# Decomposition of Cattle Dung on Mixed Grass-Legume Pastures

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## Presenter Information

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## Introduction

Animal excreta contribute positively to nutrient cycling and can improve the quality of soil (Dubeux *et al*. 2009, Carvalho *et al*. 2010). Cattle excrement, when evenly distributed over a pasture, can help to maintain plant nutrition without the application of fertilizers. The introduction of legumes intercropped with grasses benefits the soil by means of nitrogen fixation. Also, when ruminant animals eat legumes, the excrement produced may have lower C:N, C:P, lignin:N and lignin:P ratios promoting better nutrient return to the soil compared to when cattle eat only grass. Given the importance of nutrient return and decomposition time of cattle excreta on pastures, the objective of this study was to evaluate the decomposition of excrement of heifers managed in mixed grass-shrubby legume pastures and grass-only pastures.

## Materials and Methods

The experiment evaluated the decomposition of excrement of heifers managed in signal grass (*Brachiaria decumbens Stapf.)* pastures intercropped (or not) with shrubby legumes. Treatments were: (1) Signal grass in pure stand and not fertilized; (2) signal grass in pure stand + 60 kg N/ha/yr; (3) signal grass intercropped with *Mimosa caesalpiniifolia Benth*.; (4) signal grass intercropped with *Leucaena leucocephala* (Lam.) de Wit; (5) signal grass intercropped with *Bauhinia cheilantha* (Bong) Steud.; and (6i) signal grass intercropped with *Gliricidia sepium* (Jacq.) Kunth ex Walp. The experiment was planted in July 2008; legumes when present were planted in double rows spaced 10 m x 1.0 m x 0.5 m. The excrement was collected from cattle grazing/browsing the different pasture combination; paddocks (plots) measured 660 $m^2$ and were individually fenced. Fecal samples were collected and dried at 65ºC for 72 hours. Samples were then incubated in nylon bags at field conditions (Dubeux Jr. *et al*. 2006) at seven time periods (4, 8, 16, 32, 64, 128 and 256 days) with three replicates per incubation, from June 23, 2010 to February 26, 2011. The research was performed at the experimental research station of Itambé, run by the Agronomic Institute of Pernambuco (IPA). Average precipitation during the experiment was 727 mm. The means were analyzed using the PROC MIXED procedure in SAS (SAS Inst. 1996). A single exponential model (Wagner and Wolf 1999) was used for percentage loss of organic matter.

## Results and Discussion

The *Brachiaria decumbens* (60 kg N) treatment had the highest rate of fecal biomass loss (k=0,0031g/g/d) with 55% loss of organic matter over the 256 day incubation period. The lowest rate of loss was seen for *Mimosa caesalpiniifolia Benth*. (k=0,0018 g/g/d) with 37% of the material decomposing over the same period. The excrement collected in the *Gliricidia sepium* (Jacq.) and *Brachiaria decumbens* treatments showed similar loss rates (k= 0.0027 and 0.0028 g/g/d, respectively) and the *Leucaena leucocephala* decomposition rate was close to that of the *Brachiaria decumbens* (60kg N) treatment, which can be attributed to nitrogen fixation by some legumes, providing a higher quality grass on offer (Table 1). The nitrogen (N), phosphorus (P) and potassium (K) remaining showed a significant difference only based on decomposition time (Fig. 1), and the relative rate of loss (k) of N was 0.00043 g/g/d which explains the return of nitrogen of ~16%, at the end time of the incubation (256 days). Phosphorus and potassium released 60% and 99.6%, respectively, in the same incubation period.

## Conclusions

The rate of biomass loss from excrement collected in mixed grass-legume pasture and grass-only pastures are greatest during the first days of incubation. Different excreta decomposition rates among pastures are significant for nutrient cycling because faster rates may lead to greater nutrient use efficiency.

**Table 1. Percentage of biomass remaining of heifer excrement in grass-legume pastures and grass-only pastures in different incubation times**

| Treatment | Days of incubation (%) | | | | | | | | Exponential model |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 4 | 8 | 16 | 32 | 64 | 128 | 256 | |
| *Brachiaria decumbens* | 90.19 | 89.22 | 88.26 | 86.37 | 82.72 | 75.88 | 63.84 | 45.19 | $Y = 90.19^{-0.0027t}$ |
| *B. decumbens* (60 kg/N) | 87.28 | 86.19 | 85.15 | 83.01 | 78.95 | 71.42 | 58.43 | 39.12 | $Y = 87.28^{-0.0031}$ |
| *Gliricidia Sepium* | 88.86 | 87.93 | 87.04 | 85.3 | 81.91 | 75.54 | 64.24 | 46.4 | $Y = 88.82^{-0.0025t}$ |
| *Leucaena leucocephala* | 90.23 | 89.17 | 88.12 | 86.06 | 82.08 | 74.67 | 61.79 | 42.32 | $Y = 90.23^{-0.0029t}$ |
| Bauhinia cheilantha | 88.63 | 87.83 | 87.04 | 85.48 | 82.44 | 76.68 | 66.34 | 49.65 | $Y = 86.63^{-0.0023t}$ |
| Mimosa caesalpinifolia | 90.52 | 89.63 | 89.21 | 87.93 | 85.42 | 80.61 | 71.8 | 56.96 | $Y = 90.52^{-0.0018t}$ |

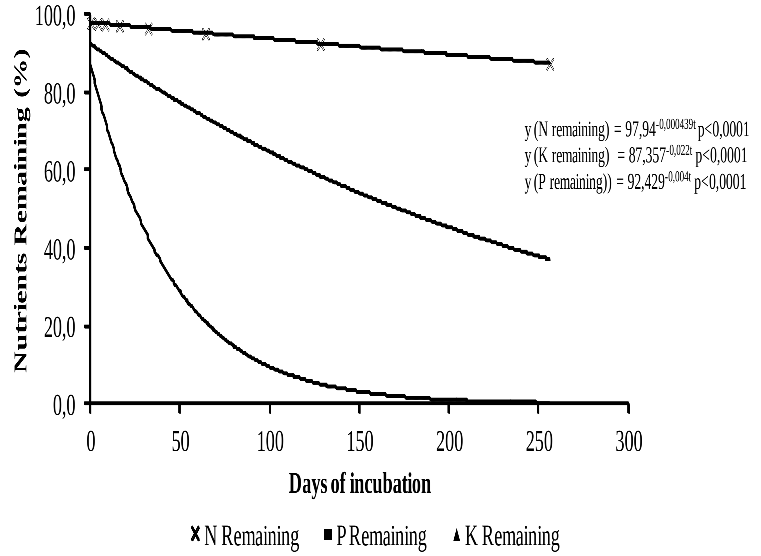


**Figure 1. Percentage of nitrogen, phosphorus and potassium remaining in heifer excrement in grass-legume and grass-only pastures.**

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