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Evaluating leucaena in timbered northern basalt country in Queensland, Australia

Evaluando leucaena bajo cobertura arbórea en el norte de Queensland, Australia

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Introduction

Introduction and successful establishment of leucaena (*Leucaena leucocephala*) has the potential to increase annual liveweight gains of grazing cattle and improve enterprise gross margins by up to 25% in a sustainable way (Buck et al. 2019). However, there has been low adoption of leucaena in northern Queensland (<2,500 ha established) despite well-established protocols in central and southern Queensland. Impediments to leucaena adoption include: reduced productivity following psyllid infestations; high establishment costs; lack of existing cleared sites; and low producer confidence and experience with plant establishment in the region. The fertile, free-draining basalt soils in northern Queensland (~2 M ha between Charters Towers and Mt. Garnet) are well suited to leucaena production. Two demonstration sites were established to evaluate the establishment, productivity and performance of leucaena on lightly timbered basalt sites located at Whitewater and The Brook Stations in far north Queensland. An additional aim of these demonstrations was to increase producer awareness and adoption of leucaena-based pastures in the region.

Materials and Methods

Whitewater Station

A Producer Demonstration Site was established at Whitewater Station (18.1467° S, 144.3183° E; 600–700 masl), which covers an area of 25,200 ha. The land types on Whitewater are broadly red duplex-based soils; red basalt (60%), granite (35%) and black basalt (5%) soils. Average annual long-term rainfall is 796 mm with 70% falling between December and March. The enterprise supplies Brahman cross (*Bos indicus* × *Bos taurus*) and Droughtmaster (stabilized *Bos indicus* × *Bos taurus*) cattle to live export (280–350 kg) and local store markets. Typical stocking rates are one Adult Equivalent (AE = 450 kg dry animal at maintenance) to 7 ha with opportunistic rotational spelling.

Site. A 33 ha lightly timbered site was selected on well drained, red basalt soils with high P and low S concentrations. Predominant pasture species included naturalized Indian couch (*Bothriochloa pertusa*), *Stylosanthes* spp. and native grasses. Strips were ripped in November 2013, nominally at 10 m spacings, following a 'line of least resistance' through the standing trees and rock outcrops to prepare a seedbed.

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Due to insufficient rainfall in the 2013/14 wet season, planting was deferred until the following wet season (2014/15). Wondergraze leucaena was planted (1.5 kg/ha) in single rows in January 2015. Gran-am[®] (24% S, 20% N) fertilizer was applied (30 kg/ha) either side of the row at the same time. All rows were sprayed with glyphosate herbicide (570 g/L; 2 L/ha) before planting and Verdict[®] (haloxyfop at 520 g/L) was applied at 100 mL/ha after sowing for grass control. Low rainfall following sowing resulted in a failed establishment and planting strips were re-ripped in October 2015. Re-planting occurred in January 2016 at a seeding rate of 1.5 kg/ha but no additional fertilizer was applied. A mix of glyphosate and Spinnaker[®] (active ingredient 700 g/kg imazetaphyr applied at 140 g/ha) was applied immediately after planting. Granulated sulphur (90% S) was applied in September 2016 (50 kg/ha) and again in August 2017 (140 kg/ha). Adequate follow-up rainfall ensured there was favorable leucaena emergence and establishment (Figure 1).



Figure 1. Tom Saunders (Whitewater) inspecting young leucaena seedlings (top) in February 2016 and mature leucaena in the standing timber in 2018 (bottom).

Grazing. Grazing of the site (leucaena) began during the 2017 dry season (July–October). Initial grazing was at a heavy stocking rate and cattle were removed prior to the 2017/18 wet season. No weight gain data were recorded. The paddock was spelled up to July 2018, when 18 weaner steers (average 228 kg) were introduced for comparison with similar animals (average 231 kg) grazing on pastures in a neighboring paddock. Stocking rates between the 2 paddocks were identical and cattle in both paddocks had access to a weaner supplement.

The Brook

The breeding, backgrounding (molasses production feeding), agistment and trading enterprises on The Brook cover 21,000 ha and include a mix of red (85%) and black (15%) basalt country. Average annual rainfall is 650 mm. The Brahman breeder herd on The Brook is crossed with Brangus (Brahman × Angus), Angus and Brahman bulls. Infrastructure development is advanced with 62 paddocks and greatest grazing distances to water of approximately 2 km. Salt and sulphur supplements are fed in the wet season, while a water medication unit delivers dry season urea supplementation to animals in some paddocks. A walk-over weighing unit is also used to monitor cattle weight gains and assist with the trading enterprise and marketing decisions.

Site. A 400 ha site on The Brook was deep-ripped using a bulldozer in October 2017. In order to establish a legume-grass pasture in the wide inter-rows, seed of *Seca stylo* (*Stylosanthes scabra* at 1 kg/ha) and granulated sulphur (90% S at 60 kg/ha) were aerially applied across the whole paddock in November 2017. Following early season storm rains, strips were sprayed with glyphosate (570 g/L; 2 L/ha) in December 2017. Both Redlands (350 ha) and Wondergraze (50 ha) were planted (twin rows 1.8 m apart; 12–15 m inter-row spacing) at a seeding rate of 1 kg/ha during January and February 2018 using a custom-made planter (Figure 3). A glyphosate (1.5 L/ha) and Vezir[®] (700 g/kg imazethapyr; 140 g/ha) mix was applied at planting for knockdown and pre-emergent weed control.



Figure 3. Single-pass twin-row planting (with custom-built planter) and herbicide application at The Brook.

Results

Whitewater

At Whitewater, leucaena was successfully established over approximately 75% of the site by the end of the

2016/17 wet season. Average daily weight gain of steers grazing pasture only at Whitewater during the 2018 dry season was 0.06 kg/d versus a gain of 0.48 kg/hd/d for steers in the leucaena paddock at the same stocking rate (Table 1). A corn-based weaner supplement was fed in both paddocks (10.5 MJ ME/kg; crude protein 14%; crude protein equivalent 11%); intakes (as fed) in the leucaena paddock were 0.57 kg/hd/d compared with 0.93 kg/hd/d in the pasture paddock. Without the daily intakes of weaner supplement some weight loss would have been expected in weaners in the pasture paddock.

Table 1. Comparison of live weights (LW; kg) and average daily gains (ADG; kg/hd/d \pm s.d.) over 63 dry season days of weaner steers grazing either pasture only or leucaena + pasture at Whitewater station.

| | LW 20.07.2018 | LW 21.09.2018 | ADG |
|--------------------|------------------|------------------|-----------------|
| Pasture only | 231 \pm 19 | 237 \pm 20 | 0.06 \pm 0.08 |
| Leucaena + pasture | 228 \pm 20 | 258 \pm 21 | 0.48 \pm 0.13 |

The Brook

Planting conditions, particularly in January 2018, were hot and dry and establishment success was limited with leucaena sparsely established across 300 ha. However the establishment of *Seca stylo* has been very encouraging. Controlling access by kangaroos, deer and cattle to the leucaena paddocks was challenging. Overall seedbed preparation was not ideal and planting depth could have been reduced. Planting such a large area when embarking on a leucaena development program is problematic. In future plantings the O'Brien family would plant a smaller area and implement a pest management plan, combined with complete repair of electric fence and traditional fencing, to limit access by marsupials, deer and cattle. An additional 100 ha of Redlands will be planted in the 2018/19 wet season using a similar twin-row configuration and inter-row spacing.

Discussion and Conclusions

Results at the Whitewater site have demonstrated that the challenges of establishing leucaena in lightly timbered but fertile basalt country can be overcome. This indicates that it is feasible to establish leucaena on the large areas of basalt country in north Queensland. While paddocks were not replicated, the marked differences in initial animal productivity data confirm the anticipated benefits of leucaena over existing native pastures even at relatively low levels in the diet. Further work is required to determine the long-term productivity and economics of leucaena in such situations, including overcoming practical constraints imposed by the standing timber (e.g. competition for moisture and on-going fertilizer requirements in fully mature leucaena).

In contrast with the results at Whitewater, the poor leucaena establishment at The Brook highlights the inherent risks with establishing leucaena in northern environments. Particular issues are the need for adequate seedbed preparation and planting techniques and the problems associated with keeping leucaena seedlings free from grazing during establishment in the north, where cleared areas are relatively few compared with central Queensland and there is a long dry period coupled with variable soils and rainfall. At The Brook, observations will continue to determine how well the legumes persist and produce in a range of seasons and how this is reflected in terms of animal production.

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