CIAT

International Center for Tropical Agriculture
Since 1967 Science to cultivate change

Towards an Eco-efficient Livestock Production

Michael Peters[1], Jacobo Arango[1], Mauricio Sotelo[1], Jhon Freddy Gutierrez[1], Ashly Arévalo[1], Daniel Villegas[1], Johanna Mazabel[1], Isabel Molina[1], Belisario Hincapie[1], Idupulapati Rao[1] in collaboration with Ngonidzashe Chirinda[2] and Laura Arenas[2].

[1]Tropical Forages Program, CIAT

[2]Soils and Landscapes for Sustainability (SoiLS), CIAT

CGIAR RESEARCH PROGRAM ON Livestock

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

Silvopastoral systems: Moving forward towards an eco-efficient livestock production

Objective: To estimate and demonstrate eco-efficiency of improved forage-based silvopastoral systems.

Location: CIAT Campus, Palmira, Valle, Colombia

Climatic conditions:

Mean temperature **24° C**

Annual rainfall **1,200** mm

Relative humidity **74%**

Sunshine hours **1,859** h/year

Pan evaporation **1,780** mm/y

Elevation **990** masl

Start date: August 2013

Experimental design: Randomized complete block with 3 replications.

Treatments:

T1: Single grass (*Brachiaria* hybrid cv Cayman or *B. brizantha* cv Toledo)

T2: Grass + Herbaceous legume (*Cannavalia brasiliensis*)

T3: Grass + Herbaceous legume (*C. brasiliensis*) + Shrub legume (*Leucaena diversifolia*; 2,000 plants of Leucaena/ha)

Individual plot size: 0.33 ha; total area: 6.0 ha

Grazing management: Rotational. The total area of each block of 0.33 ha is divided into nine sub-blocks (0.036 ha each) with an occupation time of three days. Each plot is grazed for 27 days.

Table 1. Forage characteristics of interest for livestock productivity.

Species/ Characteristics	*B.* hybrid cv Cayman (CIAT Br02/1752)	*B. brizantha* cv Toledo (CIAT 26110)	*C. brasiliensis* (CIAT 17009)	*L. diversifolia* (ILRI 15551)
Adaptation to soil pH	4.5–8.0	4.5–8.0	4.3–8.0	5.5–7.5
Crude protein (%)	15	15	25	25
Digestibility (%)	62	62	70	60
Dry matter Production (Mg/ha/year)	20	35.8	8	2-4
Stocking rate (AU/ha)	3.8	3.8	4.2*	4.5**

*Stocking rate (AU/ha) of the association grass-legume: (*B.* hybrid CIAT BR02/1752 cv Cayman + *C. brasiliensis* CIAT 17009 or *B. brizantha* CIAT 26110 cv Toledo + *C. brasiliensis* CIAT 17009)

** Stocking rate (AU/ha) of the association grass-legume: *B.* hybrid CIAT BR02/1752 cv Cayman + *C. brasiliensis* CIAT 17009 + *L. diversifolia* ILRI 15551 or *B. brizantha* CIAT 26110 cv Toledo + *C. brasiliensis* CIAT 17009 + *L. diversifolia* ILRI 15551

Animal Unit (AU) = 450 kg

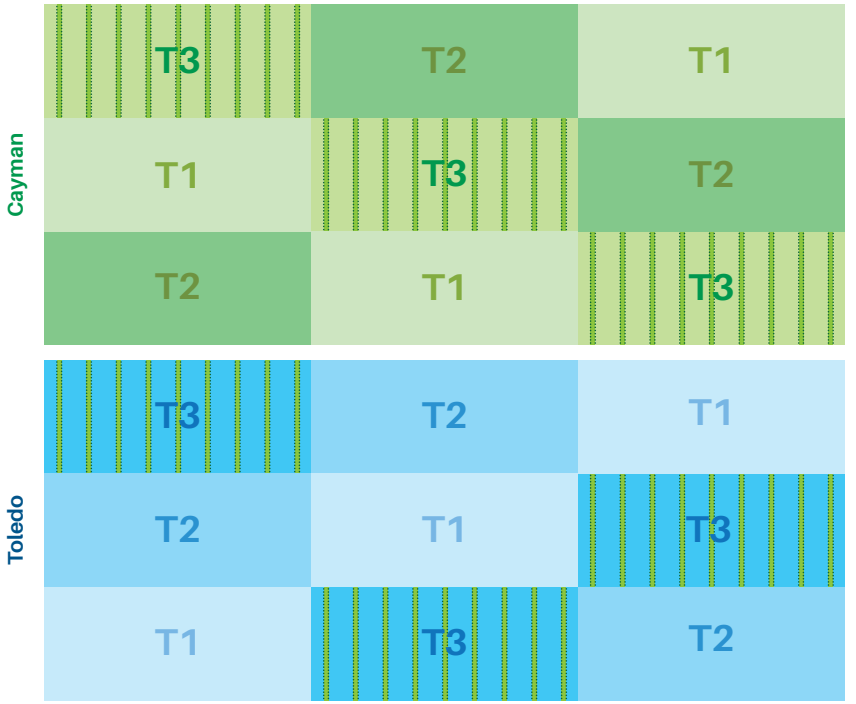

Figure 1. Experimental layout. Green bars indicate the strips of the shrub legume (Leucaena).

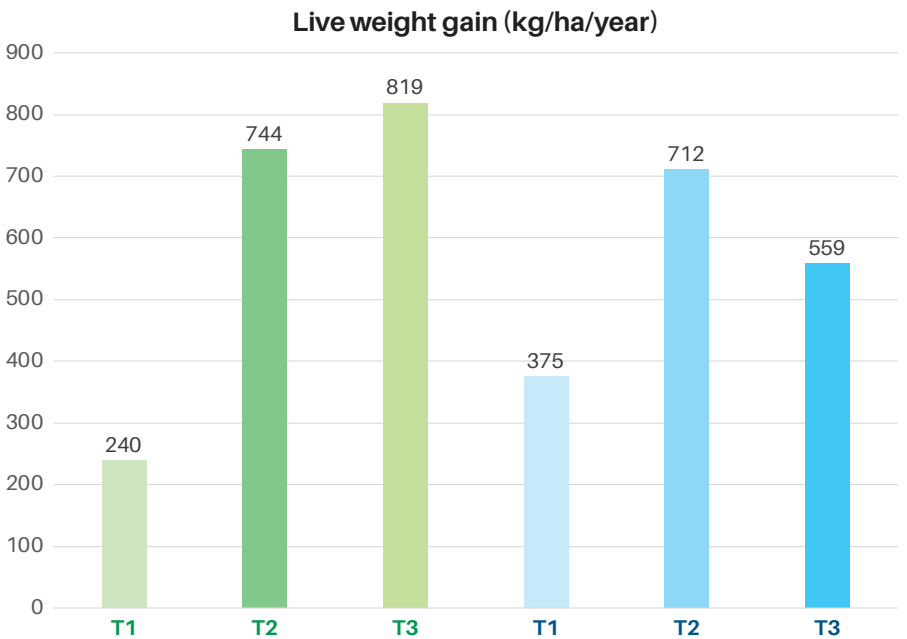

Figure 2. Live weight gain (LWG) recorded of cattle grazing improved forages. The cattle used for this trial were not specialized for fattening and therefore the potential values of LWG could be even higher.

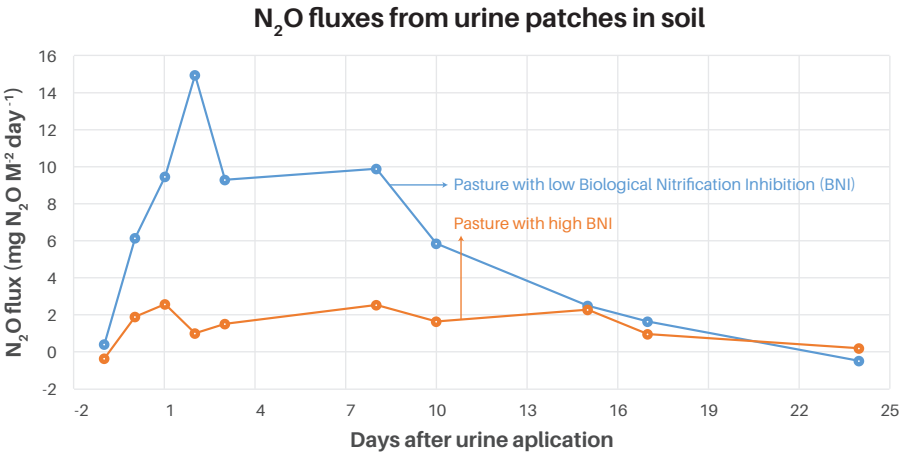

Figure 3. Nitrous oxide emissions from urine patches measured under two improved *Brachiaria* grasses differing in their ability to inhibit nitrification in soil: *B.* hybrid cv Mulato (low BNI grass) and *B. humidicola* CIAT 679 (high BNI grass).

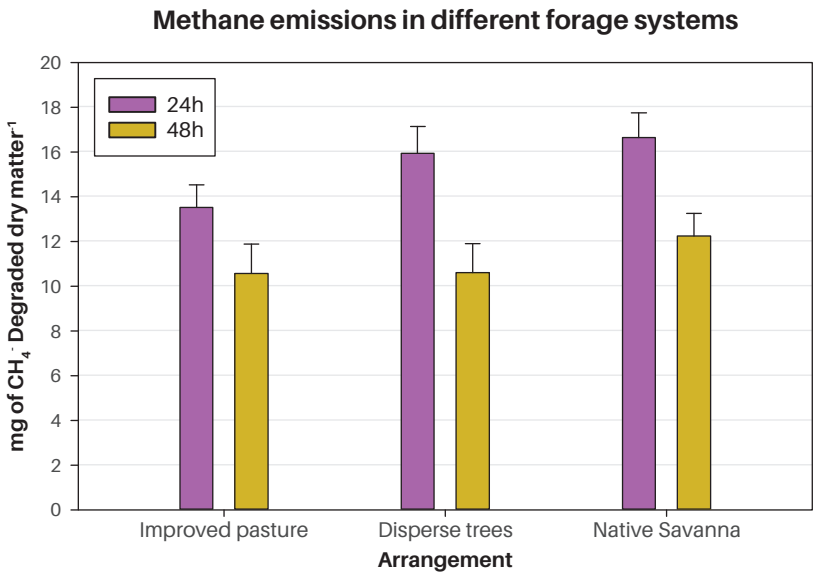

Figure 5. Cumulative methane emissions from cattle fed with tropical forages. Projected scenarios of reductions in methane emissions by the inclusion of legumes in the diet of improved grass (Arango et al 2016).

Arango J; Gutiérrez JF; Mazabel J; Pardo P; Enciso K; Burkart S; Sotelo M; Hincapié B; Molina I; Herrera Y; Serrano G. 2016. **Estrategias tecnológicas para mejorar la productividad y competitividad de la actividad ganadera: Herramientas para enfrentar el cambio climático.** Cali, CO: Centro Internacional de Agricultura Tropical (CIAT). hdl.handle.net/10568/71101

This work was implemented as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details please visit ccafs.cgiar.org/donors. The views expressed in this document cannot be taken to reflect the official opinions of these organisations.

This work was done as part of the CGIAR Research Program on Livestock. We thank all donors that globally support our work through their contributions to the CGIAR system.