Análise morfogênica em gerações de perfilhos de capim-annoni-2: Conhecendo para melhor controlar

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Resumo: O capim-annoni-*2* é uma gramínea que foi introduzida no Rio Grande do Sul na década de 50 e que hoje é considerada planta invasora de difícil controle. Com o objetivo de conhecer para melhor controlar é que buscou-se avaliar o comportamento das características morfogênica de diferentes gerações de perfilho do capim-annoni-*2*. O trabalho foi conduzido na Embrapa Pecuária Sul, em casa de vegetação, de outubro de 2013 a março de 2014. As avaliações foram realizadas uma vez por semana, sendo medidos alongamento e aparecimento de folhas, senescência e alongamento de colmo. Foram utilizadas 3 repetições num delineamento inteiramente casualizado para se gerar as taxas correspondentes às variáveis morfogênicas e estruturais. Os dados permitiram observar que há um padrão de comportamento das variáveis morfogênicas nas gerações de perfilho do capim-annoni-*2*, sendo que o ritmo de crescimento demonstrado pelas variáveis acontecem de forma mais intensa em perfilhos das gerações 1 e 2 quando comparados às demais gerações. Este conhecimento, por expressar o funcionamento da planta, associado a outros já existentes possibilita um avanço no conhecimento em busca de formas mais efetivas de controle desta planta.

Palavras–chave: *eragrostis plana* ness, planta invasora, ritmo morfogênico

Morphogenetic analysis in tillers of capim-annoni-2: Knowing to better control

Abstract: The capim-annoni-2 is a grass introduced in the state of Rio Grande do Sul, Brazil, in the 50s that is considered today an invasive plant difficult to control. Aiming to understand it to better control it, this study was conducted to evaluate the behavior of the morphogenetic traits of different tiller generations in capim-annoni-2. The experiment was carried out at Embrapa Pecurária Sul, in a greenhouse, from October 2013 to March 2014. Evaluations were performed once weekly, in which the elongation and appearance of leaves, senescence, and elongation of stems were measured. Three replicates were utilized in a completely randomized design to generate rates corresponding to the morphogenetic and structural variables. The data indicated a response pattern of the morphogenetic variables in the tiller generations of capim-annoni-2, and the growth pace demonstrated by the variables is more intense in tillers from generations 1 and 2 as compared with the other generations. Because it expresses how the plant functions, this understanding, coupled with other existing pieces of information, provides an advance in the knowledge in the search for more effective methods to control this plant.

Keywords: *eragrostis plana* ness, invasive plant, morphogenetic pattern

Introduction

The capim-annoni-2 is a grass originated in South Africa (Reis, 1993) that is resistant to cold and yields a large amount of fresh matter. These characteristics led farmers in the state of Rio Grande do Sul, Brazil, to introduce it and use it as a forage plant in the 1950s. After agronomic studies and evaluations, this species started to be viewed as unsuitable for use in grazing because of its low nutritional quality and high resistance to mechanical traction, which resulted in low animal production (Alfaya et al., 2002).

According to Gourlat et al. (2009), it has been observed that once established in grazing areas, its complete elimination is more difficult, as it displays characteristics such as high seed yield, high dormancy, which contributes to the maintenance of the soil seed bank, besides the allelopathic effect on the germination or growth of other forage species, i.e, it is a plant with a high potential for competition against native and cultivated forage species.

Therefore, the capim-annoni-2 is considered today an invasive plant difficult to control. It is thus believed that in order to control the propagation of this plant, it is necessary to understand its functioning. Given that morphogenesis allows for the characterization of specific patterns of growth and development of plants (Chapman;

Lemaire, 1993), the objective of this study was to monitor the behavior of the morphogenetic patterns in tillers of capim-annoni-2 throughout its lifecycle.

Material and Methods

The experiment was developed at Embrapa Pecuária Sul, in Bagé-RS, Brazil, in a greenhouse, from October 2013 to March 2014, totaling 175 days of evaluation. Each seedling originated from one seed, and was transplanted to pots with 2 L capacity. Six pots were used for the evaluations, and these made up the replicates, arranged in a completely randomized design.

After transplanting, the tillers from the 1st generation in all pots were marked using a colored thread. Morphogenetic characteristics were evaluated once weekly, which consisted of monitoring the tillers as to the appearance and elongation of leaves, senescence, and elongation of pseudostem.

New tillers were tagged monthly, using threads of different colors to distinguish generations. In each pot, one tiller was chosen at random per generation to also monitor the appearance and elongation of leaves, as well as to monitor the process of senescence and elongation of the pseudostem. These measurements were taken using a ruler graduated in centimeters. Leaves were considered dead when over 50% of their length was under senescence. Tillers were differentiated into aerial and basal, and to monitor their morphogenetic pattern, it was chosen to only evaluate and compare the basal tillers.

Over the experimental period, the tiller generations were monitored until the complete flowering of the capim-annoni-2, totaling six generations of tillers, from the initial marking of the only existing tiller per pot. Three of the six replicates showed, for all generations, an evaluation period and sufficient information to generate the necessary morphogenetic variables for analysis. Therefore, the rates generated in this study are based on data from three replicates.

The minimum and maximum temperatures inside the greenhouse were recorded daily. To express the results in degrees day (DD) of growth, the equations proposed by Ometto (1981) were used.

By monitoring the plants it was possible to estimate: final leaf length (FLL, cm), leaf appearance rate (LAR, leaves/tiller.DD), phyllochron (1/LAR), leaf elongation rate (LER, cm/tiller.DD), leaf lifespan (LLS, DD), number of live leaves per tiller (NLL), stem elongation rate (SER, cm/tiller.DD) and the senescence rate (LSR, cm/tiller.DD).

The data were analyzed statistically using the R package version 3.1.3 for Windows®. The dataset was tested so as to ensure the basic assumptions of the analysis of variance. Means between treatments were evaluated by Tukey's test at 5% probability.

Results and Discussion

The morphogenetic and structural variables of the capim-annoni-2 are shown in Table 1. No statistical difference ($P>0.05$) was observed for final leaf length (FLL) and number of live leaves (NLL) in the analyzed generations.

Regarding the leaf appearance rate (LAR), higher values were observed in the first two tiller generations. This variable, considered key in the morphogenesis arrangement, is related to FLL, tiller density, and NLL. The inverse of LAR is the phyllochron, and for this variable it was observed that generations 3, 4, and 5 showed a longer interval between the appearance of two consecutive leaves, requiring the accumulation of around 230-250 DD for the appearance of a new tiller. In the tillers from generations 1 and 2, the phyllochron was around 94 DD.

The highest leaf elongation rates (LER) were also observed in the first two tiller generations, and they were about twice as high as that recorded for the third and sixth generations. The lowest LAR was observed in generation 4. This variable has a direct relationship with FLL; thus, although there was no significant difference for FLL across the generations, a trend towards a larger leaf size was observed in the first two generations, as a consequence of the higher LER.

Because they had a higher LAR, tiller generations 1 and 2 showed a shorter leaf lifespan (LLS) as compared with the other generations; this is possibly a mechanism of adjustment for the stabilization of the number of green leaves on the tiller. Thus, considering the maintenance of the number of stable live leaves per tiller (Nabinger; Pontes, 2001), which, for the capim-annoni-2 in this study was between four and seven leaves, depending on the evaluated generation of tillers, those generations with the highest LAR showed the highest rates of senescence (LSR), which is coherent with the shorter LLS. The inverse was also true.

Table 1. Morphogenetic and structural traits during the monitoring of tiller generations in capim-annoni-2 under free growth.

Tiller generation	FLL	LAR	Phyllochron	LER	LLS	NLL	SER	LSR
1	35.12 A	0.0107 A	94.93 B	0.484 A	346.32 B	4.0 A	0.026 A	0.037 A
2	33.95 A	0.0107 A	94.64 B	0.453 A	491.58 B	5.0 A	0.019 AB	0.027 A
3	28.76 A	0.0043 B	228.61 A	0.152 BC	1604.87 A	7.0 A	0.008 AB	0.004 B
4	25.82 A	0.0037 B	283.99 A	0.102 C	1311.79 A	5.0 A	0.001 B	0.003 B
5	25.04 A	0.0047 B	245.70 A	0.121 BC	987.39 AB	4.0 A	0.004 AB	0.003 B
6	28.41 A	0.0060 B	179.70 AB	0.274 B	1233.71 A	7.0 A	0.007 AB	0.002 B

FLL = final leaf length; LAR = leaf appearance rate; LER = leaf elongation rate; LLS = leaf lifespan; NLL = number of life leaves; SER = stem elongation rate; LSR = leaf senescence rate.
Values followed by the same uppercase letter in the row do not differ by Tukey's test at 5%.

Conclusions

In conclusion, the tiller-generation morphogenetic patterns in capim-annoni-2 are similar, but they occur more intensely in the first two tiller generations as compared with the others. This information provides an advance in the knowledge of the control of this plant, as it demonstrates how the morphogenetic patterns take place. Associated with other information such as physiological independence, this may guide and optimize practical actions to improve the control of this invasive plant.

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