Litter decomposition of Xaraés grass pasture subjected to different post-grazing residuals

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Introduction

Since fertilizers are used less extensively on Xaraés grass (*Brachiaria brizantha* cv. Xaraés) 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 to the pasture is to manipulate the 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 (RLAIs), to determine which one provides the best restoration considering the decomposition and mineralization of organic matter.

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 4 different RLAIs (0.8, 1.3, 1.8 and 2.3). The experimental design was completely randomized with 3 replications. 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, weighed and placed inside nylon bags (15 g/bag). Subsequently, the bags were placed on the ground, covered with existing litter from that experimental paddock and examined after 0, 4, 8, 16, 32, 64, 128 and 256 days. The concentrations 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 POC NLIN of the SAS statistical software.

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Results and Discussion

The percentage of organic matter found in the residual material of Xaraés grass litter decreased as the exposure time increased (Figure 1), fitting an exponential model ($P<0.0001$). This was probably the result of 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 also decreased throughout the exposure time and fitted the exponential model ($P<0.0001$; Figure 2). This behavior is expected since microorganisms use the carbon contained in the organic material and reduce the carbon content of the remaining material, thus decreasing the C:N ratio. According to Kiehl (1979), residues with a C:N ratio higher than 33 are at an initial decomposition stage, where immobilization of mineral N and its transformation into organic N to form the microorganism cells occurs. When the C:N ratio reaches 33, a new decomposition phase of the residue called biostabilization occurs, in which N is mineralized and immobilized at the same time and there is no competition for the mineral N that was already on the soil.

In this study, at the end of 256 days of exposure, the residual material on all treatments displayed C:N ratios lower than 33, but this ratio was attained more quickly for the material under the 1.8 RLAI, leading us to infer that the litter decomposition process also happened more quickly.

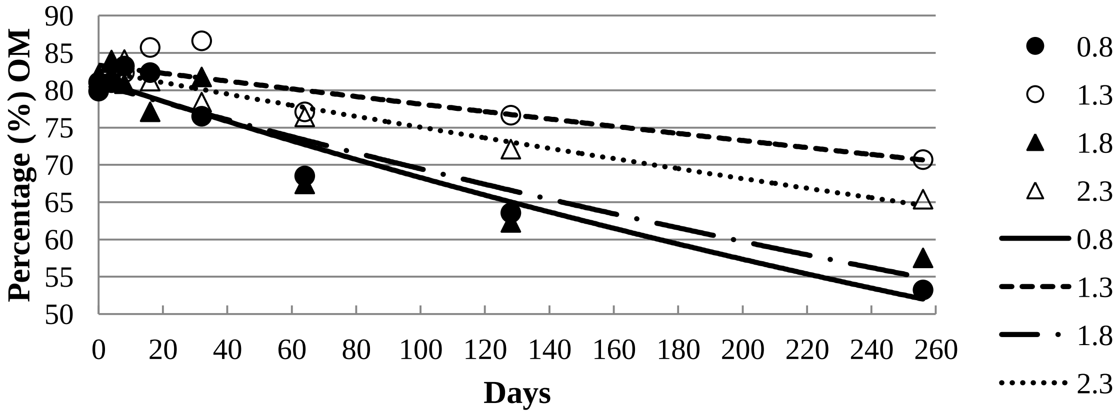

Figure 1. Effects of exposure time on percentage of organic matter (OM) in the remaining material of Xaraés grass litter on a pasture managed with different residual leaf area index (RLAI).
Exponential equations: RLAI 0.8 ($y = 81.64e^{-0.002x}$); RLAI 1.3 ($y = 83.37e^{-0.001x}$); RLAI 1.8 ($y = 81.32e^{-0.002x}$); RLAI 2.3 ($y = 82.72e^{-0.001x}$).

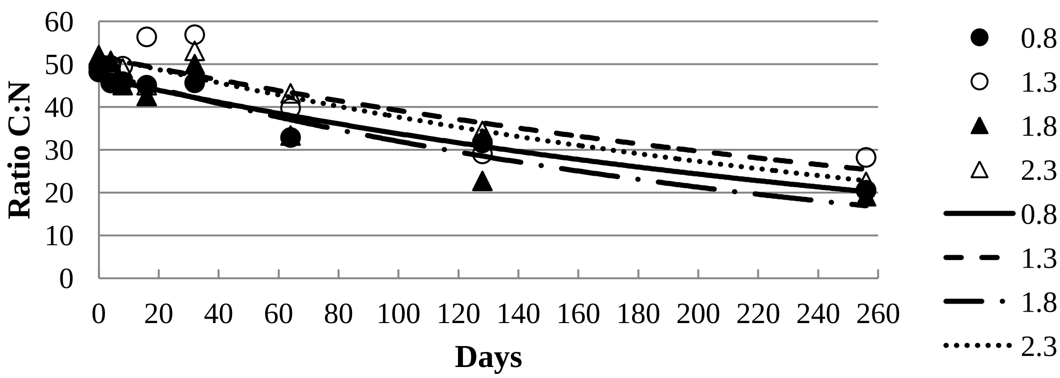

Figure 2. Effects of exposure time on C:N ratio of the remaining material of Xaraés grass litter on a pasture managed with different residual leaf area index (RLAI).
Exponential equations: RLAI 0.8 ($y = 47.24e^{-0.003x}$); RLAI 1.3 ($y = 52.81e^{-0.003x}$); RLAI 1.8 ($y = 49.68e^{-0.005x}$); RLAI 2.3 ($y = 51.78e^{-0.003x}$).

Conclusions

Despite marked decomposition of organic matter during the exposure period on all treatments, more than 50% of the original material still remained after 256 days. The residual leaf area index seemed to influence litter decomposition, but more work should be performed before recommendations are made on the desirable RLAI to adopt. Rate of litter decomposition is only one of the factors to be considered in determining grazing management strategy.

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