

Nitrogen cycling and N₂O emissions in *Brachiaria*-based grass-alone pastures and silvopastoral systems in a grazing trial in Colombia

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Introduction

Silvopastoral systems provide a number of environmental and productive benefits compared to grass-alone pastures in terms of:

- i) increased forage biomass offer and quality
- ii) nutrient cycling
- iii) biodiversity
- iv) cash flow, among other ecosystem services.

Objective

To evaluate the nitrogen (N) cycling differences in grass-alone pastures and silvopastoral systems we established a field trial in the CIAT campus in Palmira, Colombia.

Methodology

Experimental design: Complete blocks with three replications

Treatments:

- » T1: *Brachiaria* hybrid cv. Cayman (CIAT BR02/1752)
- » T2: *Brachiaria brizantha* cv. Toledo (CIAT 26110)
- » T3: *Brachiaria* hybrid cv. Cayman + *Leucaena diversifolia* (ILRI 15551)
- » T4: *Brachiaria* hybrid cv. Toledo + *Leucaena diversifolia* (ILRI 15551)

Response variables:

- » Plant biomass production
- » Nutrition quality parameters (Crude protein-CP, acid detergent fiber-ADF, neutral detergent fiber-NDF)
- » N₂O emissions from urine patches



Figure 1. Silvopastoral trial at CIAT, Colombia.

Results

Plant biomass production and nutrition quality of the pastures was higher in the grass-legume (T3 and T4) than the grass monoculture treatments (T1 and T2). N₂O emissions were higher in the grass-legume pastures.

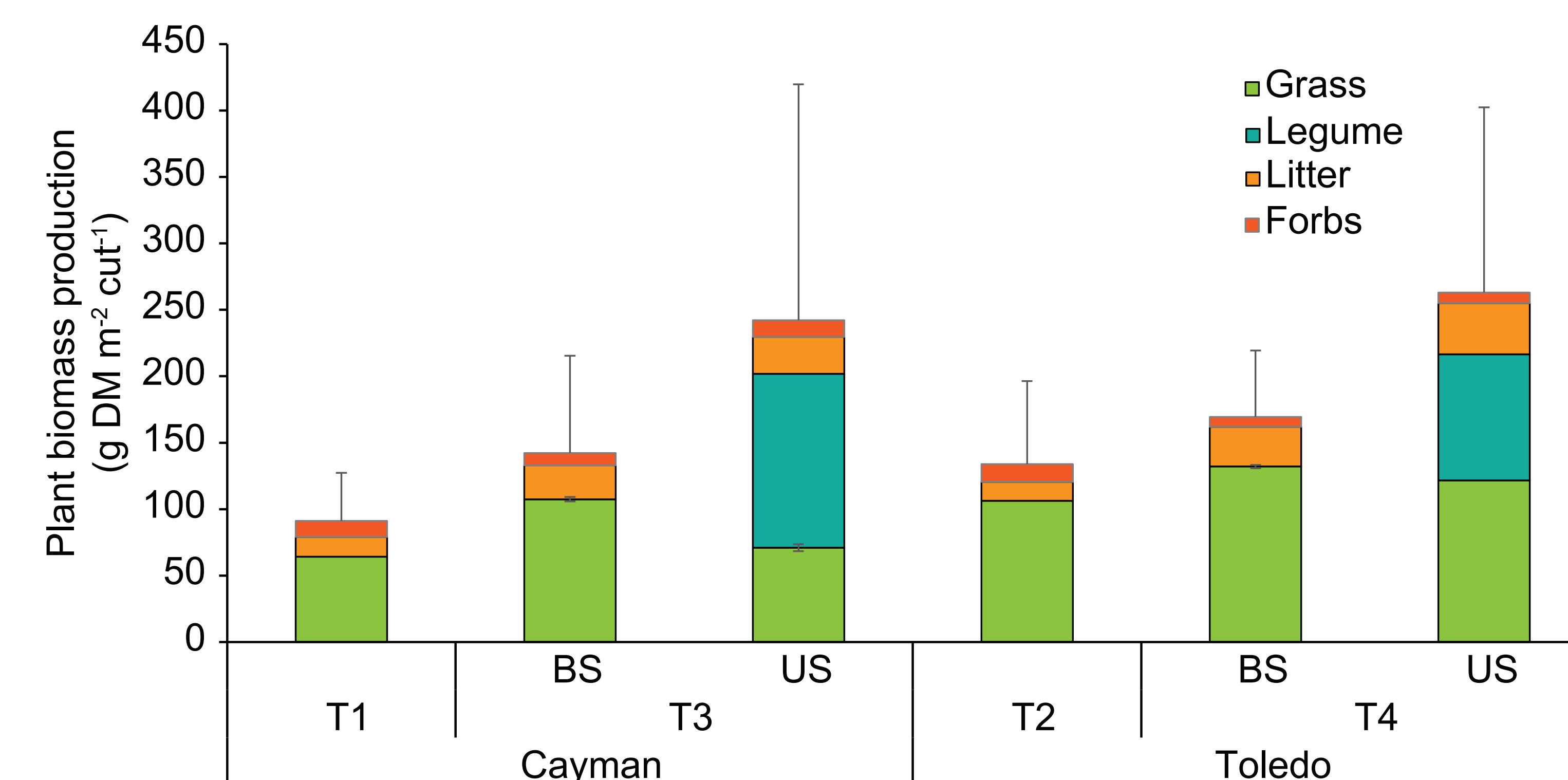


Figure 2. Plant biomass production in different pasture treatments. BS: Area between shrub rows of *L. diversifolia*. US: Area under shrubs of *L. diversifolia*.

Table 1. Nutrition quality parameters of grass alone (T1-T2) and grass-legume tree (T3-T4) pasture treatments.

Treatment	Area	CP (%)		ADF (%)		NDF (%)	
		Grass	Legume	Grass	Legume	Grass	Legume
T1	-	8.8	-	26.1	-	61.3	-
T2	-	9.6	-	32.8	-	68.6	-
T3	BS	13	-	30	-	62.5	-
	US	14.1	26.6	30	49.4	63.5	58.7
T4	BS	9.7	-	35.9	-	69.7	-
	US	12	26.4	36.5	51.7	69.2	60.3

Table 2. Nitrous oxide emissions of grass alone (T1-T2) and grass-legume tree (T3-T4) pasture treatments.

Treatment	Area	Plant biomass	N ₂ O emissions	Emissions intensity
		g DM m ⁻²	mg N ₂ O-N m ⁻²	mg N ₂ O g DM ⁻¹
T1	-	91.3	352.5	3.9
T2	-	133.9	453.4	3.4
T3	BS	142.4	404.5	2.8
	US	242.1	613.2	2.5
T4	BS	169.4	540.8	3.2
	US	263.0	685.7	2.6

Conclusions

Although N₂O emissions were higher in the grass-legume pastures, higher N uptake by the pastures in terms of higher N accumulation in tissue and biomass production yielded to lower emissions intensity, i.e. less N₂O emitted per dry matter produced.

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