



## Urinary Excretion of Mimosine Derivatives by Cows with and without Experience in Consumption of *Leucaena leucocephala*

N. E. Ruz-Ruiz  
*University of Yucatan, Mexico*

Eduardo G. Briceño-Poot  
*University of Yucatan, Mexico*

A. J. Ayala-Burgos  
*University of Yucatan, Mexico*

C. F. Aguilar-Pérez  
*University of Yucatan, Mexico*

Francisco J. Solorio-Sánchez  
*University of Yucatan, Mexico*

*See next page for additional authors*

Follow this and additional works at: <https://uknowledge.uky.edu/igc>



Part of the [Plant Sciences Commons](#), and the [Soil Science Commons](#)

This document is available at <https://uknowledge.uky.edu/igc/22/1-2/17>

The 22nd International Grassland Congress (Revitalising Grasslands to Sustain Our Communities) took place in Sydney, Australia from September 15 through September 19, 2013.

Proceedings Editors: David L. Michalk, Geoffrey D. Millar, Warwick B. Badgery, and Kim M.

Broadfoot

Publisher: New South Wales Department of Primary Industry, Kite St., Orange New South Wales, Australia

---

**Presenter Information**

N. E. Ruz-Ruiz, Eduardo G. Briceño-Poot, A. J. Ayala-Burgos, C. F. Aguilar-Pérez, Francisco J. Solorio-Sánchez, Luis Ramírez-Avilés, and Juan C. Ku-Vera

# Urinary excretion of mimosine derivatives by cows with and without experience in consumption of *Leucaena leucocephala*

N E Ruz-Ruiz, E G Briceño-Poot, A J Ayala-Burgos, C F Aguilar-Pérez, F J Solorio-Sánchez, L Ramírez-Avilés and J C Ku-Vera

Department of Animal Nutrition, Faculty of Veterinary Medicine and Animal Science, University of Yucatan, C.P. 97303, Mérida, Yucatan, Mexico

Contact email: [kvera@uady.mx](mailto:kvera@uady.mx)

**Keywords:** Intake, subclinical toxicity, secondary metabolites, urine sampling.

## Introduction

*Leucaena leucocephala* is a leguminous tree widely distributed in the tropical regions of the world. In Mexico, it has been incorporated into silvopastoral systems and is highly regarded, owing to its high content of crude protein. Nonetheless, *L. leucocephala* contains secondary metabolites, such as mimosine, a non-protein free amino acid, which may induce toxic effects in unadapted ruminants that consume the forage (Hammond 1995). Although *Synergistes jonesii*, an anaerobic bacterium, has the ability to degrade 3,4-DHP and 2,3-DHP to non-toxic compounds (Allison *et al.* 1992), in Mexico its presence has not yet been confirmed. Recent work has suggested the occurrence of sub-clinical toxicity to 3,4-DHP and 2,3-DHP in cattle grazing *L. leucocephala* in Australia and Thailand (Graham 2007; Dalzell *et al.* 2012; Phaikaew *et al.* 2012). Several options such as the transfer of rumen liquor and the adaptation of ruminants to the intake of *L. leucocephala* have been studied in an attempt to reduce the excretion of mimosine and its metabolites (Palmer *et al.* 2010).

The aim of the present work was to evaluate the effect of the experience of consumption of *L. leucocephala* on excretion of mimosine derivatives (3,4-DHP and 2,3-DHP) in the urine of cattle.

## Materials and methods

The experiment was carried out at the Faculty of Veterinary Medicine and Animal Science, University of Yucatan, Mexico. Two groups of 4 female cattle were used. The first group had been consuming *L. leucocephala* and the second group had no previous experience. Average live weights of cattle were 413 and 251 kg, respectively. During the

experimental phase, which lasted for 42 days, all animals were fed different proportions of *L. leucocephala*: *Pennisetum purpureum* and a concentrated supplement. Proportions of the feed provided are given in Table 1. Voluntary feed intake was measured daily.

Urine sampling was carried out at 12, 24, 36, 48, 60 and 72 h after offering the experimental ration. Urine was processed by means of kits consisting of Millex MCA Millipore in cellulose acetate of 0.45 µm Minisart® and a column of Maxi-Clean™ SPE 300 mg C18 c/100 p 25. Changes in colour of urine were interpreted as: 1: without apparent change in colour (absence of 3,4-DHP and 2,3-DHP); 2: apparent change in colour to blue (2,3-DHP present); and 3: higher intensity in change of colour (purple/brown) (3,4-DHP present); as described by Hammond (1995), Rincón *et al.* (2000) and Palmer *et al.* (2010). Data on total DM intake (g/kgLW<sup>0.75</sup>), and intake of *L. leucocephala* (g/kgLW<sup>0.75</sup>) were analysed based on a 2 x 4 factorial arrangement of treatments with 2 factors (with and without experience) and 4 levels of incorporation of *L. leucocephala* (0%, 15%, 30% and 45% of ration DM). After this, a multiple comparison test (Tukey) was carried out to identify statistical differences between treatments.

## Results and Discussion

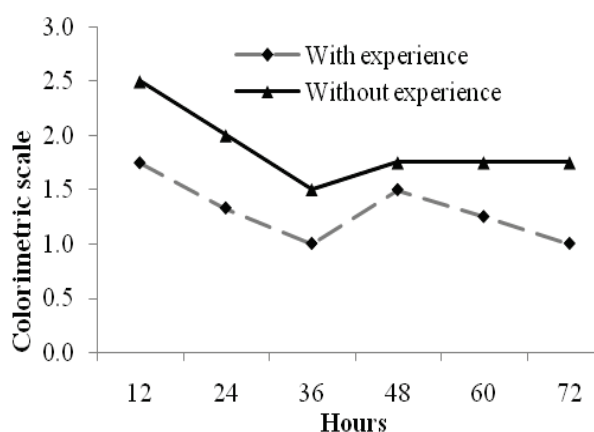
Total DM intake between both groups of cattle was different (P<0.05), being higher in cows without experience of consumption of the legume, while DM intake of leucaena was higher (P<0.05) in the group with experience in consumption of leucaena (Table 2). Levels of consumption of leucaena in the rations did not show significant differences (P>0.05) from the rations offered,

**Table 1. Percent incorporation of *L. leucocephala* in the ration of cows in relation to total dry matter (DM) intake.**

Animals	Experienced in consuming <i>L. leucocephala</i>		No experience with <i>L. leucocephala</i>		
	<i>L. leucocephala</i>	<i>P. purpureum</i>	<i>L. leucocephala</i>	<i>P. purpureum</i>	Concentrate
1	0	100	0	70	30
2	15	85	15	55	30
3	30	70	30	40	30
4	45	55	45	25	30

**Table 2. Intake of total DM and *L. leucocephala* (g/kgLW<sup>0.75</sup>) of cattle with different levels of inclusion.**

Level of Incorporation (%)	With experience	Without experience	Mean
Total DM intake (%)			
0	71.2	86.71	78.95
15	66.4	96.09	81.24
30	83.49	84.49	83.99
45	95.92	89.83	92.87
Mean	79.25 b	89.28 a	
Intake of leucaena (DM)			
0	0	0	0
15	17.02	16.24	16.63 a
30	30.16	25.63	27.89 b
45	48.74	40.56	44.65 c
Mean	31.97 a	27.47 b	

**Figure 1. Colorimetric scale of urine of cattle fed leucaena with and without experience in consumption of *L. leucocephala* with different levels of inclusion.**

which differs from the data of Ghosh *et al.* (2009), who reported that intake of *L. leucocephala* decreased as a higher amount was offered, when animals were unfamiliar with the legume. Colorimetric analysis of urine excreted showed no significant differences ( $P>0.05$ ) between groups (Figure 1), which suggest that although cattle may be experienced in eating *L. leucocephala*, subclinical toxicity

can still occur as it has been shown by other authors (Palmer *et al.* 2010; Dalzell *et al.* 2012; Phaikaew *et al.* 2012).

## Conclusions

Intake of a ration containing *L. leucocephala* by cattle might not be affected by previous experience with the legume. The presence of mimosine derivatives in the urine of both experienced and non-accustomed cattle suggests that subclinical toxicity could occur in cattle with experience in consumption of *L. leucocephala*. Further studies are needed to clarify the liveweight performance on the different rations.

## References

- Allison MJ, Mayberry WR, McSweeney CS, Stahl DA (1992) *Synergistes jonesii*, gen. nov., sp. nov.: A rumen bacterium that degrades toxic pyridinediols. *Systematic and Applied Microbiology* **15**, 522-529.
- Dalzell SA, Burnett DJ, Dowsett JE, Forbes VE, Shelton HM (2012) Prevalence of mimosine and DHP toxicity in cattle grazing *Leucaena leucocephala* pastures in Queensland, Australia. *Animal Production Science* **52**, 365-372.
- Ghosh MK, Atreja PP, Bandyopadhyay S (2009) Effect of transfer of rumen liquor from LLM adapted buffaloes on thyroid hormones and liver enzymes activities in Karan Fries cattle. *Indian Journal of Animal Production* **38**(1), 28-34.
- Graham SR (2007) Development of an on-farm test kit for detection of leucaena toxicity in ruminant animals. PhD thesis. University of Queensland, St Lucia, Australia.
- Hammond AC (1995) Leucaena toxicosis and its control in ruminants. *Journal of Animal Science* **73**, 1487-1492.
- Palmer B, Jones RJ, Poathong S, Chobtang J (2010) Within-country variation in the ability of ruminants to degrade DHP following the ingestion of *Leucaena leucocephala* – a Thailand experience. *Tropical Animal Health and Production* **42**, 161-164.
- Phaikaew C, Suksaran W, Ted-arsen J, Nakamanee G, Saichuer A, Seejundee S, Kotprom N, Shelton HM (2012) Incidence of subclinical toxicity in goats and dairy cows consuming leucaena (*Leucaena leucocephala*) in Thailand. *Animal Production Science* **52**, 283-286.
- Rincón MT, Domínguez-Bello MG, Lovera M, Romero R (2000) Degradación de piridinediols tóxicos derivados de la mimosina por bacterias ruminales: 1. Aspectos microbiológicos. *Revista Científica FCV-LUZ* **3**, 222-232.