



# Tree legume enhance livestock performance in silvopasture system

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## INTRODUCTION

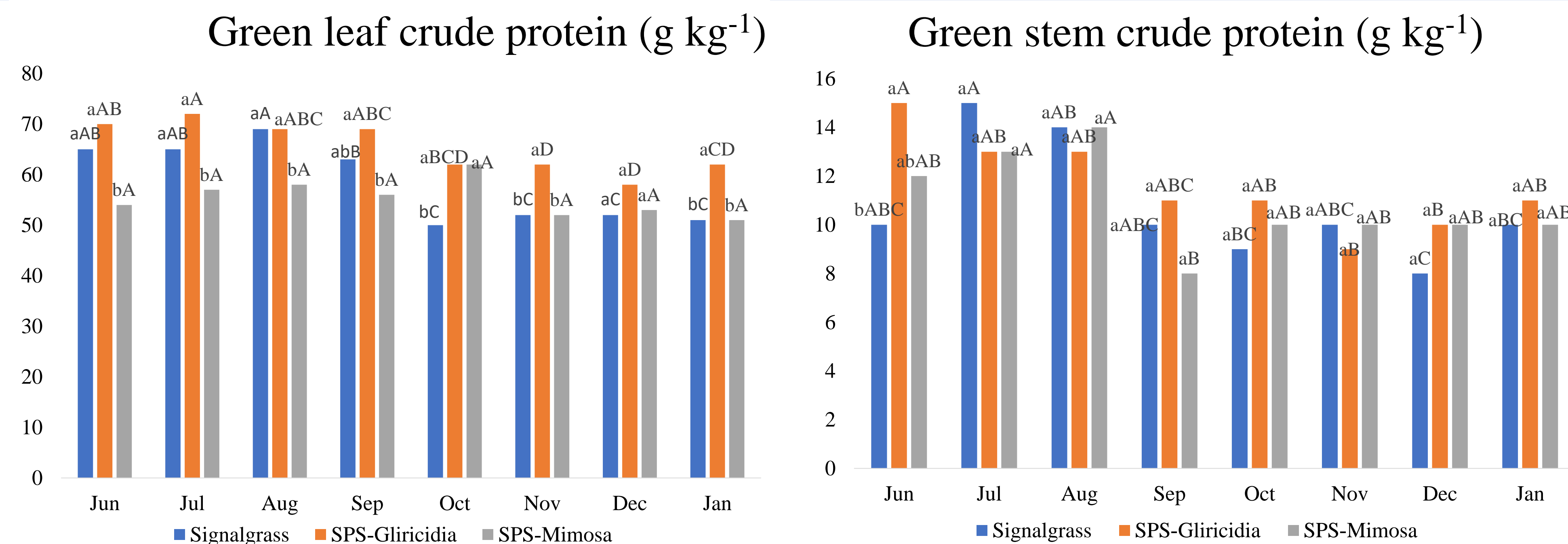
Silvopasture systems can increase overall productivity and deliver ecosystem services from different categories as provisioning, regulating, supporting, and cultural services.

## MATERIAL AND METHODS

- Herbage mass was determined using the double-sampling technique
- Grass samples were separated into stem (green and dry) and leaf blade (green and dry).
- Green herbage accumulation rate was determined by placing exclusion cages (1 m<sup>2</sup>; 1 x 1 m)
- Holstein x Zebu steers grazed paddocks under continuous stocking with variable stocking rate
- Gain per area was estimated by multiplying ADG by the stocking rate and time interval between sampling dates
- The data were submitted to statistical analysis using the Mixed procedure of SAS 9.4 (2012).



## RESULTS AND DISCUSSION



Lowercase letters show comparisons of months within treatments and uppercase letters show comparisons of treatments within each month

**Table 1.** Canopy green fraction and proportion of leaf blade and stem in the green fraction during the experimental period. Data averaged across replications and years.

Treatments*	Canopy green fraction (g kg <sup>-1</sup> )							
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Signalgrass <sup>†</sup>	740 aAB	780 aA	677 aABC	562 aCD	505 aD	497 aD	557 aD	605 aBC
SPS-Gliricidia	778 aA	763 aAB	667 aBC	552 aCD	463 aD	475 aD	477 aD	617 aC
SPS-Mimosa	805 aA	807 aA	655 aB	542 aBC	428 aC	468 aC	480 aC	618 aB
SEM	----- 25 -----							
	Proportion of leaf and stem in the canopy green fraction							
	Leaf Blade (g kg <sup>-1</sup> )							
Signalgrass	662 abA	652 abA	594 aAB	498 abBC	425 abCD	534 bBC	333 aD	323 bD
SPS-Gliricidia	742 aA	734 aA	612 aB	516 aBC	458 aCD	495 bBC	356 aD	515 aBC
SPS-Mimosa	588 bB	605 bAB	546 aBC	432 bCD	322 bD	300 aA	200 bE	350 bD
SEM	----- 24 -----							
Stem (g kg <sup>-1</sup> )								
Signalgrass	338 abD	348 abD	406 aCD	502 abBC	575 abB	434 aC	667 bA	677 aA
SPS-Gliricidia	258 bE	266 bE	388 aD	484 aC	542 bB	505 aBC	644 bA	485 bC
SPS-Mimosa	412 aDE	395 aE	454 aD	568 bC	678 aB	700 bF	800 aA	650 aB
SEM	----- 15 -----							

<sup>†</sup>Means followed by the same lowercase letters in the columns (treatments) and upper-case letter within rows (sampling dates), within each response variable (leaf blade or stem), do not differ by Tukey test (P<0.05). \*Signalgrass in monoculture; SPS: silvopastoral systems. SEM = standard error of mean.

**Table 2.** Livestock responses during 2-yr experiment comparing silvopasture systems using tree legumes with signalgrass monoculture.

	Herbage Allowance (kg DM kg <sup>-1</sup> BW)							
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Signalgrass <sup>†</sup>	3.1 aA	3.1 aA	3.0 aA	3.0 aA	3.0 aA	2.9 aB	3.0 aA	3.0 aA
SPS-Gliricidia	3.2 aA	3.1 aA	3.0 aA	3.0 aA	2.9 aA	2.9 aA	3.0 aA	3.0 aA
SPS-Mimosa	3.0 bA	2.9 bAB	2.4 bB	2.3 bC	---	---	---	---
SEM	----- 0.02 ----- 0.04 -----							
	Average daily gain (kg head <sup>-1</sup> d <sup>-1</sup> )							
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Signalgrass <sup>†</sup>	0.93 aA	0.94 bA	0.52 aAB	0.38 aB	0.40 bB	0.36 aB	0.38 aB	0.55 aB
SPS-Gliricidia	1.11 aA	1.28 aA	0.89 aB	0.70 aBC	0.61 aBC	0.49 aC	0.43 aC	0.63 aBC
SPS-Mimosa	0.50 bA	0.44 cA	-0.01 bB	-0.03 bB	---	---	---	---
SEM	----- 0.07 ----- 0.10 -----							
	Stocking rate (steers ha <sup>-1</sup> )							
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Signalgrass <sup>†</sup>	3.7 aA	3.5 aA	2.0 aB	2.0 aB	2.0 aB	2.0 aB	2.0 aB	2.0 aB
SPS-Gliricidia	3.2 aA	3.2 aA	2.0 aB	2.0 aB	2.0 aB	2.0 aB	2.0 aB	2.0 aB
SPS-Mimosa	2.0 bA	2.0 bA	2.0 aA	2.0 aA	---	---	---	---
SEM	----- 0.2 -----							
	Gain per area (kg BW ha <sup>-1</sup> 28 d <sup>-1</sup> )							
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Signalgrass <sup>†</sup>	95 aA	94 aA	37 aB	26 aB	22 bB	20 aB	21 aB	31 aB
SPS-Gliricidia	100 aA	112 aA	50 aB	39 aB	34 aB	27 aB	24 aB	35 aB
SPS-Mimosa	28 bA	25 bA	-1 bB	-2 bB	---	---	---	---
SEM	----- 10 ----- 6 -----							

<sup>†</sup> Means followed by the same lowercase letters in the columns (treatments) and upper-case letter within rows (sampling dates), within each response variable, do not differ by Tukey test (P<0.05). \*Signalgrass in monoculture; SPS: silvopastoral systems. SEM = standard error of mean.

## TAKE-HOME MESSAGES

- Silvopasture systems using tree legumes are an option to develop sustainable livestock systems;
- Greater animal productivity occurred for the SPS-Gliricidia, followed by signalgrass in monoculture, and then SPS-Mimosa
- Competition between the Mimosa trees and the herbaceous signalgrass canopy reduced green herbage accumulation rate, decreasing stocking rate and gain per area as a result;
- Both SPS had lesser herbage mass compared with signalgrass monoculture; however, greater crude protein concentration in signalgrass growing in SPS-Gliricidia compensated the lesser herbage mass translating into greater livestock gains;
- SPS's have potential not only to support greater livestock gains, but also to provide other ecosystem services that benefit the entire society;
- Gliricidia is a better option to use with signalgrass in SPS compared with mimosa trees if the main goal is livestock production. Timber sale from Mimosa might provide additional income to compensate livestock losses.