

**NITROGEN DYNAMICS FROM DECOMPOSING LITTER OF *Panicum maximum*
WITH DIFERENT NITROGEN AND PHOSPHORUS CONTENT IN BRAZILIAN
ALFISSOL**

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Abstract

The objective of this study was to measure the dynamics (immobilization and release) of N and to evaluate the effect of the initial chemical composition of four *Panicum maximum* cultivars grown in a Alfisol and fertilized with different levels of nitrogen (0, 80 e 160 kg ha⁻¹ de N) and phosphorus (0 e 200 kg ha⁻¹), on the release of the N from the litter using the litterbags technique. There was an increase in the litter initial concentration of N with time of decomposition. The Aruana and Vencedor cultivars released about 70 and 60% of N; respectively, during the decomposition of the litter from 0(zero) to 336 days; the Tobiatã and Tanzânia cultivars released about 30 and >30% of N from the concentration of the initial litter respectively. Nitrogen fertilization increased the N release, up to 20% in the highest N level tested (160 kg ha⁻¹ of N).

Keywords: decomposition, immobilization, mineralization

Introduction

The release of the nitrogen from decomposing litter may control the primary productivity of the ecosystem by influencing the N availability for either uptake by plant or loss from the system. The synchronicity between nitrogen release from the decomposing litter and the uptake by the plants and animals is an important key to get sustainable pasture systems. One way to reach this approach is to improve the litter quality by selecting forage species with high nutritional value, as well as through mineral fertilization to increase nitrogen content in the tissue of litter.

Material and Methods

This study was conducted on an Alfisol at Instituto de Zootecnia de Nova Odessa – SP from september 1995 to december 1996. Four cultivars of *Panicum maximum* pastures (Tobiatã, Vencedor, Aruana and Tanzânia) were fertilized with levels of surface applied nitrogen (0, 80 and 160 kg/ha of N as amonium sulfate) and phosphorus (0 and 200 kg/ha of P₂O₅ as triple-superfosfate) using a 6 by 4 factorial arranged in a split-plot randomizing blocks with tree replicates. The main plot (18 m x 3 m) received the cultivars and the split-plot (6m x 3 m) received the fertilizer levels. Tree months latter, the plants were harvested and the old and senescent leaves were separated and oven-dried. The litter bag technique were used to quantify the decomposition rate of these material using the procedures described in Schunke et al. (1998). The dry matter recovered from the litter bags at times of 28, 56, 112, 224 and 336 days were ground and determinated the total-N using kjeldahl method and C concentration using Walkley-Black procedure (Tedesco et al, 1985), with external heat. The C/N rate was then calculated. The nitrogen flow was calculated with data from nutrient

concentration of litter in each treatment and the corresponding litter mass loss described in Schunke et al. (1998). The decaying rate at any time t_0 was assessed by multiplying the remaining litter mass by the N concentration and the result divided by the N concentration found at the time t_0 . The analysis of variance was performed using the SAS System procedures. The Sigma-Plot procedure using the treatments average was used to assess the fitting curves. Samples of litter (1 g) from the treatments of the cultivars Vencedor and Aruana litter were aerobically incubated in soil (20 g) collected from 0-10 cm layer of the experimental plots. The well mixed soil and the litter samples were added to a 250 ml glass bottle, moistened with distilled H₂O and kept at 28 °C room. At 7, 14, 28, 56 e 112 days of incubation the mineralization was stopped by adding of 200 ml of KCl 1M by sample and the N mineral (N-NH₄ and N-NO₃) were analysed by colorimetric flow injection techniques (Alves et al., 1992). The statistical design used was randomized blocks with three replications. For the statistical analysis was used the SAS System (1985) procedures.

Results and Discussion

In the approach of this discussion we considered only the data resulting from time effect and the interactions of time against the effects of cultivar, nitrogen fertilization and phosphorus fertilization. The N concentration increased from 11,4 at t_0 to 21,8 g kg⁻¹ at t_{336} days, and represents the effect of decaying time on the C metabolism associated with N immobilization by the microorganism. The N release from t_0 to t_{336} days was affected by the *Panicum maximum* cultivars (P<0,01) and by the levels of nitrogen fertilization (P<0,01). There was no effect of phosphorus fertilization. It was observed that approximately 40% of the initial N content was released from all cultivars tested after the 28th day (Fig 1). Considering the total period of 336 days the Aruana cultivar released around 70% and the Vencedor cultivar released around 60% of the initial N concentration in their tissues. The

litter of Tobiata and Tanzania cultivars (with 9 g kg⁻¹ of initial N concentration) had a high immobilization patterns from 56 to 100 days (*t*₅₆ to *t*₁₀₀). After 224 days (*t*₂₂₄) the release of N had resumed reaching 30% of the initial N at *t*₃₃₆, for both cultivars, only. The total amount of N released from the cultivars Aruana, Vencedor, Tanzania and Tobiata were 9,3; 8,2; 3,4 and 2,5 g of N Kg⁻¹ respectively. Nitrogen fertilization affected positively the amount of N in the litter and consequently the release of N to the system. The litter from plots that received 80 and 160 kg of N released an additional 10% and 20% N respectively as compared to the control plot. In the aerobic incubation experiment, the release of N-NH₄ and N-NO₃ from the litter of Tobiata and Vencedor cultivars, were affected by incubation time *versus* cultivars (P <0,01) and incubation time *versus* N fertilization (P <0,01). The same results were obtained under field conditions. The N-NH₄ release increased as function time and was higher for Vencedor than for Tobiata. Immobilization of N-NO₃ occurred during the first two weeks of litter for both nitrogen levels and cultivars. After this period N releases begin to take place. This immobilization process was not described in the field because the litterbag harvest occurred after the 28th day. The cultivars Vencedor and Tobiata had an initial N concentration of 13 and 8 g kg⁻¹ respectively and this pattern. was not affected by nitrogen fertilization.. The N-total release from Vencedor litter increased with time. The patterns of N dynamics were similar in both methods used (incubation and field condition). In order to optimize the N release from tissue decay in a pasture system, the choice of an appropriate cultivar is more effective than building up nutrient concentration in plant tissue through soil fertilization with nitrogen and phosphorus.

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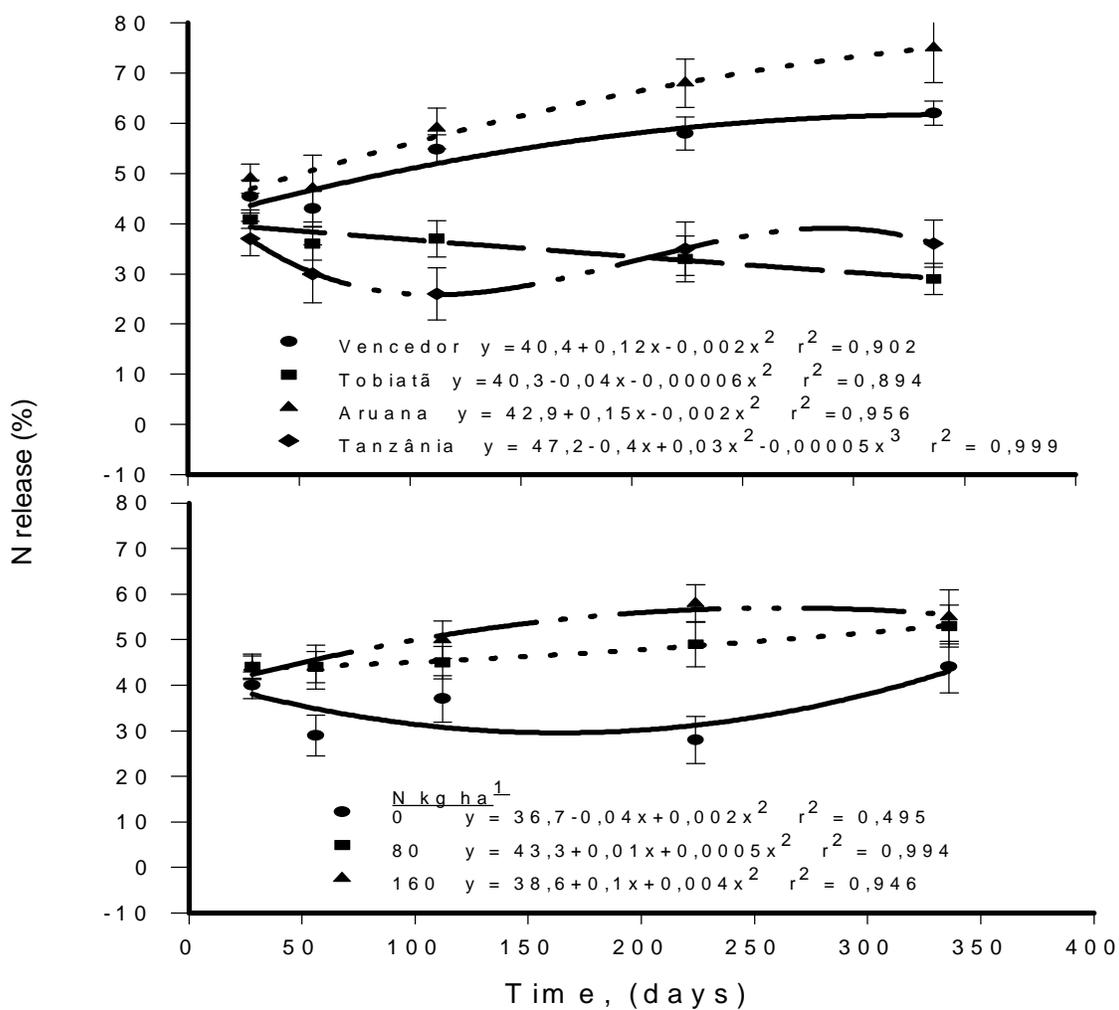


Figure 1 - Effect of cultivars and nitrogen fertilization on nitrogen release (%) from the litter of *Panicum maximum* in a Brazilian Alfisol