Short-Term Grazing Behavior of White Fulani Calves as Affected by Grazing Cycle, Plant Spacing, and Species

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ABSTRACT

The aim of this study was to investigate the behaviors of White Fulani (WF) calves on two tropical grasses (*Megathyrsus maximus* and *Cenchrus purpureus*) subjected to two plant spacing (0.5 m x 1 m and 1 m x 1 m) and four 3-weekly grazing cycles (1st, 2nd, 3rd, and 4th). The experiment was laid in a split-split-plot design with the grass species allotted as the main plot, the plant spacing as the sub-plot, and the grazing cycle assigned as the sub-sub plot to give sixteen treatments and replicated three times. Calves' behaviors (grazing, walking, standing, collision, grooming, and foot stamping) were monitored with the aid of digital video recorders and water-proof closed circuit television cameras fixed for each plot.

There was significant difference in the time spent grazing as the calves on *M. maximus* plots spent more time (6967 sec) grazing and then those on the *C. purpureus* plots. Calves grazed more on 0.5m x 1m plots (6779 sec) than 1m x 1m. At the 3rd 3week grazing cycle, calves spent 97% of their time (7003 sec) grazing which was the longest grazing time of all the cycles. The calves had more time walking during the 4th grazing cycle than other cycles and it was however observed that calves walked more on 1 m x 1 m plots as well as *C. purpureus* plots. The standing times were more pronounced with the calves during the 1st grazing cycle, 1 m x 1m as well as on the *C. purpureus* plots. There is a clear indication that the grazing time of white Fulani calves is inversely related with other behavior parameters thereby this can be said to lead to a good grazing management of tropical grasses.

(Keywords: calves, grooming, forages, grasses, tropical)

INTRODUCTION

The cattle breed called white Fulani has been reported as the most abundant Nigerian cattle breeds with socioeconomic importance (Tawah and Rege. 1996). White Fulani cattle are milk, meat and draught type but are majorly reared by their traditional owners for milk purposes (Olutogun, 1976). Tropical grasses (*Megathyrsus maximus* and *Cenchrus purpureus*) has been known to be the most cheapest and economical ruminant animal feed, especially during the grazing season.

For the effective utilization and management of these grasses, studying the grazing behavior of cattle is essential which will help in good management of the pasture. Effective grazing management has been reported as an important tool in manipulating pasture and animal performance (Lee Rinehart, 2008). Increase in yield and animal intake has been affirmed by Stobbs (1975) to be because of good pasture and grazing management.

The ease of harvesting forages by cattle is dependent on the accessibility and the quality of the forage which determines time spent grazing and in performing other grazing behaviors (Minson, *et al.,* 1976).

Sward structure and feed preference has been reported to be the major factor that influence herbage intake in grazing animals (Dumont and Boissy. 2000). Further research has been conducted on feed intake of cattle which revealed that cattle strive to meet their daily feed intake when subjected to competition for space and time which prompted cattle to either increase or decrease their grazing time to achieve their daily intake (Lang, 2009). The quantity and quality of

green forage material is directly proportional to intake rate meanwhile, grazing animals alternate their behavior when sward conditions are disturbed to compensate for their daily intake requirement (Gibb and Orr, 1997).

Senescence, grazing or defoliation has been reported by Mezzalira *et al.* (2014) to be factors responsible for changes in the condition of sward and this change in sward condition is as well related to animal behavior.

MATERIALS AND METHODS

The experiment was carried out at the Cattle Production Venture Unit of the Federal University of Agriculture, Abeokuta located in Ogun State, Nigeria. The site was established 2019. At the commencement of this experiment, the grasses were cut back to height of 15cm above ground surface and NPK fertilizer was applied at the rate of 120kgN to stimulate growth. *Megathyrsus maximus* and *Cenchrus purpureus* commonly known as Guinea grass and Elephant grass respectively are the tropical grasses that were involved in this experiment.

Estimation of Pre-Grazing Dry Matter Yield

Prior to grazing herbage materials within the range of 1m x 1m quadrat at the different grazing cycle throughout the experimental period was clipped. The quadrat was thrown three times per replicate. The dry matter percentage was estimated as: Dry matter percentage = Weight of dry sample/weight of fresh samples x 100, While dry matter yield was estimated = dry matter percent x fresh sample from 1 m^2 which afterwards was extrapolated in tonnes per hectare.

Experimental Design

The experiment was laid in a 2 x 2 x 4 split-split plot design with 2 plant species (*Megathyrsus maximus* and *Cenchrus purpureus),* 2 plant spacing (0.5m x 1m and 1m x1m) and 4 3week grazing cycles (1^{st}, 2^{nd}, 3^{rd} and 4^{th}) with three replications. The grazing cycles are as in Table 1. This experiment involved twelve (12) white Fulani yearling calves which were randomly selected from the herd. Each of the sub-sub plots had an estimated area of 55 m^2. Grazing activities of calves lasted for 2hours for 3days for a period of twelve weeks and their behaviors were recorded with digital video recorder and water-proof closed circuit television camera erected on iron rods fixed on each plot. Recorded behaviors (grazing, walking, standing, collision, grooming and foot stamping) were playbacks with Behavioral Observation Research Interactive Software as in Table 2 and the time budget analysis of each behavior was extracted and was subjected to analysis of variance which was presented graphically.

The authors complied with the ethical guidelines of the College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta Nigeria committee on the use of animals for experiment.

Table 1: Chart of the 3-Weekly Grazing Cycles.

Date	Grazing Cycle
16th April, 2020	Cutback date
7-9th May, 2020	First
28-30th May, 2020	Second
18-20th June, 2020	Third
9-11th July, 2020	Fourth

Table 2: Ethogram of Behavior Parameters in the course of Observation.

Behavior	Description
Grazing	Calves were considered grazing when forages are harvested and chewed
Walking	Movement of calves from one place to the other with head up
Standing	Standing/idling on a spot without chewing
Collision	Head butting against other calves
Grooming	Licking of self
Foot stamping	Forceful placement of the hind leg on the ground

RESULTS AND DISCUSSION

Grazing cycle and species affected the dry matter yield (DMY) of the forages whereas spacing had no effect on dry matter yield in this study (Figure 1). There was an increase in the DMY from 1^{st} to 3^{rd} grazing cycle but declined at 4^{th} grazing cycle. At 2^{nd} and 3^{rd} grazing cycles, the DMY were statistically similar with 4.6044 and 4.0418 t/ha, respectively. This could be related to the reduction in tiller energy reserves which was due to the frequent defoliation or grazing (Donaghy and William, 2006). The dry matter yield of

Megathyrsus maximus was more than (4.2735 t/ha) *Cenchrus purpureus* dry matter yield (3.1045 t/ha) in this study. This was not in accordance with the findings of Munyasi *et al.* (2015) who reported that *C. purpurues* yielded more than *M. maximus*, this could be due to the topography of the experiment site which is upland which favored *M. maximus* that could thrive where the land is less moist as well as having a lesser regrowth potential (Mannetje, 1992; Francis, 2004). Similar results was obtained for 0.5 m x1 m and 1 m x 1 m plant spacing plot which indicated that spacing had no effect on the dry matter yield of the forage.

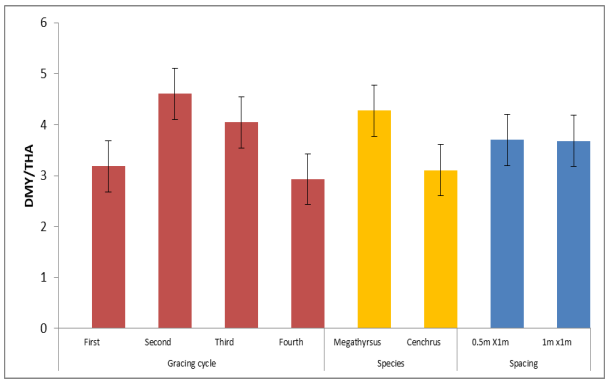

Figure 1: Effect of Grazing Cycle and Plant Spacing on the Dry Matter Yield of Two Tropical Grasses.

Time spent grazing was affected ($p<0.05$) by grazing cycle, such that grazing time increases from first to third (87%, 93%, and 97%) grazing cycle except for the fourth grazing cycle (91%) where there was a decline in grazing time. The increase in grazing time from first to third grazing cycle can be attributed to the fact that the calves are accustomed to the grazing activities, while the declined at fourth grazing cycle was as a result of reduced herbage yield. Bethwell *et al.* (2011) reported that high herbage yield may extend time spent grazing (Figure 2).

Grazing behavior was exhibited most on 0.5m x 1m plot (94%) by the calves when compared with the 1m x 1m plot (90%). This was as a result of densely herbage yield on 0.5m x 1m which is in line with the findings of Jimoh *et al* (2017). *Megathyrsus maximus* was mostly grazed (96%). This shows a level of preference the calves had for *M. maximus*, this can be related to the report of Kenney and Black (1984) that plant selection can possibly be affected by physical characteristics, palatability, accessibility and digestibility.

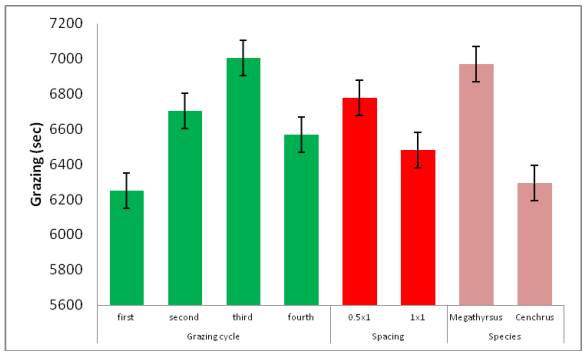

Figure 2: Effect of Grazing Cycle, Plant Spacing, and Species on Grazing time of WF calves.

In Figure 3, the walking time was significantly affected ($p<0.05$) by the grazing cycle, spacing and species. The walking time was inversely proportional to grazing time. As grazing time increases from first to third grazing cycle, walking time decreases (183.28 sec, 134.48 sec, and 48 sec), respectively. Meanwhile, the reverse was the case for fourth grazing cycle where 219.23 sec was used by the calves moving from one place to the other. Calves walked more on 1m x1m plot, this was as a result of reduced time spent grazing, this was in accordance with Jimoh *et al* . (2017) where he reported an increased in walking time as grazing time decreased. More walking time was recorded on *C. purpureus* plot than recorded for *M. maximus* plot which could be related to the plant specie preference of the calves.

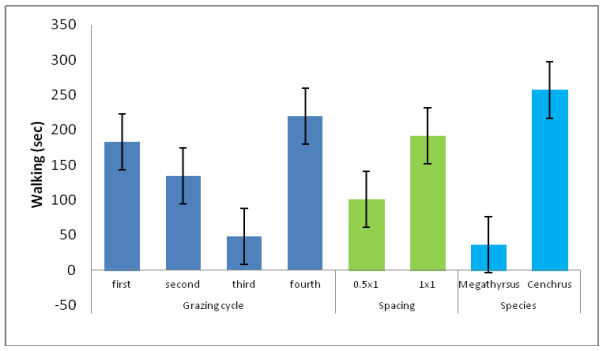

Figure 3: Effect of Grazing Cycle, Plant Spacing and Species on Walking Time of WF Calves.

In Figure 4, there is an inverse relationship between grazing and standing time. As grazing time increases from 1st to 3rd grazing cycle, standing time reduces. Which indicated that the

higher the grazing time the lower the standing time. The longest time spent standing was observed at the 1st grazing cycle with 6% out of the total time spent on the pasture. Calves spent more time standing on 1m x 1m plot and *C. purpureus* plot, this result follows the report of Jimoh *et al*. (2017) where they observed high standing time on sparsely populated plot.

Influence of grazing cycle, spacing and species on collision was shown in Figure 5 below. Collision was inversely proportional to grazing time meaning, as grazing time reduces collision behavior increases. At 1st and 2nd grazing cycle, collision time amounted to 33.95 sec and 34.89 sec, respectively which was far above the one observed at 3rd and 4th grazing cycle (0.64 sec and 5.43 sec). Similar result was observed for spacing and species. This was as a result of limited herbage yield which resulted to feed competition for the available feed (Wilson, 1975).

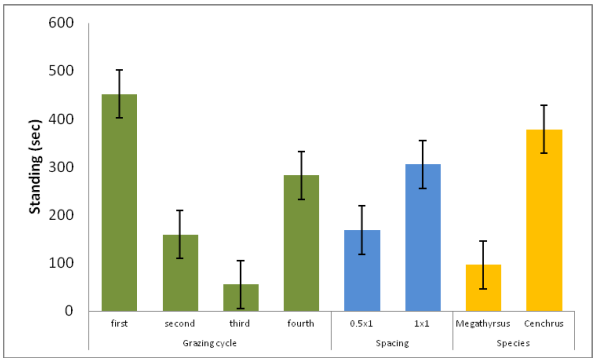

Figure 4: Effect of Grazing Cycle, Plant Spacing, and Species on Standing Time of WF Calves.

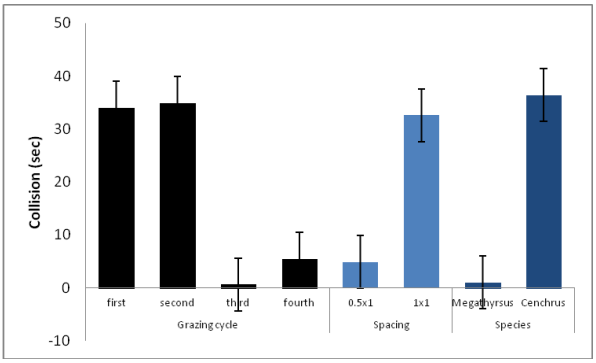

Figure 5: Effect of Grazing Cycle, Plant Spacing, and Species on Collision Time of WF Calves.

Figure 6 showed the effect grazing cycle, spacing and species had on grooming time which was significant ($p<0.05$). Grooming behavior increases as the calves were less occupied with grazing. Invariably, as grazing time increases a minimal level of grooming behavior was observed. At the 3rd grazing cycle where grazing was at the peak (97%), calves spent minute time on grooming (0.7%). Effect of spacing and species on grooming behavior was statistically the same as grazing cyle. As calves spent more time grazing on 0.5m x 1m plot and M. maximus, grooming behavior decreases. These results are in line with the observation of Toshie Ishiwata *et al.* (2008) where grooming behavior was described as an alternative behavior cattle exhibits to substitute for grazing. From their findings as well, decrease in grazing time increases the chances for carrying out oral behavior such as tongue licking and allo-grooming.

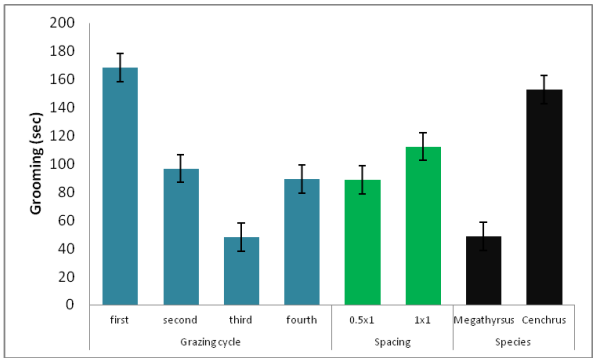

Figure 6: Effect of Grazing Cycle, Plant Spacing, and Species on Grooming Time of WF Calves.

Figure 7 is illustrated the effect of grazing cycle, spacing and species on foot stamping behavior of the calves, which was statistically affected ($p<0.05$) except for the spacing. Foot stamping behavior was carried out most (113.50sec) at 1st grazing cycle where the least grazing time was observed. It can be deducted from this result that, flies had capacity to interfer with grazing time of the calves. Brindley *et al*. (1989) reported that grazing behavior was influenced by insect harrassment in goat which subsequently, reduced their grazing/feeding time. Plant spacing had no ($p>0.05$) impart on foot stamping behaviour but the reverse was the case for species where foot stamping behavior was observed most on *C. purpureus* plot, which can

be linked with the lesser engagement of the calves in grazing beviour on this plot. This corroborate the findings of Dougherty *et al.* (1994) where the presence of stable flies, increased the herbage ingestion and reduced time spent grazing.

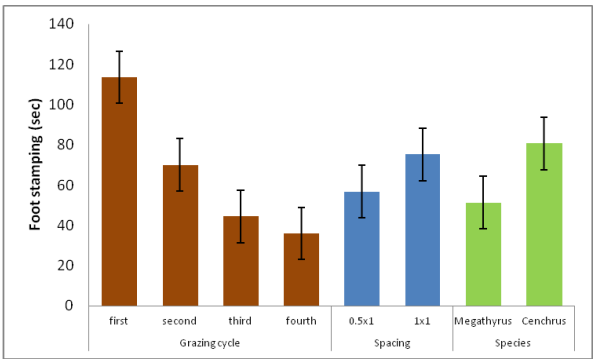

Figure 7: Effect of Grazing Cycle, Plant Spacing, and Species on Foot Stamping of WF Calves.

CONCLUSION

This study demonstrated an increase in dry matter yield from 1st to 3rd 3-weekly grazing cycle but declined at 4th 3week grazing cycle. The DM yield of *M. maximus* was found higher than *C. purpureus* DM yield while plant spacing had no influence on yield. Furthermore, grazing behavior accounted for the majority of time spent on pasture. Grazing cycle ultimately affected grazing and other behavior of the calves. As grazing time increases from 1st to 3rd 3-weekly grazing cycle, walking, standing, collision, grooming and foot stamping behavior reduces. It was also observed from this findings that spacing influenced grazing and all other behavior except foot stamping.

Calves spent more time grazing 0.5 m x 1 m walking, standing, collision, grooming and foot stamping behavior reduces but the reverse was observed on 1 m x 1 m plot. The white Fulani calves used in this study showed preference for *M. maximus* than *C. purpureus*, this in turns accounted for the more time spent grazing on M. maximus plot. In general, there was an inverse relationship between grazing and other behavior as affected by grazing cycle, plant spacing and species.

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SUGGESTED CITATION

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