# Root Decomposition of Elephant Grass Pastures Grazed at Different Management Intensities

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## Presenter Information

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## Introduction

Grazing management may alter chemical composition of plant components affecting nutrient cycling. Among pasture management tools, adjustment of stocking rate (SR) and N fertilization have potential to affect nutrient cycling in the grassland ecosystem (Dubeux *et al.* 2007). Excreta from grazing animal and litter are the two major pathways of nutrient return on grazed pastures (Thomas 1992). Fertilization and SR may alter these pathways by different forms. Increasing fertilization generally increases pasture net primary productivity. Stocking rate affects different pasture and animal responses. Regarding nutrient cycling, increasing SR will likely increase proportion of nutrient returned through excreta as opposed to litter, increasing as a result nutrient losses (Dubeux *et al.* 2006). Root system may also be affected by management intensity. Frequent defoliation and low plant nutrition level may reduce root biomass (Richards 1993) and affect its decomposition. This study evaluated the effect of different SR´s and N fertilization levels on the decomposition of elephant grass roots.

## Materials and Methods

Rainfall and temperature data for the experimental site in Itambé-PE (7.45°S, 35.24°W), Brazil is shown in Figure 1. Treatments were three stocking rates [2, 3.9, and 5.8 animal units (AU) /ha where 1 AU = 450 kg live weight] and three N levels (0, 150, and 300 kg N/ha/year) on *Pennisetum purpureum* Schum. pasture. A split-plot experimental design was used in randomized blocks, replicated three times. Main plot was SR and split-plot the N fertilization level. Roots were sampled at 0-20 cm soil layer, dried, and incubated in nylon bags for different time periods: 0, 4, 8, 16, 32, 64, 128, 256, and 512 days. Root samples were collected and incubation occurred during 2009-2010 and 2010-2011 seasons. Bags were placed into the soil, at 20 cm depth. Data was analyzed using proc mixed from SAS (SAS 1996). Fixed effects included SR, N fertilization, incubation time, and periods (2009-2010 and 2010-2011). Random effects included block and its interactions with fixed effects. If incubation time was significant, the negative single exponential decomposition model was applied for each treatment at each block using SAS NLIN procedure, and the parameters (B0 and k) were evaluated using SAS MIXED procedure.

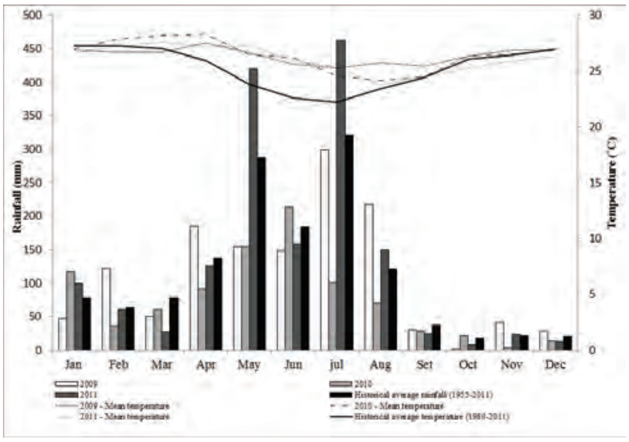


**Figure 1. Rainfall and temperature data for the experimental site; Itambé-PE, Brazil.**

## Results and Discussion

Biomass decomposition was adequately explained by the single negative exponential model. During the second experimental period (2010-2011), roots showed higher decomposition rates compared to the first period (2009-2010). Likely reasons for that are climate and treatment carry over effects (fertilization and SR) After 512 days of incubation, the remaining biomass in the first period was 40% whereas in the second period was 30%. The C:N ratio decreased along the 512 days of incubation for both experimental periods, however, the C:N ratio decreased faster during the second period (k = 0.00168 g/g/day) compared to the first period (k = 0.00113 g/g/day). The C:N ratio remained above 30 after 512 days of incubation. The Lignin:N ratio was higher in the first trial than in the second for the different stocking rate (3.9 and 5.8 AU/ha). However, for the lower stocking rate (2.0 AU/ha), the ratio LIG:N did not differ between periods. In the first experimental period (2009-2010), the LIG:N ratio presented linear decreasing with increasing stocking rate. The remaining nitrogen followed the single exponential model. Treatments differed, with remaining N of 60, 45 and 40% for 0, 150 and 300 kg N/ha/yr, respectively. Root residues were more recalcitrant in the first period compared to the second period likely due to lower N and higher ADIN and lignin.

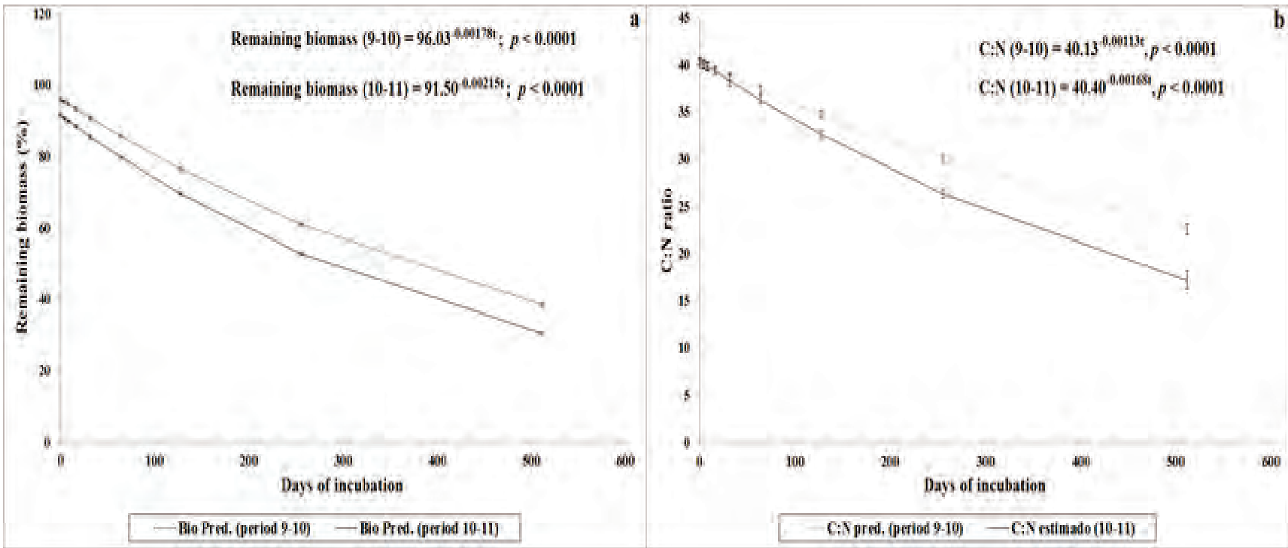


**Figure 2. Remaining root biomass (a) and C:N ratio (b) after different incubation periods during two seasons (2009-2010 and 2010-2011).**

**Table 1. Nitrogen (N), carbon (C), lignin (LIG) and acid detergent fiber N (ADIN) concentrations, C:N, LIG:N and ADFN:N ratios on an organic matter (OM) basis for elephant grass roots in 2009 and 2010 before soil incubation at Itambé Experimental Station of the Pernambuco Agronomical Institute, Pernambuco State, Brazil.**

| Year | N | C | LIG | ADIN | C:N | LIG:N | ADIN:N | LIG:ADIN |
|---|---|---|---|---|---|---|---|---|
| | g/kg organic matter | | | | Ratio | | | |
| 9-10 | 9.04 | 355.8 | 156.6 | 2.6 | 40.00 | 17.49 | 28.55 | 98.25 |
| 10-11 | 10.0 | 322.1 | 104.8 | 1.5 | 32.51 | 10.52 | 15.58 | 74.74 |
| SE | 0.21 | 21.61 | 6.54 | 0.24 | 2.43 | 0.73 | 2.46 | 8.53 |
| P | 0.0003 | 0.1090 | 0.0001 | 0.0009 | 0.0029 | 0.0001 | 0.0002 | 0.0608 |

## Conclusions

The different climate and litter quality between experimental periods accelerated litter decomposition and reduced nutrient immobilization by litter, leading to a faster recycling of nutrients on elephant grass pastures.

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