Litter Decomposition of Xaraes-Grass Pasture Subjected to Different Post-Grazing Residuals

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Introduction

Since fertilizers are used less extensively on Xaraes-grass (*Brachiaria brizantha*) pastures in Brazil because of costs, the main route of nitrogen (N) supply to plants is through nutrient recycling via litter decomposition. One of the strategies used to maintain the supply of N is to manage the pasture correctly by keeping it under grazing pressure so that the amount of recycled nutrients in the residue is sufficient to meet the pasture requirements (Jantalia *et al*. 2006). Thus, the aim of this study was to evaluate different residual leaf area indices (RLAI) and determine which one provides the best restoration of pasture leaf area index and nutrient cycling.

Methods

The experiment was conducted at Unesp, in Jaboticabal, SP, Brazil. The experimental area of 0.28 ha was divided into 12 paddocks in order to evaluate four different RLAI (0.8, 1.3, 1.8 and 2.3). The experimental design was completely randomized with three repetitions. Litter decomposition measurements followed the nylon bag technique (adapted from Dubeux Jr *et al*. 2006). The litter layer on the soil was collected from each paddock. The litter fractions were weighed and placed inside nylon bags (15 g/bag). Subsequently, the bags were incubated for 0, 4, 8, 16, 32, 64, 128 and 256 days on the ground and covered with existing litter from that experimental paddock. The contents of organic matter (Silva and Queiroz 2002), N (AOAC 1995) and carbon (Bezerra Neto and Barreto 2004) were determined in order to calculate the carbon:nitrogen (C:N) ratio of the material during the evaluation period. Litter decomposition data were analyzed with an exponential regression model using Proc Nlin of the SAS statistical software.

Results

The decreasing percentage of organic matter found in the remaining material of Xaraes litter along the incubation period (Fig. 1) fitted the exponential model ($P<0.0001$). This is probably the result of the microbial activity. Microorganisms need carbon as an energy source for their metabolic processes and formation of organic compounds and so they use the organic carbon present in plant residues deposited on the soil.

The C:N ratio decreased over the incubation period and fitted the exponential model ($P<0.0001$; Fig. 2). This behavior is expected since the use of the carbon contained in the organic material by the microorganisms reduces the carbon content of the remaining material, thus decreasing the C:N ratio. According to Kiehl (1979), residues with

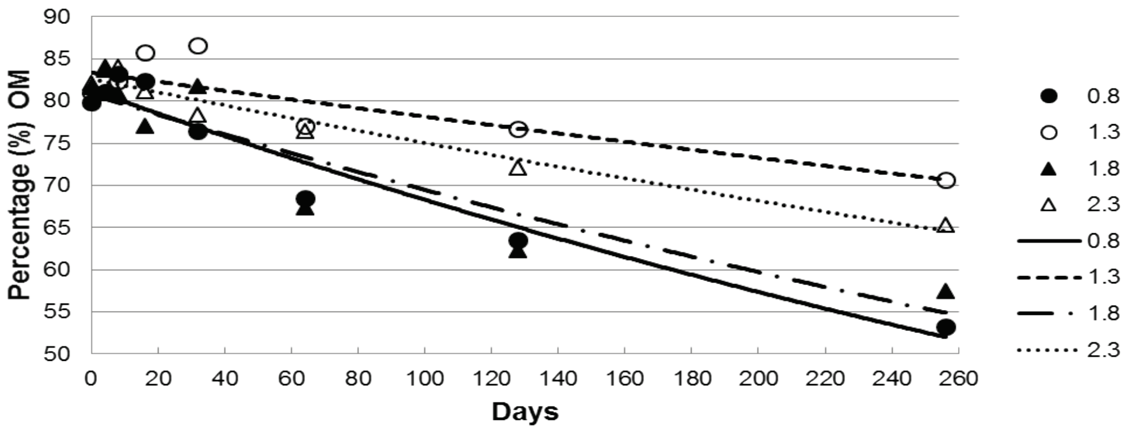

Figure 1. Percentage of organic matter (MO) in the remaining material of Xaraes litter on pastures managed with different residual leaf area index (RLAI) for different incubation times*.
*Exponential equations: RLAI 0.8 – $y = 81.64e^{-0.002x}$; RLAI 1.3 – $y = 83.37e^{-0.001x}$; RLAI 1.8 – $y = 81.32e^{-0.002x}$; RLAI 2.3 – $y = 82.72.e^{-0.001x}$

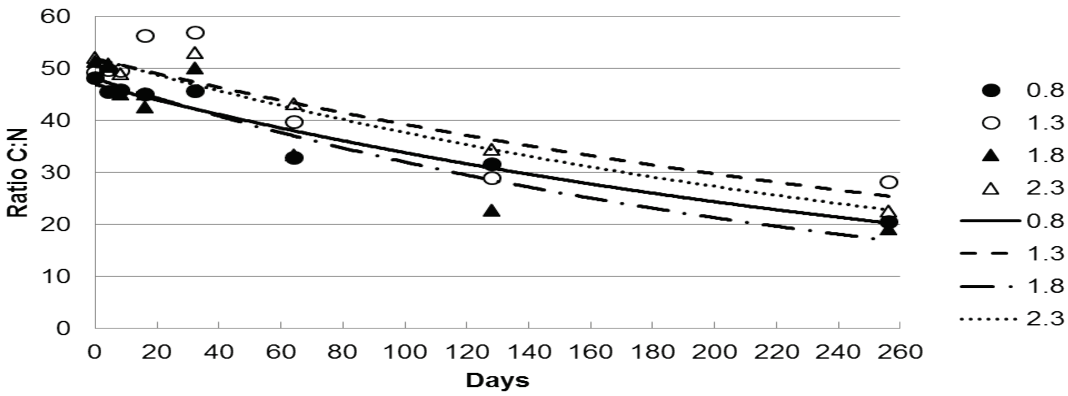

Figure 2. C:N ratio of the remaining material of Xaraes litter on pastures managed with different residual leaf area index (RLAI) for different incubation times during the year of 2011*.
*Exponential equations: RLAI 0.8 – $y = 47.24e^{-0.003x}$; RLAI 1,3 – $y = 52.81e^{-0.003x}$; RLAI 1.8 – $y = 49.68e^{-0.005x}$; RLAI 2,3 – $y = 51.78e^{-0.003x}$

C:N ratio higher than 33 have an initial decomposition stage where immobilization of mineral nitrogen and its transformation into organic nitrogen to form the microorganism cells occurs. When the C:N ratio reaches 33, a new decomposition phase of the residue called bio-stabilization occurs, in which nitrogen is mineralized and immobilized at the same time and there is no competition for the mineral nitrogen that was already on the soil.

In this study, at the end of 256 incubation days, the material resulting from the different RLAI studied displayed C:N ratios lower than 33, but this ratio was attained quicker for the material under the 1.8 RLAI, leading us to infer that the litter decomposition process also happened quicker.

Conclusions

The residual leaf area index influenced litter decomposition; defoliation to 1.8 RLAI yielded the lowest C:N ratio after 256 days of incubation.

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