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Research Article

Effect Of Sward Height and Residue on Growth Parameters and Dry Matter Yield of *Megathyrsus maximus* (Guinea grass)

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Abstract

Background and Objective: Megathyrsus maximus a major sustainable and high yielding grass in the tropics which is one of the significant uses of forages in providing quality feed for growth and productivity. This study evaluated sward height (SH) and residue (SR) effects on growth and dry matter yield of Megathyrsus maximus (MM). Materials and Methods: The study laid out as a 2 x 3 factorial arrangement in a Randomized Complete Block Design with 2 SH (80 and 100 cm) and 3 SR (10, 20 and 30 cm). All data collected were subjected to one way analysis of variance. Results: SR and SH interaction led to significant ($P<0.05$) differences in the fresh yield, dry matter yield and leaf: stem ratio. There was a decrease in dry matter yield of MM with increase in SR. Conclusion: Planting of MM at 20 cm SR and harvesting at 100 cm SH produced higher tiller numbers and dry matter yield above other treatments. Harvesting of M. maximus at 20 cm sward residue and at 100cm sward height, produced higher tiller numbers and yield.

Keywords: **Megathyrsus maximus; sward height; sward residue; tiller number; fresh yield; dry matter yield**

Introduction

Megathyrsus maximus is a major sustainable and high yielding grass in the tropics which is one of the significant uses of forages in providing quality feed for growth and productivity. In tropical Africa, traditional yield determination techniques are time wasteful and not feasible for making rapid grazing management decisions. On the other hand, field indicators of dry matter yield from sward traits could suffice as an easily understandable approach that can be carried out seamlessly [1]. However, field dry matter yield indicators must be developed under contrasting environmental conditions to effectively model the association between sward traits and dry matter changes. Maintaining high rates of forage intake, and consequently high animal performance for tropical forages, requires pastures with adequate canopy structures [2]. This is because growth beyond this point promotes sward deterioration, which is characterized by higher percentages of stem and dead material, a lower percentage of leaf and a reduced leaf-to-stem ratio, resulting in the accumulation of low-quality forage [3,4]. Factors such as frequency of cutting, species composition, climatic conditions, soil fertility and season of harvest [5] have led to low quality and yield production of forages in tropical countries. The objective

of this study is to determine the sward heights (80 and 100 cm) and residues (10, 20 and 30 cm) effects on the growth parameters and dry matter yield of M. maximus.

Materials and Methods

Study Area

The field experiment was carried out at the Pasture and Range Management Introductory Plot Unit of the Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State, Nigeria. Sourcing of Elephant grass (Megathyrsus maximus): Crown splits of Megathyrsus maximus were harvested from an already established plot. The crown splits were planted at 15 cm. The different crown splits cut was planted individually at intervals of 0.5m apart on different plots. After four weeks of growth, all grasses were cut-back to a stubble height of 15cm to allow for uniform growth across all treatments. Poles measuring 80 and 100 cm were erected on the plots on treatment basis to aid in determining when the sward reached a particular height. Sourcing of Poultry manure: Poultry feces without wood shavings were collected from Poultry unit of DUFARMS, FUNAAB as layers were raised in battery cage system and were fed with layer mash.

Poultry manure application rates: Feces were air dried for two weeks and were applied at split doses of 400 kg N/ha total dose. Two weeks after manure application, the grass crown splits were planted based on treatments. Plot layout and Experimental plot design: Total land area measuring 420 m2 (28 m x 15 m) was mapped out. The land was divided into three blocks, each measuring 3 m x 28 m (84 m^2) and total of 18 plots were mapped out each measuring 3 m x 3 m (9 m2) with a 1m buffer zone between plots and blocks. Each plot per block was demarcated as each plot comprises of forty-nine stands with 0.5 m interspacing between stands. Soil sample collection: Growth data were randomly taken each on six stands per plot across all blocks. Prior to planting, soil samples were randomly collected from the plots at the depth of 0-15 cm using soil auger.

Herbage yield determination

Herbage yield determination (fresh herbage yield, dry matter percentage and dry matter yield) was carried out.

Determination of fresh herbage yield (t/ha)

The total fresh herbage yield was determined by weighing the total herbage mass harvested from 1 x 1 m2 quadrat thrown 3 times from each plot per treatment and extrapolated to tonnes/hectare.

Determination of dry matter percentage (%)

The dry matter percentage of the harvested fresh herbage was determined in replicates. About 300 g of sub samples were weighed, oven-dried at 65 oC until constant weight was attained. After drying, the dry matter percentage was calculated using the equation below.

$$Dry\ matter\ percentage\ (DM\ \%) = \frac{Weight\ of\ dry\ sample \times 100}{Weight\ of\ fresh\ sample}$$

Statistical analysis: Data collected on growth and herbage yield of the grass per treatment were subjected to two-way analysis of variance. Treatment means were subjected to General linear model and separated using Tukey's honestly significant difference (HSD) test of the R Statistical Software [6].

Results

Table 1 shows the interactive effect of sward and residual heights on the growth indices of mega thyrsus maximus. There was significant ($p<0.05$) difference in all the parameters. The number of tillers value increased as the proportion of sward and residue height increased, while in reverse, leaf area value decreased as the proportion of sward and residue height increased. Leaf area recorded highest value at 10cm sward and residual height as the proportion of sward height and residue increased while, number of dead leaves recorded lowest value at 10cm sward and residual height as the proportion of sward height and residue increased. [7] reported similar result stating that tiller density of perennial ryegrass was lesser at a lower stubble height than that at higher stubble heights. Grass with higher sward height had higher tiller number than those with lower height. Table 2 shows the interactive effect of sward and residual heights on fodder yield (t/ha) of Megathyrsus maximus. There was significant ($p<0.05$) difference in the fresh yield t/ha, dry matter yield t/ha and leaf: stem ratio interaction of both the sward height and the residue. Dry matter yield decreased as the sward residue increased causing accumulated dry matter yield in M. maximus. This is in line with stating that perennial ryegrass in which the swards were cut at 3cm stubble height accumulated more than twice as much forage as those cut at 4cm height.

Table 1: Interactive Effect of Sward and Residual Heights the Growth Indices of Megathyrsus Maximus.

Parameters	80 cm			100 cm			SEM	P-value
	10	20	30	10	20	30		
Leaf length (cm)	75.26^{b}	74.67^{b}	75.99^{b}	80.72^{ab}	80.33^{ab}	90.38^{a}	2.49	0.003
Leaf width (cm)	3.43^{a}	2.80^{bc}	2.52^{bc}	2.92^{b}	2.57^{bc}	2.48^{c}	0.10	0.001
Leaf area (cm^2)	194.62^{a}	157.64^{ab}	144.60^{b}	178.06^{ab}	154.71^{ab}	168.04^{ab}	9.72	0.008
No of leaves	78.19^{c}	104.28^{b}	122.79^{a}	79.79^{c}	81.14^{c}	113.66^{ab}	3.16	0.001
No of dead leaves	2.40^{b}	5.51^{a}	6.56^{a}	2.39^{b}	5.76^{a}	716^{a}	0.43	0.001

No of tillers	10.33[b]	13.22[ab]	13.18[ab]	13.36[ab]	16.95[a]	16.84[a]	0.99	0.001
No of days to sward height	83.61[b]	83.65[b]	81.81[b]	102.22a	102.70[a]	100.84[a]	1.27	0.001

Table 2: Interactive Effect of Sward and Residual Heights on Fodder Yield (T/Ha) of Megathyrsus Maximus.

Parameters	80 cm			100 cm			SEM	P-value
	10	20	30	10	20	30		
Fresh Yield (t/ha)	33.02[a]	30.39[a]	19.94[b]	32.01[a]	30.30[a]	28.17[ab]	1.90	0.002
Dry matter yield (t/ha)	16.44[a]	14.89[ab]	9.82[b]	16.05[a]	14.64[ab]	13.50[ab]	1.23	0.006
DM %	49.19	48.70	49.08	49.67	47.90	47.37	1.53	0.901
Leaf: Stem Ratio	0.83[d]	1.00[c]	1.15[b]	0.83[d]	1.01[c]	1.30[a]	0.02	0.001

abc: Means with different superscripts along the same row are significant (P<0.05) SEM: Standard Error of Mean 80:10 – 80 cm sward height: 10cm – sward residue 100:10 – 100 cm sward height: 10cm – sward residue

80:20 – 80 cm sward height: 20cm – sward residue 100:20 – 100 cm sward height: 20cm – sward residue

80:30 – 80 cm sward height: 30cm – sward residue 100:30 – 100 cm sward height: 30cm – sward residue

Discussion

Decline in leaf number in lower sward residue could be as a result of decreased number of leaves available for photosynthesis to take place after clipping and this led to slower regrowth due to decline in carbohydrate reserves [8]. Declining photosynthetic activity has been reported to be negatively correlated with forage nutritive values and the regrowth potential ability of the plants [9]. In pasture establishment, species and management practices that will promote longevity or persistence of the sward are very paramount. Lower tiller numbers in a sward have implications for regrowth potential of the plants. reported similar result with this experiment that tiller density of perennial ryegrass was lesser at a lower stubble height than at higher stubble heights. The grass with higher sward height had higher tiller numbers than the one with lower height. However, grass gets to sworn height faster in grass with the target height of 80 cm.

From this study, forage accumulation typically favored lower sward residue. The sward heights produced similar dry matter yield but increasing the sward residue decreased dry matter accumulation in M. maximus. There was a decline in the dry matter yield as the sward residue increased. This was in consonance with the report of [10,11] that in perennial ryegrass in which the swards were cut to a 3-cm stubble height, accumulated more than twice as much forage as those cut to a 4.0-cm height. Stubble heights are remarkably species and environmentally dependent. Although the result from this study revealed that more yield was produced from the lowest residual length, harvesting at higher residual length is more promising because of higher leaves production which will be nutritious to animals and regrowth potential ability because of the tiller number. Therefore, for higher tiller number and dry matter yield the target height of sward at 100 cm will be better considered than harvesting at 80 cm sward height.

Conclusions

a) The sward heights produced similar dry matter yield, while increasing the sward residue, decreased dry matter yield in M. maximus.

b) Harvesting of M. maximus at 20 cm sward residue and at 100cm sward height, produced higher tiller numbers and yield.

Competing Interest

The authors have declared that no competing interest exists.

Data Availability

All relevant data are within the paper and its supporting information files.

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