Tropical Grasslands – Forrajes Tropicales (2014) Volume 2, 127−129

The effect of *Leucaena leucocephala* on beef production and its toxicity in the Chaco Region of Argentina

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Keywords: Legume trees, tropical pastures, mimosine, semi-arid tropics.

Introduction

Hedgerows of the fodder tree legume, *Leucaena leucocephala* ssp. *glabrata* (leucaena), planted with a companion grass, provide productive, profitable and sustainable tropical pasture (Shelton and Dalzell 2007). Although leucaena can improve beef production, poor grower adoption has limited development of leucaena in the Chaco Region of Argentina. Factors contributing to poor adoption include: (1) unsuccessful establishment; (2) limited understanding of leucaena management as a forage resource; and (3) concerns about mimosine toxicity. While these 3 limitations have been overcome in other regions of the world (e.g. northern Australia and the Chaco Region of Paraguay), in Argentina little is known about leucaena management and the protection of ruminants against mimosine toxicosis.

The objective of this study was to evaluate the effects of leucaena on beef production and its toxicity in the west of the Argentine Chaco Region. We hypothesized that the introduction of leucaena into grass pastures would significantly increase beef productivity, if mimosine toxicosis did not appear.

Methods

Site description and treatments

The experiment was established at the Animal Research Institute of the Semi-arid Chaco Region, operated by the National Institute of Agricultural Technology (INTA), located at Leales, Tucumán (27º11´ S, 65º14´ W; 335 m asl), in northwest Argentina. The climate is subtropical subhumid with a dry season from April to September and average annual rainfall of 880 mm (75% from October to March). Average maximum/minimum temperatures are 32/20 ºC in January and 22/7 ºC in July; on average 16 frosts occur each year, with an average ground surface temperature of -2.2 ºC and minimum temperature of -7 ºC. Mean evaporation exceeds mean rainfall in all months.

The experiment used 6 ha of *Brachiaria brizantha* cv. Marandú (brachiaria) pasture, established in 1995 on Ustipsamment aquic and Fluvaquentic Haplustoll soil types (US Soil Taxonomy system). A stand of leucaena cv. K636 was zero till-planted into this pasture in hedgerows 5 m apart in December 2009 to form 3 treatments with different proportions of leucaena in the feed available to animals (2 ha each): (1) leucaena in twin rows (LLB); (2) leucaena in single rows (LB); and (3) brachiaria only (BB).

Fodder availability, animal production and signs of toxicosis

Dry matter (DM) availability of leucaena and brachiaria was estimated at the beginning of each grazing period by adapting the comparative yield method of Mannetje and Jones (2000). Animal production was determined using 10-month-old Braford steers with an initial bodyweight of 217 ± 7 kg over 98 days (9 December 2010 to 16 March 2011), divided into 5 consecutive grazing periods: P1, 12 days (9 Dec−20 Dec); P2, 16 days (21 Dec−5 Jan); P3, 20 days (6 Jan−25 Jan); P4, 28 days (26 Jan−22 Feb); P5, 22 days (23 Feb−16 Mar). Before the first grazing period, the steers were familiarized with leucaena by providing access to the legume for 16 days (23 Nov−8 Dec). Steers were randomly allocated to each treatment at a variable stocking rate, according to fodder availability. At the end of each grazing period, steers were individually weighed to determine mean liveweight gains per day (LWG). Steers were observed daily to record any of the typical signs of leucaena toxicosis, such as lethargy and depressed appetite, excessive salivation, skin sores, and hair loss from the pizzle and tail

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switch, reported by Jones and Jones (1984). Urine could not be collected and tested for mimosine and its derivative DHP, as described by Dalzell et al. (2012).

Statistical analysis

Twelve, 8 and 4 steers in the LLB, LB and BB treatments, respectively, were evaluated by longitudinal data analysis according to the time-sequential measurements collected (Littell et al. 1998). The repeated measures in time were analyzed using mixed models (with treatment as fixed effect) and using the auto-correlation structure produced by the sequentially repeated measures on the same animals during the 5 periods.

Results

Rainfall data and fodder availability

Accumulated rainfall from the first fall (7 October) to the end of the trial (16 March) was 774 mm; 202 mm before the first grazing period, 0 mm in P1, 41 mm in P2, 79 mm in P3, 327 mm in P4 and 125 mm in P5. Leucaena availability increased throughout the experiment, with LLB exceeding LB in all periods (range 680 and 240 kg DM/ha in P1 to 2,570 and 1,290 kg DM/ha in P5 for LLB and LB, respectively). Brachiaria availability was similar in all treatments throughout, so that the proportion of leucaena in the total available fodder ranged from 40 to 60% in LLB and from 20 to 30% in LB.

Animal production and signs of toxicosis

Steers with access to leucaena (LLB and LB) had higher LWG/hd than steers without access (BB) during the first period (Table 1). However, thereafter LWG/hd on LLB pasture declined continuously till animals were barely maintaining weight in Period 5. Steers on the LB pasture exhibited LWG of 1.33 kg/hd/d during P2, but then followed the same trend of declining LWG as those on the LLB pasture. Weight gains of animals on brachiaria alone increased steadily through Periods 1, 2 and 3, then declined, but steers still gained 0.53 kg/d in Period 5. Liveweight gain/ha followed a similar trend with gains in P1 favoring LLB (Table 1). However, LWG/ha decreased towards the end of the experiment on all treatments, with gains on LLB and LB inversely proportional to leucaena availability.

Visible signs of mimosine toxicosis first appeared during P4 and P5 in LLB and LB treatments, respectively. At the end of the trial, after 98 days grazing leucaena, 5 steers (41% of the herd) on LLB and 2 steers (25% of the herd) on LB pastures exhibited visible signs. The main symptoms, apart from lethargy and depressed appetite, were excessive salivation, skin sores and hair loss from the pizzle and tail switch.

Conclusions

The high weight gains obtained initially indicated that the introduction of leucaena into grass pastures could increase beef cattle productivity (LWG per unit area and per head) in the Chaco Region of Argentina. However, the development of signs of mimosine toxicosis and decline in weight gains with time, despite very high yields of available leucaena, indicated that remedial measures were needed to control this condition and take advantage of the high protein feed on offer. The benefits of ruminal inoculation with mimosine (DHP)-degrading bacteria, as used in other tropical areas, must be assessed urgently, if the potential benefits from grazing leucaena pastures in the Chaco Region of Argentina are to be realized.

Table 1. Liveweight gain (LWG) per day, expressed per head and per hectare, during 5 grazing periods (P1−P5; 9 December–16 March) in 3 treatments: leucaena in twin rows with brachiaria (LLB), leucaena in a single row with brachiaria (LB) and brachiaria pasture alone (BB).

Grazing period	Grazing days (no.)	kg LWG/hd/d			kg LWG/ha/d		
		LLB	LB	BB	LLB	LB	BB
First period (P1)	12	1.07a[1]	1.00a	0.65b	4.32a	3.08a	1.33b
Second period (P2)	16	0.62b	1.33a	0.97ab	1.89b	2.72a	1.99ab
Third period (P3)	20	0.55b	0.64b	1.18a	2.51b	1.97b	2.41a
Fourth period (P4)	28	0.10b	0.24ab	0.48a	0.60b	0.97ab	0.99a
Fifth period (P5)	22	0.02b	0.09b	0.53a	0.12b	0.37b	1.10a

[1]Values within periods and parameters followed by different letters differ at $P<0.05$.

References

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.

Jones RM; Jones RJ. 1984. The effect of *Leucaena leucocephala* on liveweight gain, thyroid size and thyroxine levels of steers in southeastern Queensland. Australian Journal of Experimental Agriculture and Animal Husbandry 24:4−9.

Littell RC; Henry PR; Ammerman CB. 1998. Statistical analysis of repeated measures data using SAS procedures. Animal Science 76:1216–1231.

Mannetje L't; Jones RM, eds. 2000. Field and laboratory methods for grassland and animal production research. CABI Publishing, Wallingford, UK.

Shelton HM; Dalzell SA. 2007. Production, economic and environmental benefits of leucaena pastures. Tropical Grasslands 41:174−190.

Radrizzani A; Nasca JA. 2014. The effect of *Leucaena leucocephala* on beef production and its toxicity in the Chaco Region of Argentina. Tropical Grasslands – Forrajes Tropicales 2:127–129.
DOI: 10.17138/TGFT(2)127-129

This paper was presented at the 22nd International Grassland Congress, Sydney, Australia, 15−19 September 2013. Its publication in *Tropical Grasslands – Forrajes Tropicales* is the result of a co-publication agreement with the IGC Continuing Committee. Except for adjustments to the journal's style and format, the text is essentially the same as that published in: **Michalk LD; Millar GD; Badgery WB; Broadfoot KM, eds. 2013. Revitalising Grasslands to Sustain our Communities. Proceedings of the 22nd International Grassland Congress, Sydney, Australia, 2013. New South Wales Department of Primary Industries, Orange, NSW, Australia. p. 517–518.**