and hay liked by all kinds of stock.

Materials and Methods

Experimental Site

The study was conducted at the Center for Agriculture and Pastoral Research (CAPAR) of Usmanu Danfodiyo University, Sokoto. The farm is geographically located on latitude 12°45^{l}N and longitude 5°25^{l}E and on 350m altitude. The farm is situated at 33 kilometers away from Sokoto metropolis by the south, along the Sokoto-Gusau road, in Dange-Shuni local government area of Sokoto State, Nigeria. (CAPAR 2010). Dabagi farm falls within the Sudan-Savanna vegetation zone. Isah and Shinkafi (2000). The climate is characterized by alternating wet and dry seasons. The rainy season starts normally in June/July and ends in September with approximate annual rainfall of 500 - 900 mm with wide inter annual variations, (SERC, 2010). The total annual rainfall during the 2016 and 2017 were 663.42 mm and 606.18 mm respectively.

Treatment and Experimental Design

The treatments for this research consisted of five Nitrogen fertilizer levels (0, 100, 120, 140, and 160Kg/ha) and three inter row spacings (30, 50, and 70cm), which were combined factorially and laid out in a randomized complete block design (RCBD) replicated four times.

RESULTS AND DISCUSION

Growth Performance

Plant Height

Results on mean plant height of Rhodes grass as influenced by nitrogen fertilizer and inter row spacing during 2016 and 2017 rainy season and the years combined is presented in Table 1. The result showed that plant height increased generally with age of the plant from 3.45 cm at 3 WAS to 180.00 cm at 12 WAS. Fertilizer application had significant effect ($P<0.05$) on plant

height at 3, 6, 9 and 12 WAS, during 2016, 2017 rainy season and the years combined results.

The significant ($P<0.05$) effect of nitrogen fertilizer on plant height of Rhodes grass observed from 3 to 12 WAS in this study (Table 1) is similar to the result reported on Rhodes grass by Abass (2007) and Saad (2009) in Sudan, Yisehak (2008) in the Savanna region of Ethiopia, and Aderinola *et al.* (2011) on *Andropogon tectonum* in the derieved savanna zone of Nigeria. They all reported taller plants from plots treated with nitrogen fertilizer. The taller ($P<0.05$) plants of Rhodes grass obtained at 12WAS (180.0 cm) from application of 160 $kgNha^{-1}$ during 2016 and 2017 trials and the years combined (Table 1) indicated that the higher nitrogen fertilizer dose was required to produce tall Rhodes grass plants in the study area.

Inter row spacing showed no significant effect ($P>0.05$) on plants height at 3WAS in the 2016, 2017 and the years combined results. However, significant ($P<0.05$) effect was observed at 6, 9 and 12WAS in the 2016, 2017 and the years combined results. At 6WAS, the wider inter row spacing of 70cm and 50cm recorded taller ($P<0.05$) plants compared to the 30cm spacing. Similarly at 9 and 12 WAS, the wider inter row spacing of 70cm produced taller ($P<0.05$) plants in 2016, 2017 and the years combined compared to the 50 and 30 cm spacings. The significant ($P<0.05$) effect of inter row spacing on plant height of Rhodes grass observed from 6 to 12 WAS in this study (Table 1) is in line with the reports by several authors (Martin and Snaydon 1982; Murtagh 1986; Obi 1991; Bertoria e*t al,,* 1998; Karaaslan *et al.,* 2007; Kutu and Asiwe, 2009) that plant spacing is an important agronomic attribute that has effect on light interception by plant during which photosynthesis takes place. The taller ($P<0.05$) plants of Rhodes grass obtained from the wider inter row spacing of 70 cm during 6 - 12WAS in the 2016, 2017 and the years combined (Table 1) is in line with the findings by Bertoria e*t al,* (1998) that plant growth rate was higher at wider spacing than when plants were closely planted. Obi (1991) noted that optimum spacing enable plants to utilize more effectively the soil moisture and nutrient, and avoid excessive competition among the plants. Thus, the wider (70 cm) inter row spacing was required to produce taller Rhodes grass plants in the study area. Similar results were also reported by Kutu and Asiwe (2009) on Cowpea in the humid zone of Nigeria, Nandita *et*

al. (2009) on Sesame in the dry land areas of South Africa, and Miah *et al.*, 1990) on *Nizersail mutants* in the dry sub humid zones of Bangladesh.

Table 1: Plant height of Rhodes grass at 3, 6, 9 and 12WAS as affected by nitrogen fertilizer levels and inter row spacing during 2016 and 2017 rainy seasons and the years combined in the dry sub humid zone of Sokoto, Nigeria

	3WAS			6WAS			9WAS			12WAS		
TREATMENTS	**2016**	**2017**	**Combine**	**2016**	**2017**	**Combine**	**2016**	**2017**	**Combine**	**2016**	**2017**	**Combine**
FERTILIZER (F) (KGNHA^{-1})												
0 (F0)	1.53^{d}	1.60^{d}	1.56^{d}	40.20^{e}	31.71^{e}	33.43^{e}	67.50^{e}	59.20^{e}	63.30^{e}	88.90^{e}	83.40^{d}	86.90^{e}
100 (F1)	2.40^{c}	2.34^{c}	2.37^{c}	69.22^{d}	63.25^{d}	66.23^{d}	101.00^{d}	96.90^{d}	98.90^{d}	127.40^{d}	127.80^{c}	127.60^{d}
120 (F2)	2.47^{c}	2.77^{b}	2.62^{c}	87.29^{c}	80.64^{c}	83.96^{c}	124.60^{c}	122.00^{c}	123.30^{c}	141.10^{c}	141.60^{b}	142.50^{c}
140 (F3)	3.64^{a}	3.27^{a}	3.45^{a}	92.11^{b}	88.53^{b}	90.32^{b}	146.50^{b}	151.60^{b}	149.00^{b}	167.40^{b}	173.40^{a}	170.90^{b}
160 (F4)	3.18^{b}	3.19^{a}	3.18^{b}	96.99^{a}	95.30^{a}	96.14^{a}	160.80^{a}	162.90^{a}	161.90^{a}	179.90^{a}	180.10^{a}	180.00^{a}
LSD	0.402	0.326	0.357	7.034	2.846	2.424	9.459	3.872	5.068	8.805	7.136	5.185
SIGNIFICANCE	*	*	*	*	*	*	*	*	*	*	*	*
SPACING (S) (CM)												
30 (S1)	2.69	2.66	2.67	72.17^{b}	66.89^{c}	69.53^{c}	113.10^{b}	107.90^{c}	110.50^{c}	136.50^{b}	135.00^{b}	136.10^{b}
50 (S2)	2.53	2.76	2.65	79.60^{a}	72.18^{b}	74.37^{b}	118.90^{b}	120.60^{b}	120.20^{b}	139.00^{b}	137.90^{b}	138.90^{b}
70 (S3)	2.71	2.48	2.59	79.71^{a}	76.59^{a}	78.15^{a}	128.20^{a}	127.10^{a}	127.10^{a}	147.20^{a}	150.90^{a}	149.70^{a}
LSD	0.311	0.253	0.195	5.448	2.205	2.424	7.327	2.999	3.926	6.820	5.527	4.016
SIGNIFICANCE	NS	NS	NS	*	*	*	*	*	*	*	*	*
INTERACTION												
F * S	NS	NS	*	NS	*	*	*	*	*	*	*	*

Means within a column for factor followed by the same letters are not statistically different using Least Significant Difference (LSD) at 5% level of probability

* = Significant at 5% probability level, NS = not significant at 5% probability level.
F= Fertilizer, S = Spacing,
F*S = Interaction between Fertilizer and Spacing, WAS = Weeks after Sowing

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