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Tiller population stability of Aruana guinea grass subjected to different cutting severities and fertilized with nitrogen

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Introduction

Tiller appearance, death and survival rates determine the persistence of each grass species and its herbage accumulation. The balance between these factors may vary with frequency and intensity of grazing and nitrogen (N) fertilization. Separate analysis of data on tiller appearance and survival or death may not indicate if tiller population is stable over a given time, that is, if sufficient tillers appear to replace those which die, keeping tiller population stable. Rather, an integrated analysis of tiller appearance and death is available, the tiller population stability index (SI), as defined by Bahmani et al. (2003). If SI values are lower than 1, population stability is compromised, as tiller appearance is lower than tiller death and population density tends to decrease; the opposite happens if SI values are higher than 1. This index can be an indicator of the persistence of a pasture, as the reduction in tiller number indicates pasture degradation.

Aruana guinea grass (*Panicum maximum* cv. Aruana) is widely used as pasture for sheep, which are extremely susceptible to infestation by larvae of gastrointestinal parasites in tropical pasture-based systems. One way to mitigate this problem, reducing the need for the use of anthelmintics, is by managing pastures with a post-grazing height low enough to allow sunlight to reach the base of tussocks, possibly killing larvae and controlling larval development, without jeopardizing canopy regrowth and persistence. Sward targets for grazing Aruana guinea grass correspond to a pre-grazing height of 30 cm, equivalent to 95% canopy light interception during regrowth, and a post-grazing height of 15 cm (Zanini et al. 2012). Lowering the post-grazing height would help with parasite control. The objective of this experiment was to evaluate tiller population stability of Aruana guinea grass subjected to 2 cutting severities and N fertilization, using the stability index.

Methods

Cylinders (15 cm diameter x 20 cm deep) of undisturbed soil and plant samples (Mattos and Monteiro 2003) were collected from an Aruana guinea grass pasture established in 2001 and used for sheep grazing. The soil + plant material was placed in ceramic pots in a greenhouse. Treatments corresponded to 4 nitrogen (N) rates (50, 100, 150 and 200 mg/dm^3) combined with 2 defoliation severities (10 and 15 cm height), in a complete randomized block design with 4 replications in a 4 x 2 factorial arrangement. After a 20-day adjustment period, the first cuts at 10 and 15 cm and application of N were carried out. Further cuts at 10 or 15 cm were made as the plants reached ~30 cm high.

Response variables were the rates of tiller appearance, death and survival, which were used to calculate the tiller population stability index (SI) using the equation P_1/P_0 = TSR (1 + TAR), where: P_1/P_0 stability index was the ratio of tiller populations in month 1 and month 0; TSR was the tiller survival rate in month 1; and TAR was the tiller appearance rate in month 1 (Bahmani et al. 2003). Data were subjected to analysis of variance using SAS® (Statistical Analysis System, version 9.3) statistical package and a 5% significance level. For the N rates, regression analysis (linear and quadratic effects) was used.

Results and Discussion

Tiller population stability indexes varied according to N rates and there was interaction between cutting height and N rate (Figure 1). SI values increased as N rates increased (Y = 0.708 – 0.003N, R^2 = 0.76), demonstrating that N supply had a positive and linear effect on SI.

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This clearly shows the importance of N fertilization in promoting tillering in plants and highlights the importance of ensuring adequate nutrition of the herbage and the potential benefits of management practices like N fertilization. The SI is dependent on both cutting height and N rate. At a cutting height of 10 cm, SI was higher than 1 only with the highest N level (200 mg/dm^3). On the other hand, the 15 cm cutting height showed SI higher than 1 with both 150 and 200 mg/dm^3 of N (Figure 1). These results indicate that, with 15 cm cutting height, a lower N application is required to maintain the stability of the tiller population than with cuts at 10 cm height. However, cuts at 10 cm height are interesting as they can assist in the control of gastrointestinal larvae development, by allowing higher incidence of solar radiation at the base of tussocks. As long as nutritional requirements are met (as in this experiment) and in the absence of environmental stresses (e.g. water deficit, diseases), our results suggest that 10 cm cutting severity with N fertilization at optimal rates will maintain Aruana guinea grass tiller populations stable. This result indicates opportunities for developing management practices for grazing and N fertilizer usage to maintain the tiller population of plants, without jeopardizing production system sustainability.

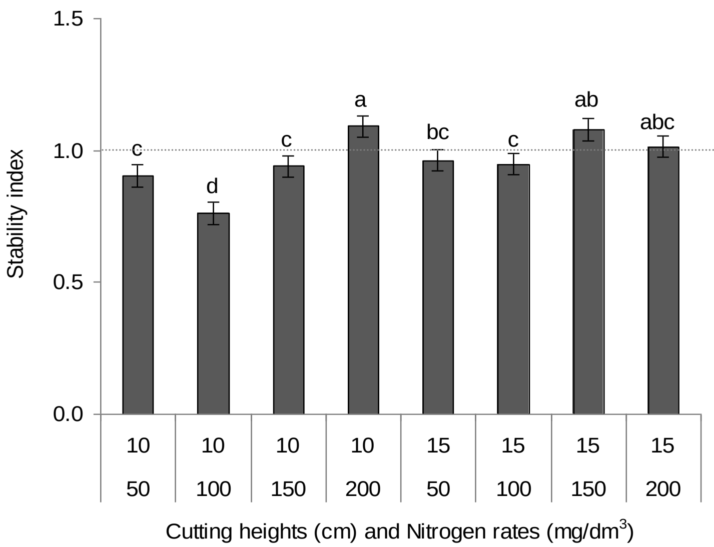

Figure 1. SI of Aruana guinea grass subjected to 2 cutting heights and 4 N rates. Lower-case letters compare SI means between treatments. Vertical bars correspond to standard error of the mean.

Conclusion

A cutting height of 10 or 15 cm, together with the regrowth period required for the canopy to reach 30 cm height, can be used as management targets to maintain plant tiller populations, as long as N supply is adequate for Aruana guinea grass. With 10 cm cutting height more attention to the supply of N is needed.

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