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RESPONSE OF MOMBAÇA GRASS (*Panicum maximum* Jacq.) TO NITROGEN DOSES AND CLIPPING FREQUENCY

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Abstract

The present experiment had the objectives of determining the response of Mombaça grass (*Panicum maximun* Jacq.) to three levels of nitrogen fertilizer (0, 250, 500 kg/ha) and two clipping frequencies (28 and 42 days). Dry matter yield (DMY), density and the average weight of tillers and the mean stage count (MSC), value that represents the quantity of the plant phenological development were evaluated. Nitrogen levels affected DMY, with the 500 kg/ha of N resulting in highest yield, and highest MSC as well. The number of tillers responded positively until the 250 kg/ha level. The 42-day frequency gave higher numbers for DMY and MSC, while the number of tillers was not affected. The MSC increased over the experimental period, due to shoot elongation and development of reproductive tillers. At the 28-day interval, vegetative tillers had strong influence on DMY, while at the 42-day, the number of vegetative tillers decreased.

Keywords: Dry matter yield, mean stage count, nitrogen, tiller

Introduction

Forage dry matter yield is dependent on mineral nutrition, especially nitrogen supply, which is the nutrient with most impact on the forage development (Monteiro, 1995). Costa and Oliveira (1997), studying *Panicum maximum* Jacq. cv. Tobiatã yield at different ages, verified that the most suitable age of cut, aiming to optimize yield and quality, was between 42 and 56 days. Barbosa et al. (1997), studying grass Mombaça tillering, under influence of nitrogen fertilization, verified that the element showed a positive effect on the number of grass tillers.

Moore et al. (1991) proposed a system of morphological descriptors and a continuos numeric index attributed to the tiller, to evaluate the phenological development of the plant. Based on the number of tillers, an average value for the plant is calculated and denominated MSC (mean stage count).

The aim of this study was to evaluate the effects of nitrogen levels and clipping frequency on the morphological adaptations that affect the yield of Mombaça grass.

Material and Methods

The experiment was conducted at the FZEA-USP, in Pirassununga, SP, Brazil, during the 1998/1999 summer, in a Dark Red Latossol, in a *Panicum maximum* Jacq. cv. Mombaça pasture, established three years earlier.

Treatments included all possible combination between three levels of N fertilization (0, 250, 500 kg N/ha) applied as NH_4NO_3 and two clipping frequencies (28 and 42 days). Treatments were assigned using a randomized complete block design with a factorial 3x2 arrangement and four replicates.

A single P fertilization was made at staging, using magnesium multi-phosphate, equivalent to 150 kg P_2O_5/ha. A constant potassium annual rate was applied (180 kg K_2O/ha) as

potassium chloride, split into the number of harvests (4 or 6 harvests). Each experimental unit was 4.10 m wide by 8.10 m long.

The morphological evaluation was performed according to the methodology developed by Moore et al. (1991). The developmental stage of the plants was monitored by mean stage count (MSC), used to quantify the change on the types of tillers in the population. For the MSC calculation, tillers were counted and examined, and classified in vegetative, elongating or reproductive. Samples were hand-clipped from tufts at ground level, in 0,125-m^2 homogeneous areas. Following the count, identification and determination of tiller index, the MSC was calculated using the following equation:

$$MSC = \sum_{i=0}^{4,9} \frac{Si \times Ni}{T}$$

where Si = growth stage, 1- 4,9; Ni = numbers of tillers in stage Si; T = total number of tillers.

The growth stages were divided in vegetative, elongating and reproductive. The vegetative stage, for example, was denominated *V* stage and presented different substages, like *V0*, which indicates the emergence of first leaf and has a value 1.0 as index. The *E0* substage indicates the beginning of the elongation and has 2.0 as index (Moore et al., 1991).

Tillers mean weight (TMW) was also determined. Samples collected for the MSC calculation were dried in a 58-60^oC air-forced oven during 72h, and them weighed and a mean tiller weight was obtained from the total number of tillers.

Additionally, for dry matter yield (DMY) measurements, a 0,125 m^2 quadrat was utilized. The sample was clipped from a pre-selected area, representative of the unit, approximately 20 cm

above soil surface. The samples were weighed fresh and were dried in a 58-60^{o}C air-forced oven during 72h for determination of dry matter concentration.

Results and Discussion

Analysis of variance showed no significance (P>0,05) for the interaction between N level and clipping interval for the responses DMY, MSC and number of tillers of Mombaça grass. Therefore, only the main effects were analyzed (Table 1). Nitrogen level influenced mean DMY per harvest (P<0,05), with 500 kg/ha resulting in maximum yield. The number of tillers was higher in fertilized plants (P<0,05), which responded to N up to 250 kg/ha, a response observed by Barbosa et al. (1997). This supports that tillering is under heavy influence of N supply. The 42-day clipping frequency gave higher values of DMY, while the number of tillers were not affected (P>0,05) by this factor. Costa and Oliveira (1997) observed in Tobiatã grass that DMY doubled from 28 to 42 days. However, it is important to evaluate the yield during the entire period, once the number of clippings was not the same for the two conditions - six harvests for 28-d and four harvests for 42-d.. The total dry matter yield over the experimental period was 35,600 kg/ha for the forage cut every 28 days and 38,500 kg/ha for the 42 days frequency, which demonstrates an equilibrium between the two intervals of cut related to DMY.

TMW was influenced (P<0,05) by the interaction N levels and clipping frequency. The regression equations for the 28 and the 42 day clipping frequency are: TMW (28 days) = 0,0022N + 0,7048; R^2 = 0,99; TMW (42 days) = 0,0037N + 1,3819; R^2 = 0,99.

Nitrogen accelerated grass maturation, revealing higher MSC values while, without N, MSC values were lower (P<0,05). Similarly, the 42-day frequency allowed the plant to develop faster with a greater presence of elongating and reproductive tillers (Table 2). MSC translated this behavior numerically, although it is a mean value and should always be interpreted bearing in

mind the type of the identified tillers in the pasture, whether they are vegetative, elongating or reproductive (Table 2). Frank and Ries (1989), evaluating N effect on morphological development in Crested wheatgrass [*Agropyron desertorun* (Fisch.) Schult] and *Pascopyrum smithii* Rydb, (Love)], observed that there was no effect of the nutrient over the tested species, and according the authors, the dry matter yield is mainly a function of water and soil nitrogen, while the morphological development is dependent on air temperature.

The number of tillers remained the same over the experiment period. For the 28-d frequency, however, vegetative tillers were more important to the Mombaça grass DMY. For the 42-day frequency, the participation of vegetative tillers decreased and tillers in elongation phase are probably those which exert strongest influence on DM yield (Table 2).

Under the conditions of the present experiment, N supported substantial DMY increase and tillering of Mombaça grass, and influenced plant maturation, translated in the MSC higher values, a parameter that should be intensively studied in order to ratify its efficiency of helping pasture management. The participation of elongating and reproductive tillers is more intense in a longer interval of cut, as a 42-day one.

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Table 1 - Effect of N doses and clipping frequency on DMY, number of tillers and MSC of grass Mombaça[1].

	N doses (kg/ha)			Clipping frequency (days)	
	0	250	500	28	42
DMY (kg/ha/harvest)	2294c	8163b	12887a	5934B	9629A
Tillers (n^o/m^2)	282b	365a	370a	354	323
MSC	1,200c	1,374b	1,570a	1,280B	1,483A

[1] Means followed by the same letter (small/capital) in the row do not differ significantly by Tukey test ($p>0,05$).

Table 2 - Tillering, MSC and DMY at the cuts for 28-days and 42-days frequency.

	Harvest date - 28 days					
	12/10/98	01/07/99	02/04/99	03/04/99	04/01/99	04/29/99
Vegetative tillers/m^2	321(100)[1]	364(96)	401(96)	319(84)	245(76)	175(57)
Elongating tillers/m^2	0	15(4)	17(4)	61(16)	77(24)	71(23)
Reproductive tillers/m^2	0	0	0	0	0	60(20)
Total tillers/m^2	321	379	418	380	322	306
MSC	0,99	1,11	1,13	1,24	1,41	1,81
DMY (kg/ha)	3764	6643	8029	7356	5948	3861

	Harvest date - 42 days			
	12/24/98	02/04/99	03/18/99	04/29/99
Vegetative tillers/m^2	341(100)	283(75)	181(68)	143(48)
Elongating tillers/m^2	0	96(25)	87(32)	77(25)
Reproductive tillers/m^2	0	0	0	83(27)
Total tillers/m^2	341	379	268	303
MSC	1,05	1,36	1,49	2,04
DMY (kg/ha)	6868	11640	10198	9809

[1] the values in parenthesis refer to the percentile participation in tiller total number.