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EFFECT OF DEFOLIATION FREQUENCY ON HERBAGE YIELD AND QUALITY OF RHODES GRASS (*Chloris gayana*) IN JOS, PLATEAU STATE, NIGERIA

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Abstract
An experiment was conducted to determine the effect of defoliation frequencies on dry matter yield and quality of Rhodes grass (*Chloris gayana*) in Jos, Plateau State, Nigeria. The experimental treatments were three cutting frequencies; cut 1 (T1), cut 2 (T2) and cut 3 (T3) with six weeks cutting interval between each cuts. The Completely Randomized Design (CRD) was used with three replicates per treatment. Results revealed that, Dry matter yield, Fresh biomass yield and plant cell wall constituents viz. NDF, ADF, Lignin and Hemicellulose contents decreased significantly ($P < 0.05$) from T1 to T3. However,crude protein (CP), Ash and EE contents increased significantly ($P < 0.05$) from T1 to T3. The various mineral elements as well as the dry matter intake (DMI), dry matter digestibility (DDM), relative feeding value (RFV) and total digestible energy (TDN) contents also increased ($P < 0.05$) from T1 to T3. CP content increased from 9.1 in T1 to 12.1% in T3, DDM content increased from 57.9 in T1 to 61.6 % in T3 and TDN content from 50.5 in T1 to 56.0% in T3, respectively. The study has shown that harvesting *Chloris gayana* at later cuts provided more better quality and digestible nutrients which exceeded the minimum trace hold of 7% required by ruminants for body maintenance. Therefore, the forage crops could be grown and harvested up to three cuts within a growing season in Jos, Nigeria.
Key words:*Chlorisgayana,* Defoliation, Frequency, Herbage, Nutrient composition

INTRODUCTION

According to Prakash (1989) *Chloris gayana* is one of the improved pasture species in Nigeria and it has been increasingly cultivated over the years in the country due to its high dry matter yield, favorable economics of cultivation, and superiority over other perennial forage grasses. *Chloris gayana* (Rhodes grass)is suited to both rain-fed and irrigated pastures. NRCS (2006) stated that to curb the perennial problem of weight loss by ruminant livestock in the dry season, there is the need to raise their plain of nutrition in the critical months of the year. This can be achieved by maximizing grass production in the wet season and conserving in order to provide feed of reasonable quality to livestock in the dry season. In Nigeria, there isa paucity of literature on the cutting frequencies and quality in various agro-ecology zones. Therefore, the study was designed to evaluate the effect of cutting frequencies on the yield and quality of *Chloris gayana* in Jos, Plateau State, Nigeria.

MATERIALS AND METHODS

The study was carried out at Federal College of Forestry, Jos North Local Government Area, Plateau State, Nigeria. The experimental design was a Completely Randomized Design (CRD). The land area was 6.5mX8m, while the size of the plots was 1.5m X 1m. The experimental treatments were three (3) cutting frequencies with six (6) weeks of cutting interval starting from June 2020 and ending September, 2020. The experimental treatments were replicated three (3) times and the distance between the replication was 1.5m. The experimental plots were established in 2019. After every defoliation of the plant, NPK 20: 10: 10 was applied at the rate of 150kg/ha, 10-20kg/ha and 25kg/ha respectively. The experimental plots were hand weeded during the trial period when necessary.

Forage dry matter yield was determined using 0.25m² quadrant. All plants within the quadrant were cut at 5cm above the soil. After defoliation, the plants were weighed immediately to estimate fresh weight per hectare using a digital scale. Sub-samples were oven-dried at a temperature of 55^0C until a constant dry weight was obtained. The dried sample was used to estimate dry matter yield per hectare. Dried samples

were ground using mortar and pestle. Proximate analysis was carried out using the method of AOAC (1990), Detergent fiber analysis was carried out using the method of Van Soest *et al.*, (1991), while mineral analysis was done using the method of absorption spectro-photometer of AOAC (1990). Samples were analyzed at the Department of Animal Science and Department of Soil Science, Ahmadu Bello University, Zaria Nigeria

The prediction of dry matter intake and digestibility was done using prediction equations by Schroeder (1994) as stated below:

Percentage of dry matter intake (DMI) = 120 ÷ %NDF

Total digestible nutrient (TDN) = 88.9 – (0.79 X ADF)

Percentage digestible dry matter (DDM) = 88.9 – (ADF % X 0.779)

Relative feed value (RFV) = (% DDM X % DMI) ÷1.29

All data generated were subjected to analysis of variance (ANOVA). The general linear model of SAS (2001) statistical software was used for the analysis and means were separated using Tukey

RESULT

The result of fresh Biomass yield and dry matter yield is presented in Table 1. Fresh biomass yield was higher (P<0.01) at cut 1 (29.4 t/ha) compared with the other cuts, while there was no difference (P>0.05) between cut 2 and cut 3. Similarly, cut 1 has the highest (P<0.01) yield of dry matter (5.4 t/ha), while cut 3 produced the lowest yield (2.5 t/ha).The result of proximate and detergent fiber composition contents at different cutting frequencies is presented in Table 2.CP, ASH and EE contents increased significantly (P<0.01) in the order T1>T2>T3. There was however a significant decrease (P<0.05) in ADF, NDF and Lignin contents with the highest value recorded in cut 1 and the lowest in cut 3.This shows that ADF, NDF and Lignin content decrease with increasing defoliation frequency. Hemicellulose content was higher at cut 1 (30.4%) compared with the other cuts, while there was no difference between cut 2 and cut 3.DMI, DDM, RFV and TDN shows a significant difference (P<0.01) for the three cuts in the order TI<T2<T3 with the lowest value recorded in cut 1 and the highest in cut 3.The result of Dry Matter Intake, Digestible Dry Matter, Relative Feed Value and Total Digestible Nutrient content as influenced by different cutting frequencies is presented in Table 4.4. DMI, DDM, RFV and TDN shows a significant difference (P<0.01) for the three cuts in the order TI<T2<T3 with the lowest value recorded in cut 1 and the highest in cut 3.

TABLE 1: Effect of cutting frequencies on fresh biomass and dry matter yield of *Chloris gayana* (t/ha).

YIELD	CUT1	CUT2	CUT3	SEM	P-value
FBY (t/ha)	29.4[a]	13.5[b]	10.5[b]	2.06	0.0035
DMY (t/ha)	5.4[a]	3.8[b]	2.5[c]	0.51	0.0209

[abc]Means with different superscripts within a row are significantly different, FBY=Fresh Biomas Yield, DMY=Dry Matter Yield, SEM= Standard Error of Mean

The reduction in DM yield with from first to third cut harvest may be due to increase in leaf proportion over the stem components, thus reducing whole plant DM yield (Ayala Torales*et al*., 2000). Humphrey (2005) also indicated that, lenient removal of grass shoot may still reduce net photosynthetic rate and cause unrecognized reductions in the movement of assimilate to the roots and thus reduce shoot growth. Additionally, (Mealor, 2010) reported that beyond 40% leaf volume removal, root growth by grass species begin to decline, and if root system is disturbed, aboveground production also suffers.The highest CP of *Chloris gayana* was obtained in Cut 3 (12.1%) indicating that the crop was of good quality and is above 7.6% CP required for maintenance as reported by (El-hag and El-kjanjari, 1992; and Osuga*et al*., 2012). However, the CP value for cut 1 (9.1%) and cut 2 (10.2%) were lower than 11% obtained by (Mc Donald, 2002). Increasing the number of cuts increased CP content because sward turns to be relatively leafy (Ayala Torales*et al*., 2000). The high CP content in this study is an indication that the hay is of good quality and is above the 7% CP required for microbial protein synthesis in the rumen that can support at least the maintenance requirement of ruminants (Van Soest, 1994; Minson,1990), and also within the range of 7.5-

15.45% reported for natural pasture(Yihalem, 2004).The highest value for Ash was recorded as (7.1 % in cut 3)which is lower than 9.4% as obtained by (El-hag and El-kjanjari, 1992).

TABLE 2: Effect of cutting frequencies on proximate analysis and detergent fibre content of *Chloris gayana*.

PARAMETERS (%)	CUT1	CUT2	CUT3	SEM	P-value
CP	9.1^{c}	10.2^{b}	12.1^{a}	0.11	<.0001
Ash	6.1^{c}	6.4^{b}	7.1^{a}	0.06	<.0001
ADF	39.9^{a}	37.2^{b}	35.1^{c}	0.67	0.0070
NDF	70.2^{a}	65.6^{b}	63.3^{c}	0.18	<.0001
Lignin	7.1^{a}	6.5^{b}	5.6^{c}	0.12	0.0003
Hemicellulose	30.4^{a}	28.3^{b}	28.2^{b}	0.67	0.0070
EE	1.8^{c}	2.3^{b}	3.1^{a}	0.06	<.0001

^{abc}Means with different superscripts within a row are significantly different, CP= Crude Protein, ADF= Acid Detergent Fiber, NDF= Neutral Detergent Fiber, EE= Ether Extract, SEM= Standard Error of Mean.

TABLE 3: Effect of cutting frequencies on DMI, DDM, RFV and TDN of *Chloris gayana*.

PARAMETERS (%)	CUT1	CUT2	CUT3	SEM	P-value
DMI	3.0^{c}	3.2^{b}	3.4^{a}	0.06	0.0082
DDM	57.9^{c}	59.9^{b}	61.6^{a}	0.52	0.0070
RFV	135.1^{c}	150.1^{b}	163.4^{a}	4.10	0.0082
TDN	50.5^{c}	53.5^{b}	56.0^{a}	0.77	0.0070

^{abc}Means with different superscripts within a row are significantly different, DMI= Dry Matter Intake, DDM= Digestible Dry Matter, RFV= Relative Feed Value, TDN= Total Digestible Nutrient, SEM= Standard Error of Mean.

The decrease in fibre contents and increase in DMD from cut1 to cut3 obtained in this study agreed with the reports of Lacefield (1988), Schroder, (1994) as well as Jeranyama and Garcia, (2004) that as the fibre content increases, digestibility of forages decreases.. The variation among TDN value depends on the ADF concentration of the forages, and as ADF percentage increases, TDN declines (Albayrak *et al.*, 1990). The DMI, DDM, RFV and TDN also increased from first to third cuts.

CONCLUSION

From the study, it is concluded that three cuts could be obtained in a growing season in Jos, Nigeria with total yield of about 11.7 t/ha. This could be of immense value for forage budgeting for farmers on the Jos plateau cultivating *C. gayana*. The CP at the different cuts can meet the threshold of 7 % in ruminants for maintenance.

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