

N fixation and N₂O emissions in silvopastoral systems based on *Urochloa* grasses & *Leucaena* shrub legume.

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Introduction

Silvopastoral systems provide a number of environmental and productive benefits compared to grass-alone pastures (Shultze-kraft et al 2018) 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 (SPS) we established a field trial in the CIAT campus in Palmira, Colombia.

Results



Figure 1. Silvopastoral trial at CIAT, Colombia. Photo: CIAT/ M Sotelo

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.

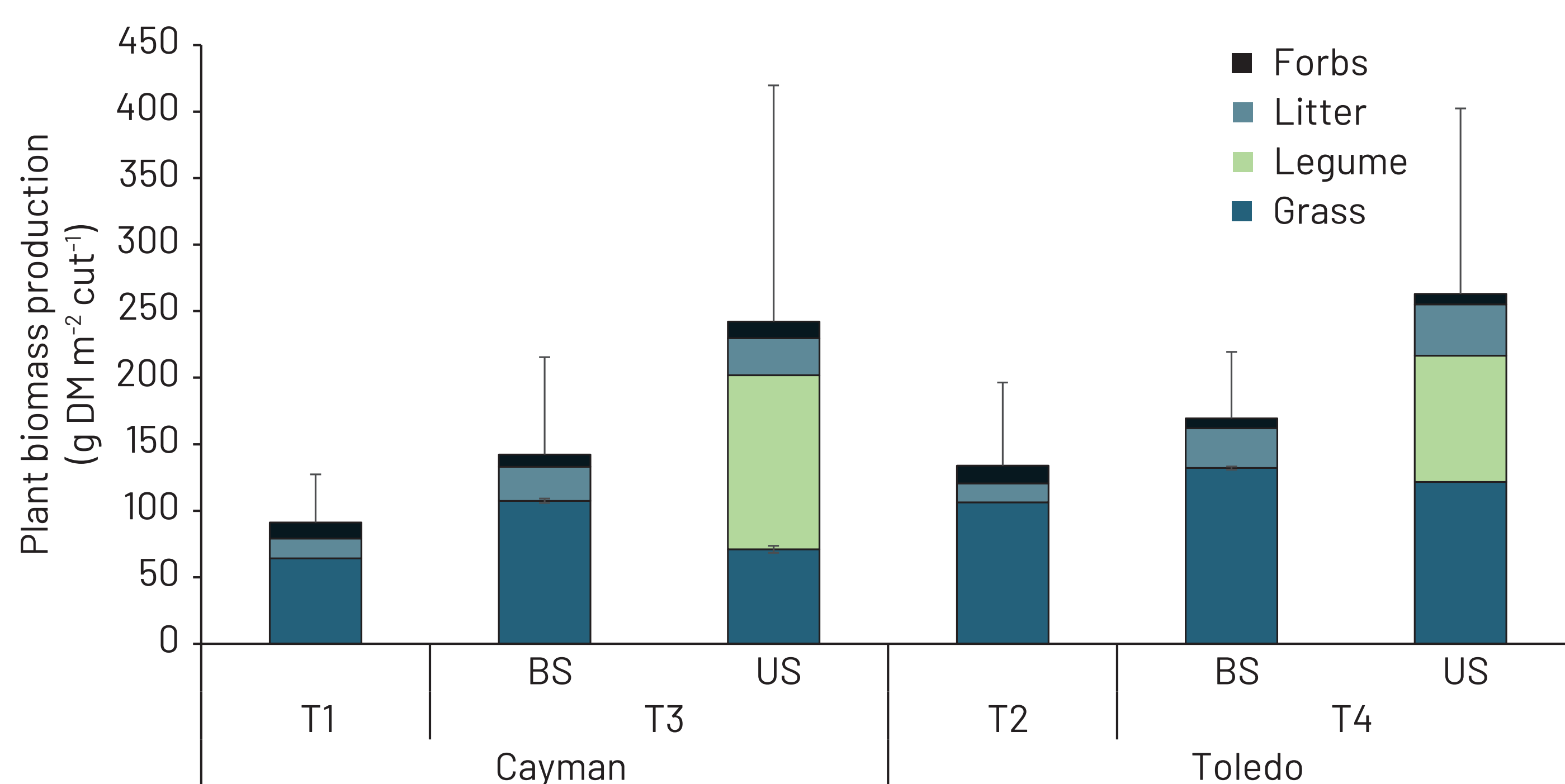


Figure 2. Plant biomass production in different pasture treatments. BS=Area between shrub rows of *L. diversifolia*. US=Area under shrubs of *L. diversifolia*.

References

Schultze-Kraft, R., Rao, I. M., Peters, M., Clements, R. J., Bai, C., & Liu, G. (2018). Tropical forage legumes for environmental benefits: An overview. *Tropical Grasslands-Forrajes Tropicales*, 6(1), 1-14. [https://doi.org/10.17138/tgft\(6\)1-14](https://doi.org/10.17138/tgft(6)1-14)

Methodology

Experimental design: RCBD with three replications. Treatments:

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

Table 1. Nutrition quality parameters of grass alone (T1-T2) and grass-legume tree (T3-T4) 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. N₂O emissions of grass alone (T1-T2) and grass-legume tree (T3-T4) pasture treatments.

Treatment	Area	Plant biomass g DM m ⁻²	N ₂ O emissions mg N ₂ O-N m ⁻²	Emissions intensity 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.

Acknowledgments

This work was conducted as part of the One CGIAR Initiative on Livestock and Climate. We thank all donors who globally support our work through their contributions to the CGIAR System. CGIAR is a global research partnership for a food-secure future. Its science is carried out by 15 Research Centers in close collaboration with hundreds of partners across the globe.

