Tiller population stability of Aruana Guineagrass subjected to cutting severities and fertilized with nitrogen

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Introduction

Tiller appearance, death and survival rates determine the persistency of each grass species and their herbage accumulation. The balance between these factors may vary with frequency and intensity of grazing and nitrogen (N) fertilization. Separated analysis of data on tiller appearance and survival or death may not indicate if tiller population is stable in a given time, that is, if tiller appearance in relation to tiller survival is large enough to maintain tiller population stable. In order to avoid that, an integrated analysis of tiller appearance and death was used, the tiller population stability index (SI), as defined by Bahmani *et al.* (2003). Aruana Guineagrass (*Panicum maximum* Jacques 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 post-grazing height low enough to favor the incidence of sunlight at the base of tussocks, killing and controlling larval development, without jeopardizing canopy regrowth and persistence. Sward targets for grazing Aruana Guineagrass 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). The objective of this experiment was to evaluate tiller population stability of Aruana Guineagrass subjected to cutting severities and N fertilization using the stability index.

Methods

Cylinders were collected (15 cm diameter by 20 cm deep) with undisturbed soil and plant samples (Mattos and Monteiro 2003) from an Aruana Guineagrass pasture established in 2001 and used for sheep grazing. The soil + plant material was placed in ceramic pots in a greenhouse. Treatments corresponded to four nitrogen (N) rates (50, 100, 150 and 200 mg/dm^3) combined with two defoliation severities (10 and 15 cm height), in a complete randomized block design with four replications in a 4 x 2 factorial arrangement. After a 20-day adjustment period, the first cut at 10 and 15 cm and application of N rates was 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 using the equation P_1/P_0 = TSR (1 + TAR), where P_1/P_0 Stability index (SI) was corresponded to the ratio between tiller population in month 1 and month 0; TSR Tiller survival rate in month 1; TAR 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 using a 5% significance level, and regression analysis (linear and quadratic effects) for the N rates was used.

Results

Tiller population stability indexes varied according to the N rates and there was interaction between cutting heights and N rate (Fig. 1). If SI values are lower than 1, population stability is compromised as tiller appearance is not large enough in relation to tiller survival and population density tends to decrease, the opposite happens if SI values are higher than 1. This index can indicate the persistence of a pasture as the reduction in tiller number indicates the existence of processes of pasture degradation. SI values increased due to N rates ($Y = 0.708 – 0.003N$, $R^2 = 0.76$) as N supply had a positive and linear effect on SI. This clearly demonstrates the importance of N fertilization in promoting tillering in plants, highlighting the importance of ensuring adequate nutrition of the herbage and the potential benefits of management practices like N fertilisation. The SI is dependent on the cutting height and N rate. At the cutting height of 10 cm SI was higher than 1 only with 200 mg/dm^3 of N. On the other hand, the 15 cm cutting height showed SI higher than 1 with 150 and 200 md/dm^3 of N (Fig. 1). These results indicate that with 15 cm cutting height a lower N application is required to maintain the stability of the tiller population in relation to cuts at 10 cm height. However, cuts at 10 cm height are interesting as they can favour the control of gastrointestinal larvae development, 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 indicate that 10 cm cutting severity with N fertilization at optimal rates

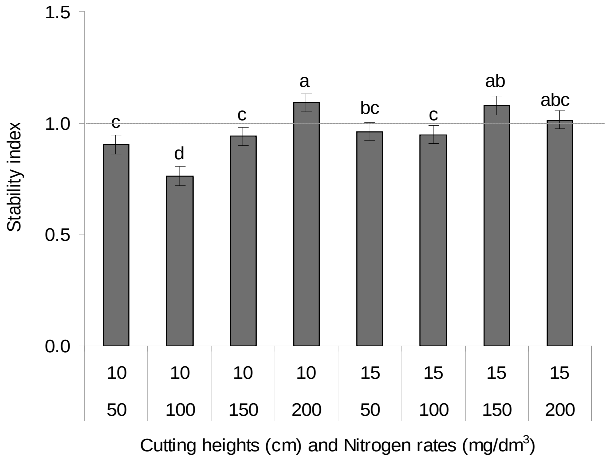

Figure 1. SI of Aruana Guineagrass subjected to two cutting heights and four N rates. Lower case letters compare SI means between treatments. Vertical bars correspond to standard error of the mean.

under non-adverse environmental conditions maintained Aruana Guineagrass tiller population stable. This result indicates opportunities for developing management practices for grazing and N fertilizer usage to maintain the tiller population of plants, without jeopardising production system sustainability and environment.

Conclusion

The 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 target to maintain plant tiller populations, as long as N supply is adequate for Aruana Guineagrass. However with 10 cm cutting height more attention to the supply of N for Aruana Guineagrass is needed.

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