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MORPHOGENESIS AND GROWTH ANALYSIS OF MOMBAÇAGRASS (*Panicum maximum*) DURING ESTABLISHMENT AND REGROWTH

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Abstract

Mombaçagrass grown in pots was evaluated regarding leaf appearance, elongation and senescence rates; leaf area indices, photosynthetcly active radiation (PAR) interception and the growth indices: leaf area ratio (LAR), net assimilation rate (NAR) and relative growth rate (RGR). Three growths were considered: seminal growth and regrowth after harvest take on the 16th and 37th day of the seminal growth.

The seminal growth exhibited the highest values for leaf appearance, elongation and senescence rates as compared to aftermath growths. LAI rose linearly from the 20th to the 77th day of the seminal growth, as well as during the aftermath growths. Maximum LAI was around 5.0 by the 70th day of growth. PAR interception did not exceed 95%. Mean values for NAR, RGR and LAR decreased asymptotically as the grass aged. For a given age, highest values of LAR, NAR and RGR were observed for the seminal growth. Lower and negative values were observed for NAR and RGR during the first 3 day regrowth periods.

Keywords: Leaf appearance, leaf elongation, leaf senescence, leaf area ratio, net assimilation rate, relative growth rate.

Introduction

The conversion of radiant energy into chemical energy is the basis of plant growth, whose intensity is proportional to the light interception by the crop canopy. Forage crop yield is closely correlated with the leaf area index of the sward. Environment and management factors conditioning the sward morphogenetic and structural traits determine pasture biomass accumulation (Chapman and Lemaire, 1993). This work aimed at the assessment of leaf appearance, elongation and senescence rates and the growth indices of Mombaçagrass (*Panicum maximum*) during three growths: the seminal and two aftermaths.

Materials and Methods

Seeds of Mombaçagrass were sown in plastic pots with 0.30 m diameter by 0.20 m height, kept 0.05 m apart from each other. Soil analysis revealed: 5.9 pH; 7 and 107 mg/dm^3 P and K; 0.0, 3.0 and 1.1 cmolc/dm^3 Al^{+++}, Ca^{++} and Mg^{++}: Before sowing, the soil was enriched with P at the rate of 115 mg/dm^3. The pots were thinned to leave four tillers in each, one week after emergence. Three growths were considered: seminal growth and the regrowths after harvesting on the 16th and 37th day after emergence, the cuts being done 0.10 m above soil level. The pots were watered daily and received 50 mg/dm^3 of N and K, in solution, fortnightly. From tagged tillers, observations were made on leaf appearance, elongation and senescence, from which the respective rates were estimated, as well as the number of total expanded leaves. On pre-established ages of each growth plants were harvested for the measurement of leaf area using a Image Analysis System Δ T, dry weight of leaves, culms, and root system. From these figures mean values for net assimilation rate (NAR), relative growth rate (RGR) and instantaneous leaf area ratio (LAR) were estimated, according to Radford (1967). Light (PAR) interception was measured using a (LI – 191 AS) line quantum sensor Licor.

Results and Discussion

The total number of expanded leaves increased from 6 to 12 from the 13^{th} to the 69^{th} day of the seminal growth, but the number of green leaves decreased to 3 by the 37^{th} day leveling off from then on. Mean leaf length ranged from 207 ± 16 mm to 1080 ± 48 mm from the start to the end of the growth period. The greatest length of last expanded leaves more than compensated for the leaf area loss by senescence and death of the first expanded leaves. Daily rates of leaf elongation, senescence and appearance were: 87.7 ± 7.8 mm. $tiller^{-1}$; 57.7 ± 3.8 mm. $tiller^{-1}$ and 0.107 leaf. $tiller^{-1}$, respectively, during the establishment. LAI increased from 0.17 to 5.42, linearly (b= 0.075/day; r= 0.97) but PAR interception leveled off at 95% by the 42^{nd} day.

During the 66 days regrowth after clipping taken on 16^{th} day of the seminal growth, when no tiller was decapitated, seven new leaves completed expansion, but the number of green leaves stabilized around three from the 32^{nd} day on, with average length of 1250 ± 140 mm. LAI varied linearly (b= 0.072/day; r= 0.96) from 0 to 4.95, but light interception was already maximum (96%) by the 24^{th} day. Daily rates of leaf elongation, senescence and appearance were: 87.8 ± 13.9; 28.4 ± 5.1 mm. $tiller^{-1}$ and 0.101 ± 0.01 leaf. $tiller^{-1}$, respectively. During regrowth after clipping on the 37^{th} day of the seminal growth, which resulted in high percentage tiller decapitation, only four leaves completed expansion. From these, only 2.5 leaves with average lengths of 751 ± 113 mm remained alive from 43^{rd} day of regrowth. LAI reached 4.21 by the 77^{th} day, while light interception leveled off at 93% on the 35^{th} day regrowth. Daily leaf appearance rate was 0.053 ± 0.02 leaf $tiller^{-1}$ and daily elongation and senescence rates were 36.7 ± 5.4 and 7.2 ± 1.4 mm. $tiller^{-1}$, respectively.

Mean values of NAR, RGR and LAR decreased as the grass aged (Table 1). This, together with tissue senescence and death account for the plateauing of dry matter accumulation after a few weeks of growth. Noteworthy is the high mean value of NAR and low mean values of RGR and LAR during first 3 day regrowth period of the early-cut (16 days) regrowth. Similarly, the negative values for NAR and RGR should be noticed in the early regrowth after harvest which resulted in severe apical meristem elimination, before their rise and subsequent decline. This is in line with report from Davidson and Milthorpe (1966), regarding negative carbon balance in early regrowth of orchardgrass.

The relationship between NAR and LAI was asymptotically negative, which is consistent with the concept of a range of LAIs over which crop growth rate (Brown and Blaser, 1968) and forage accumulation rate (Bircham and Hodgson, 1983) are maximum.

It is concluded that the rates of leaf appearance, elongation and senescence as well as the values for NAR, RGR and LAR, are highest during the seminal growth.

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Table 1 – Mean values for net assimilation rate ($g.m^{-2}.d^{-1}$), and relative growth rates ($g.g^{-1}.d^{-1}$) and instantaneous values for leaf area ratio (m2/g) of Mombaçagrass in three growths.

Age (days)	GROWTH								
	1rst			2nd			3rd		
	NAR	RGR	LAR*	NAR	RGR	LAR*	NAR	RGR	LAR*
0-3				39.9	0.13	0.013			
1-3							-8.0	-0.07	0.002
6-10				10.4	0.20	0.018			
7-21							12.1	0.10	0.009
13-20	12.1	0.13	0.019	9.7	0.17	0.017			
20-27	7.3	0.12	0.014	6.7	0.09	0.010			
21-35							4.4	0.03	0.007
27-42	8.0	0.09	0.009	5.6	0.05	0.007			
35-52				4.0	0.02	0.005	6.4	0.04	0.006
42-55	5,0	0,04	0,007						
52-66				5,6	0,03	0,005	2,2	0,01	0,005
55-69	3.1	0.02	0.005						
63-77							5.5	0.02	0.004
69-83	4.4	0.02	0.005						

* Instantaneous values for the upper age of the range