# Final report

## PDS: Value Chain Economics for Leucaena


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Prepared by:

Bron Christensen
The Leucaena Network

Peter Shotton
NT Department of Industry Tourism and Trade

Craig Lemin
Queensland Department of Agriculture and Fisheries

Brett Blennerhassett
Goshen Station, Mount Garnet



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Meat & Livestock Australia Limited
PO Box 1961
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# Abstract

Leucaena offers an opportunity for northern beef producers to dramatically improve their productivity and increase stocking rates to achieve increased economic security and enterprise viability; as well as expanding the options for turnoff into supply chains where weight requirements were unable to be met due to feed availability or quality. This Value Chain project demonstrated the productivity and financial benefits to the producer when Leucaena is incorporated into the feed base.
Three demonstration sites (Mt Garnet and Pinnarendi in North Queensland, and Douglas Daly in the Top End of the Northern Territory) conducted a series of live weight gain trials to demonstrate the productivity and profitability potential of established Leucaena grass pastures.

Data from each demonstration site was used to model the economic and animal productivity potential for each geographical area across different cattle markets.

The demonstration site outcomes were complementary to the productivity gains experienced in the more established Leucaena growing areas. The average daily live weight gains throughout the year ranged from 0.60kg/head to 0.51kg/head compared to native pastures in these regions which ranged from 0.03kg/day to 0.05kg/day. The introduction of Leucaena into an appropriate grazing system was shown to potentially improve enterprise gross margin by up to 324%.

# Executive summary

**Background**
Leucaena offers a significant opportunity for producers to improve their productivity and increase stocking rates resulting in increased economic security and enterprise viability. Improvements in productivity also allow the grazing business to explore options for turnoff into supply chains where weight requirements were unable to be met due to feed availability or quality without the inclusion of a perennial legume. The introduction of the psyllid tolerant variety, Redlands has allowed producers in northern, coastal areas of Australia to introduce Leucaena into their grazing system. This demonstration project undertook live weight gain trials on Leucaena grass pastures across three distinctly different sites in northern Australia – Pinnarendi Station, Forty Mile, North Queensland; Goshen Station, Mount Garnet, North Queensland; and Douglas Daly Research Farm, Douglas Daly, Northern Territory. The aim of the project was to demonstrate the potential live weight gains for cattle in these areas which are relatively new to Leucaena. The results of the trial have provided relevant, region based information and data on the potential benefits of Leucaena grazing systems to north Australia's red meat producers.

**Objectives**
**Quantify the live weight gain productivity of established Leucaena-grass pasture systems at three sites located in North Queensland and the Northern Territory**

***Pinnarendi Station***

The project data included pre-demonstration live weight assessments over five years as a baseline comparison. Throughout this timeframe average daily live weight gains on Leucaena-grass pastures ranged from 0.47kg to 0.75kg / day.

***Douglas Daly Research Farm***

The trial site on the Douglas Daly Research Station compared Leucaena to a grass pasture over a period of three years across three cohorts of Brahman and Brahman X steers. Average live weight gains achieved during this time ranged from 0.1kg/day (dry season) to 0.78kg/day during the wet season.

***Goshen Station***

This demonstration site reported productivity data for three cohorts of from May 2019 to June 2023. Average daily live weight gain over this period ranged from 0.34kg /day to 1.01kg /day.

**Determine the economic benefits on a whole of farm basis, of the inclusion of Leucaena – grass pastures for the three sites at turn off for the alternative markets**

***Pinnarendi***
The gross margin of $50,773 for Redlands compared favourably over $37,628 for Wondergraze and $16,703 for native pastures only. Allowing for the seed price difference between Wondergraze ($66/kg) the gross margin per hectare was $86 for Redlands, $60 for Wondergraze and $25 for native pastures.

***Douglas Daly Research Farm***

The gross margin for Leucaena was calculated to be $148,242 compared with a native grass pasture of $112,036. The gross margin per hectare of $354 for Leucaena performed well against grass pasture with a gross margin per hectare of $267. The inclusion of Leucaena in the grazing system increased the gross margin per hectare by 32%.

***Goshen Station***

The gross margin of Leucaena plantings on Goshen Station was found to be $137,845 with a gross margin per hectare of $262 compared with $54,515 and a gross margin per hectare for grass pasture only of $62. The introduction of a Leucaena grazing system resulted in a 324% improvement in gross margin per hectare.

**10% of observer producers will have adopted Leucaena-grass pasture grazing systems.**

Of the 142 observer producers who attended the activities directly associated with the project, 9 indicated an intention to introduce Leucaena into their grazing system within five years. Six attendees had already established Leucaena as a direct or indirect result of previous establishment trials and activities directly associated with The Leucaena Network.

**70% of observer producers will have increased their knowledge and skills of the establishment and management of Leucaena-grass pasture grazing systems as measured through pre and post event surveys.**

All attendees indicated a high level of satisfaction with the field days with an average prior knowledge of Leucaena of 7.25 increasing to 9.1 after attendance on a scale of (0 no knowledge to 10 Leucaena expert).

**Methodology**

Three demonstration sites (Mt Garnet and Pinnarendi in North Queensland, and Douglas Daly in the Top End of the Northern Territory) conducted live weight gain trials from already established Leucaena grass pastures. These plantings provided a range of Leucaena varieties – Redlands, Cunningham and Wondergraze, and the opportunity to determine any comparison in productivity at a commercial scale between these varieties.

**Results/key findings**

- In situations with the required soil properties and climate, Leucaena was shown to have the potential to increase the carrying capacity of paddocks planted to Leucaena by up to four times, and on average, over a twelve-month duration would support average daily weight gains of 0.5kg/d per head. This compares favourably to most native pastures found in northern Australia where average daily live weight gains of 0.03 to 0.05kg per head are reported.
- Leucaena has the potential to dramatically improve the gross margin of a grazing enterprise, between 144 to 324% on younger plantings of less than ten years and under good management.
- Leucaena that is aged and with reduced plant density of more than half the original plantings will continue to provide productivity benefits to a grazing system with but with an improved gross margin reduced to approximately 32%

**Benefits to industry**

- The results of the three demonstration sites, located in different climate and soil types across northern Australia, consistently reinforced the potential of well-managed Leucaena grazing systems to improve a grazing enterprises productivity and profitability.
- Fiscal assessment of the improved gross margin through the adoption of Leucaena-grass pastures addresses the key concern of many potential Leucaena producers, being the perceived high cost of establishment and returns on that initial investment.
- The consistency of weight gains throughout the year, and particularly towards the end of the dry season demonstrates the capacity of Leucaena to be a dry season / drought tolerant source of protein supporting animal productivity.

**Future research and recommendations**

- The key recommendation from this project is that best management practices for the long-term productivity of Leucaena-grass pastures – fertilising and cutting regimes must be further developed and documented for northern beef producers to achieve the most effective grazing strategies for optimum productivity and sustainability.

# PDS key data summary table

Project Aim: To demonstrate the productivity and financial returns from the introduction of Leucaena-pasture grazing systems into northern Australia

| | Site | | Unit |
|---|---|---|---|
| **Production benefit (impact)**<br>Animal productivity<br>ADG (kg/d or kg LW/ha) | *Pinnarendi* | 0.63 | kg/d |
| | *Pinnarendi* | 0.38 | kg/ha |
| | *Goshen* | 0.5 | kg/d |
| | *Goshen* | 1.08 | kg/ha |
| | *Douglas Daly* | 0.55 | kg/d |
| | *Douglas Daly* | 0.94 | kg/ha |
| | *Overall* | 0.56 | kg/d |
| | *Overall* | 0.80 | kg/ha |
| **Reduction in expenditure**<br>Reduction in labour i.e. DSE/FTE, LSU/FTE, AE/FTE;<br>Reduction in other expenditure | Not measured | -- | -- |
| **Increase in income** | *Goshen (Improved GM)* | $6,439<br>324% | $/ha |
| | *Douglas Daly (Improved GM)* | $12,037<br>32% | $/ha |
| | *Pinnarendi (Improved GM)*<br>*Wondergraze Redlands* | $8,233<br>144%<br>250% | $/ha |
| Additional costs (to achieve benefits) | Goshen Station | $5,231 | $/ha |
| | Douglas Daly | $9,962 | $/ha |
| | Pinnarendi | $6,970 | $/ha |
| Net $ benefit (impact) | | $1,516 | $/ha |
| Number of core participants engaged in project | | 3 | (n) |
| Number of observer participants engaged in project | | 142 | (n) |
| Core group no. | | 29,886 | ha |
| Core group no. | | 4752 | hd |
| % change in knowledge, skill & confidence – core | *Leucaena benefits* | | |
| % change in knowledge, skill & confidence – observer | *Leucaena management and benefits* | 26% | |
| % practice change adoption – core | | - | |

| | | | |
|---|---|---|---|
| % practice change adoption – observers | *Adopt Leucaena within five years* | 6%<br>11% | Adopt<br>Have adopted from previous projects or will adopt. |
| | | | |
| **Key impact data** | | | |
| **Net $ benefit /ha** | **$1,516/ha** | | |
| **Gross Margin / ha** | Goshen – 324%<br>Douglas Daly 32%<br>Pinnarendi –<br>Wondergraze – 144%<br>Redlands – 250% | | |

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# 1 Background

Leucaena offers an opportunity for northern beef producers to dramatically improve their productivity and increase stocking rates resulting in increased economic security and enterprise viability. Additional benefits include expanding the options for turnoff into supply chains where weight requirements could be achieved with the addition of a perennial legume such as Leucaena into the grazing system.

Whilst there are ongoing projects to determine best practice establishment processes, the ability to correlate these projects with economic returns is a necessity for the future success of the northern beef industry and potential diversification for increased returns to grazing enterprises in these regions.
This project has demonstrated the productivity and financial returns at the producer level.

Many red meat producers are currently undertaking their own, informal, live weight gain analysis from Leucaena – grass pastures. This project, with a mix of producer and research farm sites across northern Australia formalised a trial and provided quantified data demonstrating the potential productivity and financial returns of Leucaena. The inclusion of two already established sites currently used for research (including one producer owned and managed) aimed to mitigate the key risk of producer-based research, which is the necessity to withdraw from the project or early turnoff of animals due to financial or climate pressure. The third producer site was a continuation of the producer's existing grazing system reducing the risk of early project cessation.

# 2 Objectives

**Objective 1: Quantify the live weight gain productivity of established Leucaena-grass pasture systems at three sites located in North Queensland and the Northern Territory**

Live weight gain trials were successfully undertaken on three sites – Douglas Daly Research Farm, Douglas Daly, Northern Territory; Goshen Station, Mount Garnett, Queensland; and Pinnarendi Station, Forty Mile, Queensland.

Douglas Daly Research Farm completed three trial cohorts – 14 July 2020 – 17 May 2021; 12 July 2021 to 17 May 2022; and 28 June 2022 to 12 October 2022;

Pinnarendi Station completed four cohorts – 2018 – 2019 (commenced prior to this project however included in the results); 2019-2020; 2020-2021; and 2022.

Goshen Station completed four cohorts – 7 May 2019 – 7 May 2020; 15 September 2020 to 12 July 2021; 21 September 2021 to 2 November 2022; and 1 November 2022 to 23 June 2023.

**Objective 2: Determine the economic benefits on a whole of farm basis, of the inclusion of Leucaena – grass pastures for the three sites at turn off for the alternative markets of slaughter (~600kg), feeder cattle (~450kg) and live export (~350kg) for dissemination to industry.**

An in-depth economic analysis of the benefits resulting from the inclusion of Leucaena-grass pastures for the three sites was undertaken by the Queensland Department of Agriculture and Fisheries (QDAF).

Assessment of the three alternative supply chains was unable to be undertaken due to unforeseen circumstances and time constraints resulting in the inability to access the specific supply chain data at each turnoff.

**Objective 3: 10% of observer producers will have adopted Leucaena-grass pasture grazing systems.**
One hundred and forty-two producer observers attended the activities directly associated with the project. Of those producer attendees, nine indicated an intention to introduce Leucaena into their grazing systems within the next five years. Six attendees already had adopted Leucaena and established grazing systems as a direct or indirect result from previous establishment trials undertaken by The Leucaena Network.

**Objective 4: 70% of observer producers will have increased their knowledge and skills of the establishment and management of Leucaena-grass pasture grazing systems as measured through pre and post event surveys.**

Feedback from the 142 producer members who attended the field days showcasing this project indicated 100% satisfaction rating (7 to 10 rating) in attendance; an average prior knowledge of Leucaena and its benefits rating of 7.25 with an average increase to a rating of 9.1 at the conclusion of the events.

# 3 Demonstration Site Design

## 3.1 Methodology

The Value Chain for Economics Producer Demonstration Site (PDS) followed the previous Redlands for Regions combined PIFT/MDC project (P.PSH.0920) and was undertaken concurrent to the PDS Sustainable Long Term Leucaena Grass Production in Northern Australia (L.PDS.1909) which focused on Leucaena establishment in the Northern Territory.

Three demonstration sites (Mt Garnet and Pinnarendi in North Queensland, and Douglas Daly in the Top End of the Northern Territory) conducted live weight gain trials from already established Leucaena grass pastures. These plantings provided a range of Leucaena varieties – Redlands, Cunningham and Wondergraze, and the project provided an opportunity to compare productivity between the varieties.

The Mount Garnet site, 'Goshen Station' is an original Redlands establishment trial site (P.PSH.0920) where the original trial is now utilised as part of the property's grazing system.
The Pinnarendi site is a privately owned and managed property, where DAF was conducting liveweight gain trails (B.NBP.1618) in collaboration with the property owners. This information provided a valuable contribution to this project in the comparison of productivity on properties within the same general area – with approximately 100km between Goshen Station and Pinnarendi.
The inclusion of the Douglas Daly Research Farm (DDRF) in the Northern Territory provided support to the establishment trials being undertaken concurrently (now finalised) in the region (L.PDS.1909) and built on previous live weight gain trials at the Douglas Daly Research Farm. At project commencement, it was planned to determine the weight gains utilising DDRF's five years established irrigated Leucaena paddocks. However, prior to the initiation of the first cohort into the trial, the irrigated Leucaena was replaced with other crops and the trial was relocated to the farm's 20+ year established dryland Leucaena paddocks.

All three sites were planted with inter-row pasture.
Goshen Station had a mix of Callide Rhodes, bisset creeping bluegrass and seca stylo.

Pinnarendi had inter-row pasture of a mix of grasses including sabi, indian couch, Rhodes spp. and black spear; and legume including wynn cassia and stylosanthes spp.
The Douglas Daly Research Farm had a mix of Rhodes, mulato, sabi, buffel and jarrah grass.

It was anticipated that long range decisions regarding turn off weight and market would enable a carry-through of the live weight gain data to slaughter immediately after turn off, feedlotting or live export. Just-in-time pasture and herd management decisions did not allow for the organisation of the feedback of the ongoing animal data, except for the final turnoff at Pinnarendi where MSA grading of carcasses was reported.

Complementary Leucaena and pasture biomass assessments were planned to be conducted seasonally however personnel availability to undertake this limited the collection of this data.

Faecal NIRS at all sites to determine Leucaena consumption was also included as part of the assessment. One round of assessment was undertaken at Douglas Daly Research Farm. The results were inconclusive and did not justify further testing at the additional sites. At the time of the project conclusion, an alternative commercial service provider had not been endorsed for use.

This project was conducted with Animal Ethics Committee (AEC) approval provided through QDAF animal ethics committee. The Douglas Daly component was undertaken as part of the existing approval A19021: NT DPIR livestock research using approved protocols.

## 3.2 Economic analysis

The economic outcomes of the three liveweight gain trials were modelled to understand Leucaena profitability for each geographical area which generally target different cattle markets.

A cost-benefit analysis had been previously undertaken for Pinnarendi and reported in the Meat and Livestock Australia (MLA) milestone report, 'Demonstrating the productivity and profitability of cattle grazing Redlands Leucaena in northern Queensland' (Lemin, 2021). The gross margin methodology remains the same for the other trial sites, with any differences noted in their respective sections. All scenarios had the gross margins calculated on an estimated carrying capacity of 500ha of the respective Leucaena or grass pasture.

## 3.3 Extension and communication

The extension and communication activities planned for the project are outlined in Table 1.

**Table 1. Planned extension and communication activities**

| Activity | Target Audience | Key messages and must-have elements | Proposed Timing |
|---|---|---|---|
| Field Visit to Each Site | Core Producers | Familiarity with each site's methodology.<br>Information sharing<br>Inter-project relationship establishment | November 2020 |
| Field Days | Observer Producers<br>Industry representatives<br>Service providers | One Field Day at each site | November 2020<br>July 2021<br>July 2022 |
| Webinar | Core Producers<br>Observer Producers | To provide an update on the LWG data mid and post project | November 2021<br>March 2023 |

| | | | |
|---|---|---|---|
| Video | Industry | To provide an update on the LWG data mid and post project | July 2020 – March 2023 |
| Media Articles | Industry | Four media releases – commencement of trials; progress; field days; LWG and economic achievements; final results | May 2020 – March 2023 |
| Case Studies | Industry | Case Studies on the three trial sites | March 2023 |

## 3.4 Monitoring and evaluation

The following performance measures and metrics were assessed for the project.

**Table 2. Monitoring and evaluation plan**

| Performance Measures | Metrics |
|---|---|
| • Three producers undertaking on-farm demonstration sites<br>• Three demonstration plots investigating the economic returns of high value beef from Leucaena based pasture systems into three alternative pathways to market – processing, feed lotting and live export.<br>• 100 observers at Field Days | • Budgets<br>• Expense reconciliation<br>• Attendance records of activities |
| • Provision of live weight data from each site.<br>• Determination of the economic value, through three alternative value chains of cattle finished on Leucaena.<br>• Hosting a minimum of three field days targeting 100 additional graziers<br>• Regular blog providing project updates and outcomes to date supported by video footage available at www.leucaena.net<br>• Case studies for dissemination<br>• Four media releases featuring the PDS, MLA and individual trial producers and outcomes. | • Live weight gain data from demonstration sites in milestone reports.<br>• Live weight gain data from the appropriate supply chain in milestone reports (where available)<br>• Collation of media coverage<br>• Copies of all physical outputs documented and provided in milestone reports.<br>• Case studies developed and disseminated. |
| • 100% of core producers have key knowledge of live weight gains achievable from their Leucaena – grass pastures.<br>• 100% of core producers have knowledge of the economic benefits of their appropriate supply chain.<br>• 90% of observer producers will have access to the live weight gain data from each site.<br>• 90% of observer producers will have access to the economic outcome of the site's chosen supply chain. | • Initial and end of term survey of core producers to assess knowledge base and confidence.<br>• Activity survey of observer producers to assess practice change, knowledge base and confidence. |

| | |
|---|---|
| • 10% of observer producers will intend to initiate or increase their Leucaena – pasture systems within the project timeframe.<br>• 70% of observer producers will have increased their knowledge and skills of the establishment and management of Leucaena-grass pasture grazing systems. | |
| • 100% of core producers exhibit intention to continue with existing Leucaena or increase Leucaena plantings<br>• 10% of observer producers exhibit intention to initiate or increase their Leucaena – pasture systems within five years of the project completion. | ○ As above |
| • Live weight gain productivity of established Leucaena-grass pasture systems at three sites – two in North Queensland and one in the Northern Territory will be quantified, adding to the data available to graziers considering Leucaena-grass grazing systems in Northern Australia.<br>• All core producers will have a minimum of two years of live weight gain data from Leucaena – grass pastures for their own property.<br>• All core producers will have economic analysis of their chosen supply chain.<br>• Core and observer producers will have knowledge of region-specific live weight gains on Leucaena pastures enabling better informed decisions about pasture options.<br>• Significant benefit to Northern Australia through the adoption of strategies to increase long term, viable, high value beef production. | • Economic analysis of the relevant supply chain options chosen by each individual producer.<br>• Data from demonstration sites |
| • Leucaena – grass pastures adopted by an additional 10% of graziers across northern Australia (in suitable areas) by 2023 significantly increasing industry viability and profitability.<br>• Live weight gain increases correlated to economic returns will provide improved enterprise and industry viability.<br>• Increased profitability and viability for Northern Australian graziers and their communities. | • Feedback from core producers on unexpected occurrences in achieving live weight gains.<br>• Survey feedback from observer producers.<br>• Dissemination of report, case studies, blog and video overview to applicable areas. |

# 4 Results

## 4.1 Demonstration Sites

A summary of the live weight gains at each demonstration site are reported in Tables 3 to 5.

**Table 3. Feed base, number of cattle, stocking rate and average daily gain data for Pinnarendi Station across four cohorts**

| | Treatment | No. Head | Stocking (ha/AE) | ADG kg/ha | ADG (kg) | Total LWG (kg/yr) |
|---|---|---|---|---|---|---|
| First cohort[1] | Redlands | 14 | 2.5 | 0.35 | 0.65 | 238 |
| 2018-19 | Wondergraze | 14 | 2.6 | 0.36 | 0.68 | 247 |
| Second cohort[2] | Redlands | 7 | 3.0 | 0.65 | 0.55 | 202 |
| 2019-20 | Wondergraze | 7 | 2.9 | 0.4 | 0.55 | 199 |
| | Buffel/Seca | 12 | 2.5 | 0.24 | 0.54 | 198 |
| Third[3] cohort | Redlands | 21 | 1.7 | 0.37 | 0.59 | 214 |
| 2020-21 | Wondergraze | 21 | 1.7 | 0.40 | 0.64 | 234 |
| | Buffel/Seca | 10 | 3.6 | 0.24 | 0.61 | 228 |
| Fourth[4] Cohort | Leucaena | 30 | 1.6 | 0.37 | 0.75 | n/a |
| 2022 | Leucaena | 6* | 1.9 | 0.12 | 0.70 | n/a |

[1] 368d grazing, [2] 372d grazing, [3] 367d grazing, [4] 188d grazing

**Table 4. Feed base, number of cattle, stocking rate and average daily gain data for Goshen Station across three cohorts**

| | | No. Head | Stocking (ha/AE) | ADG kg/ha | ADG (kg) | Total LWG (kg/yr) |
|---|---|---|---|---|---|---|
| First cohort[1] | Leucaena | | | 1.01 | 0.5 | 211.7 |
| 2019-20 | Native Pasture with dry lick and 8% P blocks | | | 0.04 | 0.16 | 58.4 |
| | Native Pasture with grain based lick | | | 0.08 | 0.34 | 124.1 |
| Second cohort[2] | | | | | | |
| 2020-21 | Leucaena | | | 1.0 | 0.38 | 138.7 |
| Third[3] cohort | | | | | | |
| 2021-22 | Leucaena | | | 1.06 | 0.53 | 193.5 |
| Fourth[4] Cohort | | | | | | |
| 2022-23 | Leucaena | | | 1.16 | 0.58 | 211.7 |

[1] 365d grazing May 2019- May 2020, [2] 373d grazing Sept 2020- Sept 2021, [3] 330d grazing Sept 2021- August 2022, [4] 235d grazing Nov 2022- Jun 2023

**Table 5. Feed base, number of cattle, stocking rate and average daily gain data for Douglas Daly Research Farm across three cohorts**

| | | No. Head | Stocking (ha/AE) | ADG kg/ha[4] | ADG[5] (kg) | Total LWG (kg/yr) |
|---|---|---|---|---|---|---|
| First cohort[1] | Leucaena | | | 0.91 | 0.2/0.77 | 176 |
| 2020-21 | Mixed pasture | | | 0.87 | 0.12/0.77 | 162 |
| Second cohort[2] | Leucaena | | | 1.0 | 0.1/0.78 | 160 |
| 2021-22 | Mixed pasture | | | 1.0 | 0.1/0.75 | 155 |
| Third[3] cohort | Leucaena | | | 0.92 | 0.21/0.72 | 169 |
| 2022-23 | Mixed pasture | | | 0.95 | 0.12/0.73 | 155 |

[1] 307d grazing, [2] 306d grazing, [3] 342d grazing, 4 annual gain, [5] ADG dry season/ADG wet season

### 4.1.1 Pinnarendi Station

The Pinnarendi Station component of the project, facilitated by the Queensland Department of Agriculture and Fisheries (QDAF) commenced in 2020 . There were four cohorts with the initial cohort inducted June 2018 and the final cohort removed in August 2022. Data from all four cohorts are reported in Table 3.

The Pinnarendi trial included a comparison of the productivity of the Wondergraze and Redlands Leucaena varieties for the first three cohorts, and an exercise in 'finishing' cattle to slaughter weight for the final cohort (no Redlands-Wondergraze comparison).

Additionally, there was a comparison between Leucaena and a neighbouring improved pasture (mainly Buffel grass and Seca stylo) paddock using sub-groups of Cohort 2 and 3 animals.

#### 4.1.1.1 Cohort One

The initial cohort of 28 weaner steers were inducted into the trial on 28 June 2018 and turned off at an average live weight of 474 kg on 1 July 2019 after 368 d. The average daily weight gain for each variety (Table 6) was 0.65 kg (Redlands) and 0.68 kg (Wondergraze).

**Table 6. Pinnarendi Live Weight Gain prior to demonstration commencement**

| *Cohort 1* | *Animals* | *Stocking Rate (AE/ha)* | *LW In/Out (kg)* | *ADG (kg/d)* | *Total LWG (kg/yr)* | *Comment* |
|---|---|---|---|---|---|---|
| *Redlands* | 28 weaner steers | 0.39 | 226 / 465 | 0.65 | 238 | No supplementation<br>Not inoculated with |
| *Wondergraze* | Brahman X and Droughtmaster | 0.40 | 232 / 482 | 0.68 | 247 | *S.jonesii*<br>4 groups rotated through 8 paddocks<br>No psyllids reported |

### 4.1.1.2 Cohort Two

The second cohort of 14 weaner steers were inducted into the trial on 13 May 2019 and turned off at an average weight of 467 kg after 372 days (Table 7). Average daily weight gain of 0.55 kg/d were reported for both Wondergraze and Redlands. The animals grazing in the improved pasture paddock performed similarly with an average daily weight gain of 0.54 kg/d.

Drought conditions during the latter half of 2019 influenced weight gains achieved from the Leucaena paddocks, whereas the improved pasture paddock had a good body of feed, which was a legacy of 3 years of spelling.

**Table 7. Pinnarendi Live Weight Gain Cohort Two**

| *Cohort 2* | *Animals* | *Stocking Rate (AE/ha)* | *LW In/Out (kg)* | *ADG (kg/day)* | *Total LWG (kg/yr)* | *Comment* |
|---|---|---|---|---|---|---|
| *Redlands* | 14 weaner steers Brahman X | 0.33 | 257 / 463 | 0.55 | 201 | P supplementation in wet |
| *Wondergraze* | | 0.34 | 267 / 470 | 0.55 | 201 | Urea supplementation in dry |
| *Improved pasture* | | 0.40 | 269 / 471 | 0.54 | 198 | No replication due to drought conditions 2nd half 2019<br>No psyllids reported |

### 4.1.1.3 Cohort 3

The third cohort of 42 weaner steers was inducted into the trial on 31 July 2020 and finished with an average weight of 490 kg after 367 days (Table 8) which resulted in an average daily weight gain of 0.59 kg and 0.64 kg for Redlands and Wondergraze, respectively. Average daily weight gain in the fertilised improved pasture paddock was 0.61 kg which was comparable to the Leucaena although the stocking rate was about half.

**Table 8. Pinnarendi Live Weight Gain Cohort 3**

| *Cohort 3* | *Animals* | *Stocking Rate (AE/ha)* | *LW In/Out (kg)* | *ADG (kg/day)* | *Total LWG (kg/yr)* | *Comment* |
|---|---|---|---|---|---|---|
| ***Redlands*** | 42 weaner | 0.58 | 263 / 478 | 0.59 | 214 | Some short-term psyllid damage to |
| ***Wondergraze*** | steers Brahman | 0.60 | 265 / | 0.64 | 234 | Wondergraze in April 2021 reported. |
| ***Improved Pasture*** | X 10 weaner steers Brahman X | 0.28 | 501 219 / 443 | 0.61 | 228 | Performance difference between Redlands and Wondergraze attributed to paddock differences, not varietal difference. |

### 4.1.1.4 Cohort Four

A fourth cohort of 30 head of Brahman cross and Brangus steers, with an average weight of 511kg, were inducted into the Leucaena paddocks at Pinnarendi for 'finishing' on 1 March 2022 (Table 9). This was after all Leucaena at the site had been cut in December 2021. This cohort aimed to grow animals to slaughter weight and obtain carcass data (Meat Standards Australia (MSA) grading). Project constraints meant the available grazing period was just five months from March to July 2022, however Leucaena at the site remained very productive due to unseasonal rainfall in May and July. Animals were grazed as one group and rotated sequentially through all Leucaena paddocks at 6-8 day intervals. The stocking rate was 0.61 AE/ha for the total 30 head. There was no varietal comparison in this trial.

Following the final cohort weighing on 17 July, 24 of the 30 head were slaughtered at JBS Townsville on 19 July, after being on the trial for 138 days. MSA grading data was acquired.
The six remaining trial cattle were weighed on 5 September prior to being slaughtered at JBS Townsville after being on the trial for a total of 188 days.
The stocking rate for the six head that remained on the trial for the additional 50 days was 0.36 AE/ha.

**Cohort 4 Comments**
Leucaena productivity during most of the grazing period was high since lower than average rainfall in February and March 2022 were compensated by unseasonal rainfall in May and July. Leucaena intake by the fourth cohort animals was not significantly restricted by Leucaena productivity.
Psyllids significantly affected Wondergraze at the site from August onwards; to the extent that the six head which remained on the trial at this time (Table 7) were rotated through Redlands paddocks only.
The overall ADG of 0.75 kg over 138 days achieved at Pinnarendi is impressive in this environment and could not have been achieved without the contribution of Leucaena. The ADG of 1.15 kg recorded over 27 days to 20 June was remarkable for the time of year and is mainly attributed to Leucaena productivity after rain in the second week of May. With the exception of Urochloa, inter-row pasture grasses remained dormant after this rainfall, although stylos did continue to grow.

**Table 9. Pinnarendi Live Weight Gain Cohort 4 at respective weigh dates.**

| *Cohort 4* | *Period (d)* | *Animals (n)* | *LW In/Out (kg)* | *ADG (kg/day)* | *Total LWG (kg/yr)* |
|---|---|---|---|---|---|
| ***01 Mar-12 April*** | 42 | 30 | 511/541 | 0.72 | 262 |
| ***12 Apr- 24 May*** | 42 | 30 | 541/566 | 0.61 | 222 |
| ***24 May- 20 Jun*** | 27 | 30 | 566/597 | 1.15 | 418 |
| ***20 Jun- 17 Jul*** | 27 | 30 | 597/614 | 0.62 | 225 |
| ***17 Jul – 05 Sept*** | 50 | 6 | 598/621 | 0.47 | 171 |
| ***01 Mar – 17 Jul*** | 138 | 30 | 511/614 | 0.75 | 273 |
| ***12 Apr- 17 Jul*** | 96 | 30 | 541/614 | 0.77 | 280 |
| ***01 Mar – 05 Sept*** | 188 | 6 | 489/621 | 0.70 | 254 |
| ***12 Apr – 05 Sept*** | 146 | 6 | 516/621 | 0.72 | 262 |

***Carcass data***

Carcass characteristics reported by MSA grading (Table 10) were for the 24 head processed 19 July. Five animals were ineligible for MSA grading as either the rib fat measurement was ≤ 2 mm, or pH was > 5.7 (body no.'s 283, 286, 282, 268, 273, Table 2). Nonetheless, an opportunity grading index was calculated for these carcasses. All but one carcass had a P8 fat measurement of 5-22 mm resulting in processor grading into the top box. All but two carcasses had a cold ossification score of 200 or less. Mean carcass weight was 310 kg.

**Table 10. MSA grading data for steers 'finished' on Leucaena for 138 days at Pinnarendi.**

| *Tag no.* | *138 Day ADG (kg)* | *Body no.* | *P8 fat (mm)* | *Rib fat (mm)* | *Cold ossification score* | *MSA Marbling Score* | *Hump cold (mm)* | *pH* | *MSA index* |
|---|---|---|---|---|---|---|---|---|---|
| 51 | 0.86 | 267 | 20 | 4 | 190 | 220 | 125 | 5.70 | **50.08** |
| 52 | 0.63 | 276 | 23 | 8 | 150 | 240 | 150 | 5.65 | **52.76** |
| 53 | 0.89 | 283 | 10 | *2*[A] | 140 | 290 | 100 | 5.65 | *55.92** |
| 54 | 0.59 | 266 | 20 | 9 | 180 | 220 | 105 | 5.64 | **53.02** |
| 55 | 0.82 | 286 | 12 | 4 | 190 | 320 | 115 | *5.74*[A] | *52.04** |
| 56 | 0.70 | 287 | 10 | 11 | 150 | 340 | 115 | 5.63 | **55.62** |
| 57 | 0.57 | 272 | 22 | 4 | 160 | 360 | 100 | 5.66 | **55.93** |
| 58 | 1.08 | 284 | 10 | 13 | 140 | 400 | 140 | 5.64 | **56.53** |
| 59 | 0.54 | 275 | 7 | 6 | 180 | 340 | 90 | 5.61 | **56.09** |
| 61 | 0.65 | 285 | 8 | 4 | 150 | 320 | 105 | 5.65 | **54.78** |
| 62 | 0.64 | 274 | 20 | 9 | 140 | 220 | 95 | 5.65 | **56.6** |
| 63 | 0.97 | 282 | 10 | *2*[A] | 140 | 380 | 115 | 5.64 | *55.41** |
| 64 | 0.81 | 289 | 10 | 7 | 160 | 300 | 150 | 5.69 | **52.96** |
| 66 | 0.75 | 277 | 13 | 10 | 130 | 340 | 125 | 5.63 | **55.95** |
| 68 | 0.67 | 279 | 20 | 5 | 200 | 330 | 85 | 5.63 | **56.13** |
| 70 | 0.64 | 288 | 10 | 15 | 150 | 370 | 130 | 5.67 | **55.42** |
| 71 | 0.61 | 269 | 13 | 3 | 140 | 370 | 155 | 5.64 | **54.51** |
| 74 | 1.06 | 280 | 20 | 3 | 150 | 350 | 110 | 5.59 | **55.22** |
| 76 | 1.02 | 268 | 10 | *2*[A] | 150 | 250 | 90 | 5.61 | *55.82** |
| 77 | 0.72 | 271 | 20 | 4 | 150 | 230 | 130 | 5.64 | **51.92** |
| 78 | 0.66 | 278 | 18 | 5 | 280 | 360 | 105 | 5.63 | **53.35** |
| 79 | 0.85 | 281 | 15 | 10 | 150 | 400 | 120 | 5.58 | **55.74** |
| 81 | 0.60 | 270 | 15 | 3 | 190 | 220 | 110 | 5.69 | **51.26** |
| 82 | 0.48 | 273 | 9 | *1*[A] | 300 | 310 | 100 | 5.68 | *51.59** |

[A]attribute disqualifies carcass from MSA grading (regrade opportunity index calculated)

### 4.1.1.5 Pinnarendi Biomass Assessment

***Leucaena***

Total average dry matter yields from Leucaena enclosures at Pinnarendi for Redlands and Wondergraze paddocks from 2019-2021 are reported in Table 11. The three-year average yield of Redlands was 55% lower than for Wondergraze reflecting paddock differences at the site. In particular, Redlands Paddock 8 consistently recorded the lowest yields, except in 2021. The ratio of leaf to stem (by weight) was lower at the end of the wet season, with an increased proportion of leaf present at the end of the year. Typically, the leaf to stem ratio at the end of the main growing season was about 50:50; with a corresponding ratio of 75:25 at the end of the dry season. This is associated with vigorous structural growth during the wet season.

**Table 11. Mean (± sem) total annual dry matter yields (kg/ha) measured at Pinnarendi 2019-2021; with highest and lowest individual enclosure yields.**

| *Year* | *Wondergraze* | | | *Redlands* | | |
|---|---|---|---|---|---|---|
| | ***Total yield (kg/ha ± se)*** | *High (kg/ha)* | *Low (kg/ha)* | ***Total yield (kg/ha ± se)*** | *High (kg/ha)* | *Low (kg/ha)* |
| 2019 | **680 ± 183** | 1,072[P7] | 327[P3] | **263 ± 87** | 495[P4] | 49[P8] |
| 2020 | **1,418 ± 201** | 1,946[P6] | 993[P3] | **872 ± 168** | 1,201[P4] | 379[P8] |
| 2021<br>*2021^* | **1,341 ± 181**<br>***1,548 ± 183*** | 1,603[P6]<br>*1,811[P6]* | 1,110[P3]<br>*1,198[P1]* | **786 ± 132**<br>***1,002 ± 131*** | 1,205[P5]<br>*1,362[P5]* | 376[P2]<br>*665[P2]* |

[P#] indicates paddock in which yield was recorded, ^ corrected for pilferage.

***Inter-row Pasture***

The inter-row pasture was initially dominated by Urochloa, indian couch and black spear grass with rhodes, red natal and buffel in some areas. Legumes comprised of seca stylo and wynn cassia. The overriding feature of the inter-row pasture at the site was observable increase in weeds and a decline in introduced grass species. This was first reported in January 2021, when purple top (*Verbena bonariensis*) was dominating some areas of the pasture to a greater extent than previously during the trial. Whilst this could have been a seasonal phenomenon it was more likely the result of grazing pressure. Grazing pressure had been constant, with no significant spelling of paddocks since cattle were introduced in April 2019.

### 4.1.1.6 Summary Comments – Pinnarendi

***Key points***

- The Live Weight Gains recorded indicated that Redlands productivity was comparable with Wondergraze.
- No penalty from grazing with Redlands – cattle readily accepted the browse and liveweight performance was considered "good".
- Economic studies indicated only a modest reduction in productivity (10% less liveweight gain in a year) from psyllid damage to Wondergraze and would justify the additional expense establishing with Redlands in psyllid prone environments – only difference being seed costs at an extra $40-50/ha depending on sowing rate.
- Over the trial, at an average stocking rate of 0.42 AE/ha, an average daily weight gain of 0.61kg/day was achieved on Leucaena.

**Table 12. Estimated (±se) inter-row pasture dry matter yield (kg/ha) at Pinnarendi (2018-over 2021 (Leucaena paddocks and inter-row pasture paddock).**

| **Time / Paddock** | **Estimated DM yield. (kg/ha ± se)** | **Comment** |
|---|---|---|
| **July 2018** | | All paddocks approx. 80% hayed off |
| P1 | 6,610 ± 760 | 35% legume, 65% grass |
| P2 | 5,920 ± 630 | 44% legume, 56% grass |
| P3 | 5,520 ± 640 | 58% legume, 42% grass |
| P4 | 6,040 ± 640 | 48% legume, 52% grass |
| **March 2019^** | | End of growing season visual estimate with quadrats cut for calibration |
| P1 | 5,220 | 40% legume, 60% grass and other |
| P2 | 5,060 | 30% legume, 70% grass and other |
| P3 | 5,750 | 35% legume, 65% grass and other |
| P4 | 5,060 | 35% legume, 65% grass and other |

| | | |
|---|---|---|
| **December 2019^** | | End of dry season visual estimate; 2 x quadrats cut in P9; o Overall indicative pasture utilisation about 70% (based on March 2019 estimates) |
| P1 | 1,620 | |
| P2 | 1,600 | |
| P3 | 1,280 | |
| P4 | 1,420 | |
| P5 | 1,550 | |
| P6 | 1,350 | |
| P7 | 1,100 | |
| P8 | 1,500 | |
| P9 (buffel) | 1,400 | |
| **March 2020^** | | End of growing season cuts from 24 1m$^2$ exclosures erected paddocks 1-9 |
| P1 | 4,100 | 10% legume, 90% grass |
| P2 | 4,240 | 10% legume, 90% grass |
| P3 | 3,710 | 35% legume, 65% grass and other |
| P4 | 4,250 | 10% legume, 90% grass and other |
| P5 | 4,710 | 60% legume, 40% grass and other |
| P6 | 3,670 | 40% legume, 60% grass and other |
| P7 | 4,920 | 70% legume, 30% grass and other |
| P8 | 4,480 | 40% legume, 60% grass and other |
| P9 (buffel) | 4,710 | 15% legume, 15% grass |
| **April 2021^** | | |
| P1 | 6,100 | 71% grass |
| P2 | 5,225 | 95% grass |
| P3 | 5,100 | 92% grass |
| P4 | 6,050 | 72% grass |
| P5 | 8,825 | 80% grass |
| P6 | 6,325 | 79% grass |
| P7 | 6,100 | 83% grass |
| P8 | 5,400 | 90% grass |
| P9 (buffel) | 8,900 | 71% grass |

^ se not determined

***Recommendations***

- Whilst Leucaena provides improved productivity compared to native and improved pastures, the site at Pinnarendi is characterised by low water-holding capacity, low fertility and rainfall seasonality.
- Grazing management and consideration of row spacing is required to better manage concurrent productivity of Leucaena and inter-row pasture during wet season The applied set stocking approached used at Pinnarendi led to rapid decline in inter-row pasture quality.
- There is a requirement for improved fertiliser strategies for sites with low fertility. Further research could investigate timing, type, application rate/method of fertiliser to support high and consistent Leucaena growth.

### 4.1.2 Goshen Station

'Goshen Station' at Mount Garnet was an original Redlands trial site (P.PSH.0920) which is now utilised as part of the property's grazing system. The live weight gain demonstration project formalised and documented assessments currently being undertaken by the property owners, Brett and Theresa Blennerhassett.

#### 4.1.2.1 Cohort One

A mob of 120 Brahman Cross steers were inducted into the 69ha Leucaena paddock on 7th May 2019 at a stocking rate of 0.6ha/AE. Within the mob, 40 head were identified and tagged as trial cattle. These trial cattle gained an average of 141.3kg over the 375 days of the demonstration with an average daily live weight gain (ADG) of 0.5kg (Table 13).

An informal live weight assessment trial was also undertaken by the producer to assess productivity on native pastures. Thirteen head in a paddock of 200 weaner steers were identified and tagged for weight comparison over 269 days. Native pasture paddocks were stocked at a rate of 10ha/1 weaner. Cattle were supplemented with dry lick and 8% phosphorous blocks. The average daily weight gain of 0.16kg was used for comparison against all weighing periods of the trial cattle.

A second informal trial was undertaken from 28 November 2019 to 11 February 2020 where 49 weaner steers were identified within a mob of 350 steers in a native pasture paddock. These cattle were supplemented with a grain-based lick. The average daily weight gain of 0.34kg was used for comparison against all weighing periods of the trial cattle.

**Table 13. Average Gain for cohort 1 2019-2020**

| | ADG (kg/d) | ADG (kg/d) | ADG (kg/d) | ADG (kg/d) | ADG (kg/ha) | |
|---|---|---|---|---|---|---|
| | May-August 2019 | August-November 2019 | November 2019- May 2020 | | | LWG (kg/yr) |
| **Period (d)** | **111** | **94** | **170** | **375** | | |
| **Leucaena** | 0.62 | 0.26 | 0.62 | 0.5 | 1.01 | 211.7 |
| **Native Pasture with dry lick and 8% P blocks** | 0.16 | 0.16 | 0.16 | 0.16 | 0.04 | 58.4 |
| **Native Pasture with grain-based lick** | 0.34 | 0.34 | 0.34 | 0.34 | 0.08 | 124.1 |

A reduction in live weight gains achieved by the trial cattle was associated with some psyllid pressure and resultant foliage loss. The Leucaena was grazed to reduce foliage loss to psyllids and it was noted that the Redlands variety was less affected, had improved resilience and recovered in a more-timely manner compared to existing Cunningham Leucaena stands.

#### 4.1.2.2 Cohort Two

Twenty Brahman cross steers were inducted into the demonstration on 15 September 2020, with an average weight of 133kg. Cattle achieved an average daily gain of 0.38kg/d with a significant reduction in weight gain during the period between April to July due to higher than usual incidence of three-day (bovine ephemeral fever).

**Table 14. Average Daily Gain for cohort 2 2020-2021**

| | ADG | ADG | ADG | ADG | ADG |
|---|---|---|---|---|---|
| | Sept 2020-Jan 2021 | Jan 2021-Apr 2021 | Apr 2021-Jul 2021 | Jul 2021 – Sept 2021 | 2020 - 2021 |
| **Period (d)** | 137 | 73 | 91 | 71 | 372 |
| **Leucaena** | 0.33 | 0.82 | 0.14 | 0.35 | 0.38 |

#### 4.1.2.3 Cohort Three

Thirty Brahman cross steers were inducted into the Leucaena paddocks on the 02 September 2021 with an average weight of 170kg. This cohort remained in the demonstration for a period of 406 days until 2 November 2022. The average weight gained per head during that period was 213.8kg with an average daily gain of 0.53kg. This compared favourably to the previous native pasture trail which reported average daily gains of 0.16kg on native pasture with dry lick and 8% P blocks and 0.34kg on native pasture with grain-based lick.

**Table 15. Average Daily Gain (kg/d) for cohort 3 2021-2022**

| | ADG (kg/d) | ADG (kg/d) | ADG (kg/d) | ADG (kg/d) |
|---|---|---|---|---|
| | Sept 2021-Apr 2022 | Apr 2022-Jun 2022 | June 2022 – Nov 2022 | 2021-2022 |
| **Period (d)** | **192** | **68** | **146** | **406** |
| **Leucaena** | 0.6 | 0.47 | 0.46 | 0.53 |
| **Native pasture with dry lick and 8% P blocks** | | | | 0.04 |
| **Native pasture with grain-based lick** | | | | 0.08 |

The live weight gains achieved by steers grazing Leucaena as cohort 3 were in line with those expected of the improved pastures – highest during the wet season and lower at the end of the dry season. Cattle on Leucaena during the wet season performed well, therefore it is advantageous to capitalise on this opportunity.

Liveweight gains on improved pasture is expected to vary around an average of 0.3kg/head per day with improvement during the wet season. Based on current prices of $4 per kg, grazing cattle on Leucaena-grass pastures provided an additional $379.60 per head per annum.

#### 4.1.2.4 Cohort Four

Twenty brahman cross steers were inducted into the Leucaena paddocks (Table 17) on 1st November 2022 with an average incoming weight of 182.95kg (Table 16). Inter row pastures consisted of Bisset, Rhodes grass, Urochloa, seca stylo and some Buffel grass (Table 18). The average weight gain per head over the 235 days of the final demonstration was 136.64kg with an average daily weight gain of 0.58kg per head.

**Table 16. Average Daily Gain for cohort 4 2022-2023**

| | Live Weight (kg) | Live Weight (kg) | ADG (kg/d) | LWG (kg) |
|---|---|---|---|---|
| | Nov 2022 | June 2023 | | |
| **Period (d)** | | | 235 | |
| **Leucaena** | 182.9 | 319.6 | 0.58 | 137 |
| | | | | |

#### 4.1.2.5 Goshen Station Biomass Assessments

**Table 17. Leucaena biomass yield estimates (kg/ha) Goshen Station 2020**

| *Period (2020)* | *DM Yield (kg/ha)* | *Notes* |
|---|---|---|
| 17 Dec to 28 May | 569 | 33% leaf; 67% stem<br>Cold affected – had dropped a significant amount of leaf the day before harvesting.<br>If leaf stem ratio recorded at Pinnarendi at same time is applied to Goshen data, then total yield prior to cold weather was more likely about 850-875 kg/ha |
| 28 May to 27 Oct | 281 | 77% leaf; 23% stem<br>Psyllid affected |

**Inter-row Pasture**

**Table 18. Pasture biomass estimates (kg/ha) Goshen Station 2020**

| *Period* | *Estimated DM Yield (kg/ha)* | *Comment* |
|---|---|---|
| End of wet season 2020 | Not assessed | Potentially 3,000 kg/ha |
| End of May 2020 | 1,800 | Lower (1,000-1,200) where recently grazed |
| End of October 2020 | 600-800 | New growth reported after approx. 70mm rain |

#### 4.1.2.6 Summary Comments – Goshen Station

- The trial provided measurements across the entire year and throughout several seasons.
- Leucaena has provided the producer with a viable option for feeding young cattle eliminating the need for ongoing supplementation and improved enterprise management opportunities (image 1,2)
- The producer reported that the investment of time and finances had provided significant and long-lasting benefits.

**Image1: Redlands Leucaena 'Goshen Station' prior to grazing**

**Image 2: Redlands Leucaena 'Goshen Station' after grazing**

### 4.1.3 Douglas Daly Research Farm (DDRF)

Paddocks used on the Douglas Daly Research Farm were 4 ha with the five Leucaena paddocks containing Cunningham and Tarramba Leucaena (Leucaena leucocephala) with an inter-row mix of Sabi (Urochloa mosambicensis), Pangola *(Digitaria eriatha)* and buffel grasses (Cenchrus ciliaris).

The grass dominated paddocks contained Pangola and buffel with some Sabi grass.

#### 4.1.3.1 Cohort One

Grazing:

Year 1. Forty-two Brahman steers were inducted into the trial on 14 July 2020. The paddocks were grazed at 1.5 head per ha (set stocked) during the dry season and adjusted to 1.75 head per hectare with the commencement of the wet season.

Grazing results:

- Dry season live weight gains (14-07-2020 to 2-11-2020) averaged 14 kg for the grass paddocks (0.12 kg/h/day) and for the leucaena –grass paddocks 25 kg (0.23 kg/h/day).
- Wet season live weight gains (2-11-2020 to 17-05-2021) were similar between the grass and grass – Leucaena paddocks. Weight gain over the 196 days was 160 kg per head (0.82 kg/h/day) on average for all paddocks.
- Yearly LWG for the Leucaena –grass paddocks averaged 186 kg/head and the grass only paddocks 176 kg/head over the 307 days.
- Paddock 46 (Sabi grass with minimal Leucaena) gave the lowest LWG of the seven paddocks being assessed (155 kg/h)

**Table 19. Cohort 1 Average Live Weight Gains (kg/head, kg/ha) for Brahman steers on Douglas Daly Research Farm**

| Cohort 1 2020 - 21 | Row spacing (m) | LWG* (kg/hd) | Dry season (kg/hd) | Wet season (kg/hd) | LWG* (kg/d) | Dry season^ (kg/d) | Wet season# (kg/d) | LWG (kg/ha) |
|---|---|---|---|---|---|---|---|---|
| Buffel grass & Leucaena | 12 | 201.9 | 31 | 170.9 | 0.7 | 0.3 | 0.9 | 1 |
| Pangola & Leucaena | 12 | 198.8 | 25.5 | 171.3 | 0.6 | 0.2 | 0.9 | 1 |
| Sabi grass & low population Leucaena rows | 10 | 154.6 | 13.8 | 142.6 | 0.5 | 0.1 | 0.7 | 0.8 |
| Sabi grass & Leucaena | 10 | 182.8 | 29.8 | 159.2 | 0.6 | 0.3 | 0.8 | 1 |
| Buffel grass & Leucaena 8m row | 8 | 192.5 | 28.1 | 161.7 | 0.6 | 0.3 | 0.8 | 1 |
| Pangola grass | | 173.5 | 18.4 | 151 | 0.6 | 0.2 | 0.8 | 0.9 |
| Buffel grass | | 179.3 | 8.4 | 171.9 | 0.6 | 0.1 | 0.9 | 0.9 |
| **Average** | | | | | | **0.15** | **0.85** | **0.9** |

*307d, ^111d, #196d

**Table 20. Row spacing and seasonal liveweight gain (kg/ha/d) for Brahman steers on Douglas Daly Research Farm**

| | Row spacing (m) | Wet season | Dry season | All year |
|---|---|---|---|---|
| Cunningham Var & Sabi | 8 | 1.27 | 0.18 | 0.84 |
| Cunningham/Taramba Var & Sabi | 10 | 1.42 | 0.39 | 1.01 |
| Cunningham Var& Buffel | 8 | 1.44 | 0.36 | 1.02 |
| Cunningham Var &Buffel | 12 | 1.47 | 0.39 | 1.05 |
| Cuningham/Taramba Var & Pangola | 10 | 1.53 | 0.35 | 1.07 |
| Buffel & Sabi grass | 0 | 1.35 | 0.24 | 0.91 |
| Pangola &Sabi grass | 0 | 1.54 | 0.11 | 0.96 |

Cohort 1 cattle were last weighed on the 17 May 2021 prior to being transferred to another facility. The paddocks were then rested until July when the second cohort were inducted.

During the dry season ample dry grass pasture was available (6 to 8 t total biomass). The quality of the pasture was low compared to the wet season (approx. 3 – 5 % CP, 40 - 50% digestibility). The

Leucaena leaf on offer was variable depending on the paddock, between 3 to 38 kg/ha (dry leaf equivalent), however most Leucaena leaf had been consumed by mid – late September. (Leucaena leaf crude protein 20 – 28 %, DMD around the 75% and ME 14 – 15 MJ/kg).
Reasonable rainfall in late September and October 2020 (141 mm) soon produced green grass and Leucaena leaf in all paddocks with ample Leucaena leaf and green grass on offer since the early start to the wet season.

#### 4.1.3.2 Cohort Two

The second cohort of brahman steers were inducted on 12 July 2021. The paddocks were rotationally grazed at 2 head per ha. Similar to the previous year there was ample dry grass pasture available however the quality of the grass pasture was low compared to the wet season. From the 17/08/22, the grass yields in the five Leucaena paddocks were reduced due to paddock clean-up of volunteer Leucaena plants and B/L weeds. Over this time to the start of the wet season average LWG reduced to 0.02 kg/hd/day compared with the grass only paddocks of 0.04 kg/hd/day.
The wet season pasture growth reflected the 988 mm of rainfall received for 2021 – 2022 over 7 months. The majority of rainfall being received between December to March. The live weight gain over the wet season (November to May) was reported as 0.78 kg/hd/d for the Leucaena – Grass mob and 0.76 kg/hd/d for the grass dominated paddocks.

**Table 21. Cohort 2 Average live weight gain for Brahman steers on Douglas Daly Research Farm**

| Cohort 2 2020 - 21 | LWG* (kg/hd) | LWG* (kg/d) | Wet season# (kg/hd) | Dry season^ (kg/d) | Wet season## (kg/d) | LWG+ (kg/ha) |
|---|---|---|---|---|---|---|
| Leucaena | 161 | 0.52 | 147 | 0.1 | 0.78 | 1.0 |
| Grass pasture | 154 | 0.50 | 142 | 0.1 | 0.75 | 1.0 |

*306d, #188d, ##244d, ^62d, +309d

Dry season live weight gains averaged 13.3 kg/hd for the grass –Leucaena paddocks and 11.6 kg/hd for the grass only paddocks over 121 d (12-07-2021 to 10-11-2021). Wet seasons live weight gains were similar between the Leucaena and grass rotations being 147 kg/head (Leuc) and 142 kg/head, respectivelyover 188 d (10-11-2021 to 17-05-2022)
Over a total period of 309 d the Leucaena – grass pastures were reported to outperform the grass only pastures with LWG reported as 161 kg/head compared with 154 kg/head, respectively.

#### 4.1.3.3 Cohort Three

On the 28th June 2022 the 3rd Cohort of 30 head of weaner steers were inducted into the Leucaena and grass paddocks and 12 head into the grass only paddocks. An additional two older animals joined the trial mob in the Leucaena paddocks for the initial 44 days of trial to enable transfer of the rumen bug. The dry season stocking rate for both the Leucaena and grass only paddocks was 1.5 head/ha.

Cattle in the Leucaena paddocks are rotated every 7 days and cattle in the grass paddocks are rotated every 14 days.
On the 2nd of December the stocking rate of both mobs was adjusted to 2 head per hectare with the commencement of the wet season.

**Table 22. Cohort 3 Average live weight gain for Brahman steers on Douglas Daly Research Farm**

| Cohort 3 2022 - 23 | LWG* (kg/hd) | LWG* (kg/d) | Wet season# (kg/hd) | Dry season^ (kg/d) | Wet season# (kg/d) | LWG* (kg/ha) |
|---|---|---|---|---|---|---|
| Leucaena | 185 | 0.53 | 169 | 0.21 | 0.72 | 0.92 |
| Grass pasture | 186 | 0.54 | 172 | 0.12 | 0.73 | 0.95 |

*342d, #236d, ^105d

Dry season live weight gains averaged 20 kg/hd for the grass –Leucaena paddocks and 13 kg/head for the grass only paddocks over 105 d (28-06-2021 to 12-11-2021). By comparison live weight gains reported over 188 d for the wet season were similar at 0.72-0.73 kg/d across both paddock types. Over a total period of 342 d steers in both paddocks achieved similar liveweight gains, of 185 and 186 kg/hd for the Leucaena and grass-based pastures, respectively.

#### 4.1.3.4 Douglas Daly Research Farm Biomass Assessment

At the start and end of the dry season each 4 ha paddock was assessed to estimate the available pasture yield and pasture composition including available Leucaena leaf biomass (Table 24).

**Table 23. Inter-row pasture biomass recorded and pasture composition for Douglas Daly Research Farm trial paddocks.**

| | May-21 | Nov-21 | Nov-21 | Jun-22 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Calc total yield | Calc total yield | Assessed Yield of green pasture | Calc total yield | | | % of | % of | % of | % of | % of | % of |
| Pad | kg/ha | kg/ha | kg/ha | | | | Sabi grass | Buffel | Pangolal grass | Other grass | All B/L's | Wynn |
| 39 | 13,000 | 11,968 | 1,197 | 6,900 | | | 61 | 26 | 0 | 4 | 4 | 5 |
| 45 | 15,000 | 14,984 | 1,498 | 5,900 | | | 5 | 3 | 77 | 7 | 8 | 0 |
| 46 | 14,600 | 21,831 | 2,183 | 12,600 | | | 90 | 0 | 0 | 3 | 5 | 2 |
| 48 | 19,100 | 16,743 | 1,674 | 9,500 | | | 80 | 0 | 0 | 15 | 5 | 0 |
| 534 | 8,600 | 11,403 | 1,140 | 5,400 | | | 60 | 31 | 0 | 7 | 0 | 2 |
| | | | | | | | | | | | | |
| *Grass Only paddocks* | | | | | | | | | | | | |
| | | Calc total yield | Assessed Yield of green pasture | | | | % of | % of | % of | % of | % of | % of |
| Pad | | kg/ha | kg/ha | kg/ha | | | Sabi grass | Buffel | Pangolal grass | Other grass | All B/L's | Wynn |
| 531 | 11,000 | 16,554 | 1,655 | 10,400 | | | 15 | 63 | 0 | 8 | 11 | 3 |
| 44 | 14,300 | 26,920 | 2,692 | 6,200 | | | 5 | 0 | 90 | 1 | 4 | 0 |

**Table 24. Paddock features and Leucaena leaf Biomass estimates (kg/ha DM) for 2020 and 2021 Douglas Daly Research Farm**

| | | | Leucaena leaf yield (kg/ ha dry leaf) | | |
|---|---|---|---|---|---|
| Paddock # | Rows (n) | Row length (m) | 01 Jul 2020 | 01 Oct 2020 | 01 May 2021 |
| 534 | 8 | 250 | 26 | 19 | 300 |
| 48 | 6 | 575 | 9 | 7 | 260 |
| 46 | 6 | 575 | 3 | 2 | 25 |
| 45 | 5 | 575 | 4 | 3 | 300 |
| 39 | 5 | 575 | 38 | 29 | 260 |

**Supplementary lick blocks**

Livestock Nutrition Technologies (LNT) Uramol® lick blocks were supplied to both mobs during the dry season with average daily consumption approx. 50 g/hd/d. Maxi-phos® lick blocks were also supplied during the wet season with average daily consumption approx. 60 g/hd/d.

**Faecal NIR analysis.**

Faecal samples were collected from both mobs to assess pasture quality consumed by the cattle. Faecal samples collected were dried and sent to Symbio Laboratories for analysis.
Results from the two mobs collected at the same date found more non-grass % was slightly higher in the Leucaena – grass paddocks (suggesting Leucaena consumption), but crude protein, Faecal N and DMD %. Were all similar. The % of phosphorus in the faeces was higher from the grass paddocks.

**Table 25. Faecal NIR assessment**

| Date | Paddock | CF086-Faecal Phosphorus (mg/kg) | CF086-Diet Crude Protein (%) | CF086-Delta-13C (%) | CF086-Est in vivo DM Digest (%) | CF086-Ash % Faecal (%) | CF086-Faecal Nitrogen (%) | CF086-ME intake MEAN (MJ/100 kg LWt) | CF086-Non-Grass (%) |
|---|---|---|---|---|---|---|---|---|---|
| 2.4.2922 | Grass Paddock 531 | 5300 | 10 | 14 | 61 | 17 | 1.9 | 15.9 | 4.5 |
| 2.4.2922 | Leucaena - grass Pads 534 | 4000 | 10 | 15 | 65 | 16 | 1.9 | 19.4 | 10.4 |
| 1.11.2020 | Grass paddocks 1.11.2020 | 7700 | 15 | 15 | 69 | 17 | 2.6 | 25.3 | 10.7 |
| 1.11.2020 | Leucaena - Grass pads | 4900 | 16 | 16 | 70 | 15 | 2.5 | 25.6 | 16.5 |
| 11.5.2021 | Leucaena - Grass pads 39 | | 10 | 18 | 63 | 13 | 1.9 | 17.8 | 31.5 |

### 4.1.3.5 Summary Comments Douglas Daly Research Farm

- Leucaena has potential to address the protein drought experienced in the Northern Territory during the dry season and result in increased productivity of grazing enterprises compared grass dominated pastures only. Leucaena provides a quicker turn-off due to a higher quality feed intake, resulting in a potentially higher stocking rate and fewer grazing days to meet an LWG target.
- Gross margin analysis based on an economic assessment conducted by QDAF using cohort 1 data and no forage growing costs allocated suggested a 23% benefit associated with Leucaena. Nevertheless, the higher stocking rate in year 2 gave a slightly higher LWG per hectare than years 1 and 3 but reduced the average LWG per head. However, most of the Leucaena paddocks

were > 20 years old with remaining Leucaena stands of 30 – 40 % (or less) of the original establishment.

- Rainfall received over the three seasons from 2020 – 2023 was 1,370, 988 and 1480 mm with the majority of rainfall being received between mid November to mid March.
- The wet season rainfall resulted in vigorous Leucaena growth producing more leaf than could be consumed by the cattle with the Leucaena plants growing beyond a grazing height. Similarly, high rainfalls resulted in higher grass pasture quantity and quality.

**Image 3: Dryland leucaena paddock on Douglas Daly Research Farm prior to grazing**

**Image 4: Dryland leucaena paddock on Douglas Daly Research Farm after grazingz**

### 4.1.4 Supply Chain

The ability to 'track' the live weight gain of cattle through the supply chain (backgrounding, feed lotting or live export, processing) was not achieved demonstrating the complexity of cattle production form northern systems. Rapid decisions to take advantage of prices, emerging market opportunities and the identification of the preferred turn-off avenue in sufficient time hampered the opportunity for tracking through the supply chain. Further discussions regarding the measurement of live weight gains post-farmgate point of origin suggest that only some integrated supply chains could capture this data adequately. The procurement of northern Australia live weight gain data would be an invaluable tool for the northern beef industry but challenging to secure. The data available to date has supported some farm based economic analysis which has value to the grazing industry.

### 4.1.5 Core Producer Surveys

A summary of the three core producer survey results is below:

Total Hectares Managed: 5,586 ha
Current Leucaena Plantings: 461 ha
Planned Leucaena Plantings: 1233 ha
Number Breeders: 2,400
Number of Cattle Turned Off pa: 1552
Total Number of Cattle: 4,752
Current Knowledge of Successful Establishment (average): 8

Current Knowledge of achievable LWG (average): 8
Current Knowledge of Economic Returns (average): 7
Confidence to achieve significant LWG (average): 8.5

The post core producer survey provided the following core producer feedback:

**Pinnarendi**

***Aim:* contribute to knowledge of Leucaena productivity / economics in northern Queensland**

**Outcome:** Yes. Not with respect to Pinnarendi (which was in-progress anyway) but by association with the producer at Goshen Station (N Qld.) and visit to Douglas Daly Research Station (NT Gov). Have considerable more knowledge about how Leucaena at Goshen was established and is managed.

***Prior Confidence to achieve live weight gains: Rating 9***

**Outcome:** Partly, weight gains were already demonstrated so already had a high level of confidence. However performance of Leucaena after cutting/pruning has now been observed and subsequent ability to fatten heavyweight cattle was demonstrated – albeit in a good season.

***Knowledge of Economic Returns***

**Outcome:** Our knowledge of economic returns has improved, particularly in the longer term – clearer now what the longer term management requirements will look-like i.e. more frequent/lighter fertiliser applications, rotational grazing (with wet-season spelling incorporated). Pruning frequency still an unknown and the fertiliser requirement to sustain productivity on in-fertile red-earth soils still need investigation.

***Desired Learnings:***

- Grazing / pruning management of Leucaena for maximum productivity.
- Economics of fertiliser applications to Leucaena and inter-row pasture.
- Objective comparison of double versus single row Leucaena.
- Economics of irrigated Leucaena in dry tropics.

**Outcome:** Better informed on first point. Last 3 points need more investigation. Last point less relevant to industry as a whole but presents an opportunity which some growers are pursuing. Further work at Pinnarendi under DAF-MDC QPRP project aims to address first 2 points.

***Main benefit***

Increased interaction with producer/Leucaena grower at Goshen Station and interaction with NT based researchers. On-going involvement with The Leucaena Network.

***Future plans***

Not at Pinnarendi. Goshen (Blennerhassett) is continuing to increase area planted to Leucaena – currently about 400 ha and increasing by 50-100 ha annually.

***Overall Satisfaction***

Seven. Would have been good to include Leucaena developments in Georgetown district in study. Better documentation of stocking rates and rotational grazing system at Goshen.

***Future activities by The Leucaena Network or MLA***

- Increased knowledge around fertiliser/nutrient demand for sustained productivity
- Potential for smaller/dwarfing types (with equivalent productivity) to reduce or eliminate pruning requirement

- Studies on grass/Leucaena balance in relation to row spacing – northern producers pushing out row spacing to increase pasture component (and reduce competition from Leucaena)

***Recommend the PDS program***: Yes

***Suggested improvements***

As I was not leading/managing this program (participant role)– not familiar with structure and workings of PDS process – therefore don't feel experienced/informed enough to provide judgement/feedback

**Goshen Station**

***Aim: To gain live weight information..***

**Outcome:** Yes it has met the outcome through observation and actual weigh gain recordings.

***Prior Confidence to achieve live weight gains: Rating 8***

**Outcome:** Yes, my confidence has improved to a 10 as I know I can achieve live weight gains.

***Knowledge of Economic Returns***

**Outcome:** My knowledge has improved from participation in this project.

***Desired Learnings:***

- Fertiliser application
- Daily weight gain – in paddock walk over scales

**Outcome:** Yes, this has assisted with this information.

***Main benefit***

The main benefit was to learn what the actual weight gains were.

***Future plans***

Future plans include all available land to plant with Leucaena over time.

***Overall Satisfaction***

I rate the project 9/10

***Future activities by The Leucaena Network or MLA***

There needs to be more financial benefit to the grazier for the information they give back to The Leucaena Network and MLA.

***Recommend the PDS program***: Not sure

***Suggested improvements***

I feel there needs to be more financial benefit given to the producer. The grazier doesn't receive nowhere near enough funds for the time and inconvenience given to these projects.

**Douglas Daly Research Farm**

***Aim: To learn more about managing Leucaena and the production of the grass – Leucaena base pasture. Also what economic value the grazing system will produce here compared to the 2 collaborative properties in Queensland.***

**Outcome:** The production of the grass – Leucaena base pasture in the NT was achieved obtaining LWG with-in 12 months of grazing for the live export trade (to Indonesian feedlot / wet market).

***Prior Confidence to achieve live weight gains: Rating 8***

**Outcome:** My level of confidence is still much the same.

The Leucaena stands at DDRF are over 20 years old with only about 40% of the Leucaena shrubs remaining.

I'm sure re-planting more Leucaena into the existing grasses would improve cattle production particularly during the dry season grazing.

***Knowledge of Economic Returns***

**Outcome:** The economic returns from the Leucaena-grass pastures on DDRF provided some varied stocking rates however the greater economic return was from the rotational grazing and higher stocking rates.

***Desired Learnings: Knowing how much Leucaena will be consumed by cattle during the wet and dry seasons and what other factors will influence the consumption of Leucaena.***

**Outcome:** The project did assist with learning of how much Leucaena may be consumed by cattle during the wet and dry seasons (by visual and F.NIR testing). Other factors influencing the consumption of Leucaena seems to be the grass quality and quantity.

***Main benefit***

That even though the old stands of grass - Leucaena were aged and a much lower % of Leucaena from the past, dry season cattle performance was better than the grass only pastures.

***Future plans***

At this stage there will be no additional plantings of Leucaena mainly due to the land being used by other projects.

***Overall Satisfaction***

Overall satisfaction is high (8-9). It would be interesting to compare (in the same year) a new well established grass – Leucaena stand compared to a new grass stand in regards to economic returns, LWG's legume consumption in the wet and dry season.

***Future activities by The Leucaena Network or MLA***

Positive reduction of green-house gas imitations (methane) from cattle grazing on grass – legume pastures compared to grass only and native pastures.

***Recommend the PDS program***: Yes

***Suggested improvements***

Not sure at this stage. Past PDS's I've been involved with have involved a number of producer's all having a similar query so looking towards a common solution. (Which often reveals other answers and questions)

A copy of the Core Producer Pre-Project and Post Project Survey template is provided in Appendix 6.2.

## 4.2 Economic Analysis

The Queensland Department of Agriculture and Fisheries (DAF) undertook an assessment of the live weight gains available until June 2021 and developed an economic assessment of the profitability of Leucaena into a grazing system.

The full economic analysis of the three trial sites is included in Appendix 6.1.

**Pinnarendi Station**

Gross margins for the live weight gain trial on Pinnarendi Station were calculated for both Wondergraze and Redlands varieties and native pasture on the same type of soil.
The gross margin of $50,773 for Redlands compared favourably with $37,628 for Wondergraze and $16,703 for native pastures. Allowing for the seed price difference between Wondergraze ($66/kg) the gross margin per hectare was $86 for Redlands, $60 for Wondergraze and $25 for native pastures.

**Douglas Daly Research Farm**
The trial site on the Douglas Daly Research Station compared Leucaena to a grass pasture for 306 days, from July 2020 through to May 2021. The Leucaena had an average daily gain of 0.61kg/d and the grass pasture had an average daily gain of 0.57kg/d over this period. The gross margin for Leucaena was calculated to be $148,242 compared with the grass pasture of $112,036. The gross margin per hectare for Leucaena and grass dominated pastures was $354 and $267, respectively. The inclusion of Leucaena in the grazing system increased the gross margin per hectare by 32%.

**Goshen Station**
The gross margins for the grazing systems on Goshen Station were calculated to compare the economic performance of Leucaena relative to a grass pasture on the same soil type. The trial site had 337 d of live weight gain data from May 2020 through to April 2021. Cattle on the Leucaena had an average daily gain of 0.66kg/d and those on the grass pasture had an average daily gain of 0.40kg/d over this period. The annual liveweight gain for cattle was 224kg on Leucaena and 135kg on the grass pasture.
The gross margin of the Leucaena plantings was calculated to be $137,845 with a gross margin per hectare of $262 compared with $54,515 and a gross margin per hectare for grass pasture of $62. The introduction of the Leucaena grazing system resulted in a 324% change in gross margin per hectare.

## 4.3 Extension and Communication

The live weight gain results have been showcased at the following project events:

**DAF Pinnarendi Station Field Day – 30 March 2021**
DAF's Craig Lemin, Bernie English and Joe Rolfe presented the findings to date of the Pinnarendi trials; Bron Christensen presented on the activities of The Leucaena Network including this PDS; and Brett Blennerhassett presented the live weight gains achieved on Goshen Station as well as sharing his experiences in the establishment and management of Leucaena on Goshen Station.

**Northern Territory Government Field Day, Douglas Daly Research Farm – 28 April 2021**
DITT's Peter Shotton hosted a field walk to the Leucaena trial paddocks where he presented the results achieved to date; Bron Christensen provided a brief introduction to Leucaena estsablishment and an update on the live weight gains achieved by the Pinnarendi and Goshen sites.

**Northern Territory Government Field Day, Douglas Daly Research Farm – 4 April 2023**
DITT's Peter Shotton again hosted a field walk to the Leucaena trial paddocks. Trial results across all three sites were presented to the attendees which was followed by an open discussion on the adoption of Leucaena by producers in the Northern Territory. This discussion indicated that whilst many producers were considering Leucaena as a future investment in their grazing system, and acknowledged the productivity and financial benefits, they are currently committed to diversification through cash crops including cotton.

**Goshen Station Field Day – 9 May 2023**
Brett and Theresa Blennerhassett hosted interested producers, industry, service providers and banking representatives at the final project Field Day. Brett Blennerhasset provided an overview of the weight gains over the previous three years of the project and Craig Lemin and Kendrick Cox spoke of the Pinnarendi experiences including pasture trials. Bron Christensen provided the attendees with the results from the Douglas Daly Research Farm. The attendees were then able to visit the Leucaena paddocks, view the cattle and see first-hand the improved fodder availability provided through the inclusion of Leucaena, coupled with active pasture and herd management.

Promotional material for these events is included in Appendix 6.3.

In addition, Bron Christensen presented on the interim live weight gains available at other Network events including:

- Fairview LWG Trial Field Day (20 February 2021)
- Final Fairview field day (27 May 2021)
- Introduction to Leucaena field day at Gin Gin (26 June 2021)
- Introduction to Leucaena field day at Thangool (11 September 2021)
- The Leucaena Network Carbon Forum in Rockhampton (October 2021)
- Whitewater Field Day, Mount Surprise, Far North Queensland – 15 March 2022
- Douglas Daly Leucaena Field Day at 'Malilangwe' and 'Blackbull Station', Northern Territory – 4 May 2022
- The Leucaena Network Sterile Leucaena Industry Update at the Redlands Research Station in October 2022.

Outcomes from the project have also been included in presentations at significant industry events including:

- Etheridge Shire Council Forum – 7 April 2021. 15 minute presentation.
- Esk Beef Up Forum – 25 May 2021. 20 minute presentation.
- The Developing Northern Australia Conference– 17 August 2021. 10 minute presentation.
- Australian Association of Animal Science (AAAS Conference) held in Cairns 5 -7 July 2022. 10-minute presentation in the 'Extension and Adoption' breakout session.
- North Australia Beef Research Council (NABRC) Conference 23-25 August 2023. 10 minute presentation and panel discussion.

The live weight gain data has also been presented in a Fact Sheet / Handout / Case Study that was provided to all visitors at The Leucaena Network stands at:

- Northern Territory Cattlemen's Association Conference (25 – 26 March 2021)
- Beef Australia 2021 (3 – 7 May 2021)
- Food Futures Conference (18-20 May 2021)
- Northern Beef Producers Expo in Charters Towers (3-4 June 2022)
- NT Farmers Food Futures Roadshow in Mareeba (August 2022
- Clermont Beef Up Forum (October 2022).

A Case Study featuring Goshen Station has been updated to include data from this trial and this Case Study has been provided to all attendees at 2022 and 2023 events; and included in information packs and handouts to new enquirers.
Outputs from the project are included in Appendix 6.4

Social media through the Network's Facebook page has been widely shared and commented on. A media release on the live weight gains achieved through the project, coupled with the live weight gains from the Fairview trial was distributed to rural press and radio outlets. This was reproduced by The Country Life however the focus was limited to the Fairview Trial and Goshen Station. The additional trial data was provided through a share of the release on The Leucaena Network's Facebook page.

Media coverage is noted in Appendix 6.5.

## 4.4 Monitoring and Evaluation

The Northern Territory Government's Field Days in April 2021 and July 2023 were utilised as part of the project's extension and adoption component with an invitation for the project to present as part of the comprehensive industry and issues agenda. Due to this integration with many other topics and speakers, evaluation of the Leucaena specific sessions was not undertaken. However, attendees at the demonstration project's other two field days were provided with surveys at the completion of each day.

The Douglas Daly Research Farm's April 2021 Field Day's 20 attendees indicated a 33% change in grazier knowledge and confidence in Leucaena establishment, management, and productivity (7.5 to 8.9 rating) and a 100% satisfaction rating of 7 or above for the field day and value for their time spent. Comments included:

- Ran very well - lots of information. We will maintain membership to get access to information.
- More data. And please follow up *(done)*
- Hold another field day earlier in the season to see growth and how it is grazed with the pasture.
- Perhaps a little more information on the effects on cattle for those who do not know anything about the plant eg Rumen bug (*Note: all attendees were provided with information packs at the end so they could read all about the basics - Fact Sheets, Case Studies, MLA Book, Membership Form, Overview, Presentation Handout)*
- Timing of a field day to match green / growth phase and number of days prior to grazing.
- I loved the powerpoints last year - more photos of Qld; The Field Days are great. Interactive events on the ground!

Unfortunately, feedback data was not collected from participants at the Douglas Daly Research Farm's April 2023 Field Day however general comments from participants was very positive and some valuable feedback was provided during the closing sessions where DITT Director Phil Hausler led a discussion session regarding the participants opinions on the fodder and diversification options for NT growers.

Likewise, due to the multi-venue nature of the Pinnarendi Field Day, feedback from participants was planned in the organisation but missed in the execution.

The 19 Goshen Field Day attendees indicated a 33% improvement in grazier knowledge and confidence in establishing and utilising Leucaena (an average prior rating of 7 to 9.3 after) and a 100% satisfaction rating of 7 or higher. Comments included:

- Good to hear the results
- A good range of speakers – very informative
- A good day

The comprehensive MER Report is provided in Appendix 6.6

# 5 Conclusion

The project provided quantified data supporting the potential of Leucaena to yield improved liveweight gain of cattle across northern Australia. With median average daily live weight gains of 0.60kg/d achieved at Pinnarendi, 0.52kg/day at Goshen Station, both located in far north Queensland, and 0.77kg/d at Douglas Daly Research Farm in the Top End region of the Northern Territory, Leucaena plantations have been shown to provide the opportunity for graziers to significantly increase their carrying capacity and productivity.

The economic assessment based on the use of Leucaena supported the increased viability of grazing properties when a perennial tree legume is utilised.

Pinnarendi's economic assessment indicated that Leucaena provided a 144% (Wondergraze) and 250% (Redlands) increase in gross margin compared to native pasture. The significant difference in the gross margin between the two varieties was due to the detrimental impact of psylid infestations in the region, with the pyslid tolerant variety Redlands providing more consistent productivity and improved recovery after an infestation.

Goshen Station's gross margin per hectare (of the Leucaena pastures) improved by 324% from $62 to $262 after the establishment and utilisation of Redlands Leucaena.

The Douglas Daly Research Farm's gross margin improvement was less dramatic with an improvement of 32%. Whilst this remains a positive outcome for properties in the region, the reduced improvement compared to the other two sites can be attributed to the age of the plantings (>20 years) and the reduction in the standing plants to 30 – 40% of the original planting.

The project aligned with expectations that the productivity and weight gains achieved by Leucaena would be highest during the wet season and lower towards the end of the dry season.

The project reinforced the general knowledge that the overall management of Leucaena grazing systems is more intense compared to pasture only due to the legume height management requirements and weed control.

The difference in the gross margins between the more recently established Leucaena and the aged plantings identifies a knowledge gap in the Leucaena grazing industry, being best practice management and maintenance practices for long term productivity.

The key recommendation from this project is to further document best management practices for the long-term productivity of Leucaena-grass pastures – fertilising and cutting regimes and the most effective grazing strategies for the industry to achieve optimum productivity and sustainability.

## 5.1 Key Findings

- Leucaena has the potential to increase the carrying capacity of paddocks with the appropriate soil properties and climate, by up to four times, and on average, over a twelve-month duration will provide a daily weight gain of 0.5kg per head / day. This compares favourably to most native pastures in the far northern areas of Australia with an average daily live weight gain of 0.03 to 0.05kg per head / day.
- Leucaena has the potential to dramatically improve the gross margin of a grazing enterprises, between 144 to 324% on younger plantings of less than ten years and when well managed.

- Leucaena that is aged and with reduced plant density of more than half the original plantings will continue to provide productivity benefits to a grazing system with an improved gross margin of 32%

## 5.2 Benefits to industry

- The results of the three demonstration sites, located in different climate and soil types across northern Australia, consistently reinforced the potential of well-managed Leucaena to improve the productivity and profitability of a grazing.
- The demonstrated improvement in gross margin through the adoption of Leucaena-grass pastures addresses the key concern of many potential Leucaena producers, being the perceived initial high cost of establishment and likely return on that investment.
- The consistency of liveweight weight gains throughout the year for cattle grazing Leucaena based systems and particularly towards the end of the dry season demonstrated the capacity of Leucaena to be a dry season / drought tolerant source of protein for improved animal productivity.

# 6 Appendix

## 6.1 Appendix One - Economic Analysis

**Economic analysis of leucaena liveweight gain trials**

Prepared for the Leucaena Network

**August 2021**

Queensland Government

## Background

The economic outcomes of three leucaena liveweight gain trials undertaken across Northern Australia were modelled. The three trial sites were Goshen Station and Pinnarendi Station in northern Queensland and the Douglas Daly Research Farm in the Northern Territory. The primary purpose was to understand leucaena profitability for each geographical area which generally target different cattle markets.

A cost-benefit analysis was previously undertaken for Pinnarendi and has been published in the Meat and Livestock Australia (MLA) milestone report, 'Demonstrating the productivity and profitability of cattle grazing Redlands leucaena in northern Queensland' (Lemin, 2021). The economic section from the report has been included in the appendix. The gross margin methodology remains the same for the other trial sites, with any differences noted in their respective sections. All scenarios had their gross margins calculated based upon the estimated carrying capacity of 500ha of the respective leucaena or grass pasture.

## Goshen Station

Gross margins were calculated to compare the economic performance of leucaena relative to a grass pasture on the same soil type. The trial site had 337days of live weight gain data from 15th May 2020 until 13th April 2021. The leucaena had an average daily gain of 0.66kg and the grass pasture had an average daily gain of 0.40kg over this period. Based upon this data, the annual liveweight gain was 224kg for leucaena and 135kg for the grass pasture.

The target weight for Goshen Station is 450kg to send to the abattoir at Bingil Bay. For the analysis, the steers on grass were held for 560 days (an extra 223 days vs leucaena) to reach the same end weight of 450kg.

The leucaena and grass production had to be estimated for the steer carrying capacity on 500ha as no dry matter data was available. The simulated pasture growth from FORAGE was used for the grass pasture paddock, which was 2,939kg/ha for the last 12 months on Goshen Station. Personal communications from department research officers and extension staff estimated the leucaena production to be 2,000kg/ha and estimated the grass production between the leucaena rows to be 6,000kg/ha.

A list of operations to establish the leucaena on Goshen Station was taken from the 'Redlands for Regions' (Christensen et al., 2019) MLA final report. This included the establishment of sown pasture between the leucaena rows. This was calculated to cost $825/ha. No ongoing maintenance costs were recorded and therefore not included in the analysis.

The results for the Goshen Station gross margin analysis can be view in Table 1 below.

**Table 1** Gross margin analysis results for Goshen Station

| *Steer cohort* | *Grass pasture* | *Goshen Station Redlands leucaena* |
|---|---|---|
| Number purchased | 134 | 533 |
| Starting weight | 226 | 226 |
| Starting price | $3.02 | $3.02 |
| Closing weight | 450 | 450 |
| Closing price | $2.70 | $2.70 |
| Number of days | 560 | 337 |
| Weight gain per day | 0.400 | 0.614 |
| **Livestock Sales** | **$159,133** | **$603,427** |
| Livestock Purchases | $91,634 | $363,750 |
| Freight In | $918 | $3,148 |
| Freight Out | $2,640 | $10,548 |
| Treatment Expenses | $7,050 | $20,739 |
| Selling Expenses | $2,376 | $9,493 |
| Forage growing costs | $0 | $57,905 |
| **Total Expenses** | **$104,618** | **$465,582** |
| **Gross Margin** | **$54,515** | **$137,845** |
| Gross Margin (after interest) | $47,486 | $121,053 |
| Gross margin per hectare (after interest) | $62 | $262 |
| Percentage change in GM /hectare | | 324% |

## Douglas Daly Research Station

The trial site on the Douglas Daly Research Station compared leucaena to a grass pasture for 306 days, from the 14th of July 2020 until 17th May 2021. The leucaena had an average daily gain of 0.61kg and the grass pasture had an average daily gain of 0.57kg over this period. Based upon this data, the annual liveweight gain was 186kg for leucaena and 174kg for the grass pasture.

The target weight for Douglas Daly is 350kg for live export from Darwin port. Both the leucaena and grass were able to fatten the steers to the required weight in the trial period, with the leucaena steers gaining an extra 12kg. Whilst the other two trial sites calculated freight costs in, the cattle at Douglas Daly Research Station are assumed to be bred on property due to the long distance to saleyards.

The grass biomass in the trial ranged from 8,500kg/ha – 12,000kg/ha, therefore a midway point of 10,250kg/ha was used in the analysis. The leucaena biomass was estimated based on residual (after grazing) yield of 280kg. Given an assumed 85% utilisation rate (Bowen & Chudleigh, 2018), this results in 2,145.9 kg/ha of leucaena leaf available for utilisation.

The leucaena establishment cost was estimated to be $170/ha with an ongoing maintenance cost of $72/ha as per personal communications from trial site staff.

The results for the Douglas Daly gross margin analysis can be viewed in Table 2 below.

**Table 2** Gross margin analysis results for Douglas Daly Research Station

| *Steer cohort* | *Grass pasture* | *Douglas Daly Redlands leucaena* |
|---|---|---|
| Number purchased | 468 | 701 |
| Starting weight | 180 | 180 |
| Starting price | $3.02 | $3.02 |
| Closing weight | 354 | 366 |
| Closing price | $2.85 | $2.85 |
| Number of days | 306 | 306 |
| Weight gain per day | 0.569 | 0.608 |
| **Livestock Sales** | **$439,069** | **$679,822** |
| Livestock Purchases | $254,533 | $381,179 |
| Freight In | $0 | $0 |
| Freight Out | $6,950 | $10,409 |
| Treatment Expenses | $24,586 | $27,287 |
| Selling Expenses | $30,294 | $46,481 |
| Forage growing costs | $0 | $50,246 |
| **Total Expenses** | **$316,363** | **$515,601** |
| **Gross Margin** | **$122,706** | **$164,221** |
| Gross Margin (after interest) | $112,036 | $148,242 |
| Gross margin per hectare (after interest) | $267 | $354 |
| Percentage change in GM /hectare | | 32% |

# Appendix – Pinnarendi cost-benefit analysis

## Redlands versus Wondergraze leucaena

### Desktop analysis

The only cost difference that arises when planting Redlands compared to Wondergraze leucaena is due to Redlands seed being more expensive – $70/kg versus $50/kg for commercial quantities of seed. All other aspects of planting and subsequent management during establishment are the same. To date, the Pinnarendi trial has shown that there is no production penalty from grazing Redlands. It is palatable to cattle and productivity (LWG) has been the same as for Wondergraze. However, the trial has not yet demonstrated any productivity advantage from Redlands under sustained psyllid infestation, as there has been no significant psyllid populations at the site over the previous three years.

Nonetheless, given the straightforward cost difference between Redlands and Wondergraze it is possible to do a simple analysis to determine the productivity loss at which the extra cost of Redlands would be recouped. For this exercise the assumptions are based on ADG and stocking figures from Pinnarendi as follows:

- average daily liveweight gain = 0.6 kg
- annual liveweight gain = 219 kg per AE
- stocking at 2.5 AE/ha (1 AE = 450 kg steer)
- annual liveweight productivity = 219/2.5 = 87.6 kg/ha
- price scenarios: A $4.30/kg liveweight (current)
  B $2.85/kg liveweight (most recent 6 year average)
- sowing: twin rows at 1 kg/ha/row i.e. 2 kg/ha overall
- cost premium for Redlands seed = 2 kg/ha x $20/kg = $40/ha

Calculations based on these assumptions are given in Table 14.

**Table 14 Expressing cost of Redlands seed as equivalent productivity loss.**

| *Measure* | *Price A $4.80/kg* | *Price B $2.85/kg* |
|---|---|---|
| Cost of Redlands - liveweight equivalent (kg/ha) | 40/4.80 = 8.33 | 40/2.85 = 14.04 |
| Cost of Redlands – AE productivity (kg/yr) | 2.5 x 8.33 = 20.8 | 2.5 x 14.04 = 35.1 |
| **Cost of Redlands – equivalent productivity loss (%)** | **20.8/219 = 9.5** | **35.1/219 = 16.0** |

Assuming no loss in productivity (expressed as liveweight gain) for Redlands from psyllids, Table 14 indicates it takes about 10% loss in productivity in a single year from Wondergraze due to psyllids to justify the cost of alternately planting Redlands at a sale price of $4.80. At a lower price of $2.85, it would take a 16% productivity loss (or two years with 8% productivity loss).

This indicates that a modest loss in productivity is sufficient to justify the use of Redlands, although actual levels of productivity loss incurred from psyllids have not yet been measured. In a sub-coastal northern environment, it is usual for psyllids to defoliate Wondergraze resulting in leaf loss of >50%, but liveweight gain loss has not been quantified. Liveweight gains will be reduced from psyllid attacks, but may be less than implied by the actual loss of forage (leucaena) considering the ability of leucaena to recover once psyllid populations decline and the on-going contribution from inter-row pasture.

Notably during 2020, coastal and near coastal Redlands plantings were also significantly (>50% of area) affected by psyllids with attendant loss of plant productivity which is of concern. Nonetheless, if Wondergraze had been planted instead, the magnitude and duration of losses would almost certainly have been higher.

## Gross Margin Analysis

### Method

Gross margins were calculated for each of three forage data sets to allow comparison of the economic performance of Wondergraze and Redlands varieties of leucaena relative to an unfertilised native pasture on the same soil type. The gross margins were calculated based on the actual forage and cattle management at each site. The gross margins are presented as an annual gross margin, expressed as $/ha/annum. The analysis includes variable costs, cattle trading costs and the cost of establishing both varieties of leucaena amortised over the expected life of the crop.

This method used the typical gross margin approach based on the allocation of variable costs to enterprises or activities but also included a pseudo 'contract' rate to cost machinery operations. The contract rate apportions overhead, operating and labour costs on a per hectare basis for the use of the machines or combinations of machines. To this figure, an allowance for contractor profit and minor travel costs is added. The final figure approximates the rate that could be charged by a farmer who was asked to do some work on a contract basis for a neighbour and who also wanted to recover a proportional share of the costs of owning and operating the machines, plus the labour associated with the activity, plus some small measure of profit. The contract rate does not represent what should be charged by a contracting business to undertake the same activity as that form of business would incur different costs; i.e. it is a conservative estimate.

The gross margins were calculated as the gross income received from the sale of cattle less the variable costs. Variable costs included both livestock costs and costs of leucaena establishment as an annualised variable cost.

Cattle were valued in and out of the leucaena paddock regardless of whether they were already owned by the property initially or retained on-property after grazing finished at the site. The purchase and selling prices are derived from a six year and one month average for north Queensland saleyard prices (January 2015 – January 2021). The livestock value into the paddock, for stock purchased immediately prior to grazing, was calculated as the landed purchase cost, accounting for transport and buying costs. Total livestock costs thus included purchase cost, animal health expenses, sale levies, freight and the opportunity cost of livestock capital. Labour costs of handling the livestock were excluded on the basis that such livestock costs are unlikely to differ significantly between the leucaena types on an annual basis. The opportunity cost involved in owning the cattle was accounted for by calculating the amount of interest that could have been received on the livestock capital if the leucaena enterprise had not been undertaken (interest rate of 5% assumed) and subtracting this amount from the gross margin.

For forage systems such as leucaena-grass that have a productive life of more than one year and/or have establishment costs that contribute to production over several years, the establishment costs were amortised (added as an average annual cost) in the calculation of the gross margin. The amortisation process includes the opportunity cost of the capital applied in the pasture establishment process in the calculation of the gross margin plus an allowance for the value of any grazing foregone during the establishment period of the perennial forage. This method allows a broad comparison of the gross margins received from annual forage crops with forages that have longer production periods.

However, it is recommended that more detailed investment analysis techniques (for example the use of 'Breedcow') be applied prior to making investment decisions about whether to invest in long-lived forage crops. Such analysis techniques should incorporate the riskiness of the investment, the timing of costs and returns and the effect on whole farm cash-flow and profitability. Changes to operating costs and labour requirements should also be considered where necessary.

The growing costs of the leucaena were based on a mixture of chemical and mechanical weed control methods. This was done to match current industry practice. Cattle production from each site was assessed using a scenario where steers were entered at the same weight: 180 kg liveweight, and were finished at 400 kg liveweight for the Redlands leucaena and 379 kg liveweight for the Wondergraze leucaena. The 21 kg liveweight difference arises from the expected impact of psyllids on the Wondergraze leucaena. The grazing days, stocking rate and daily liveweight gain for each forage at each site were based on an assessment of measured values in both unpublished and published reports and the considered judgement of experienced beef research and extension staff.

## Results

To date, the Pinnarendi trial has shown that there is no production penalty from grazing Redlands. It is palatable to cattle and productivity (LWG) has been the same as for Wondergraze. However, the trial has not yet demonstrated any productivity advantage from Redlands under sustained psyllid infestation, as there has been no significant psyllid populations at the site over the previous three years. Nonetheless, the gross margin analysis used a weighted risk matrix using the probability of psyllid incursion over a 10 year period and subsequent liveweight gain impact based on the considered opinion of project investigators (Table 15) .

**Table 15 Psyllid impact probability of occurrence**

| ***Probability of occurrence*** *(Years in 10,P)* | ***Expected liveweight gain*** *(kg/day)* | ***Value*** *(Px)* | ***Annual liveweight gain*** *(kg per head)* |
|---|---|---|---|
| **1 in 10 years** | 0.400 | 0.400 | 146 |
| **2 in 10 years** | 0.480 | 0.960 | 175 |
| **2 in 10 years** | 0.550 | 1.100 | 201 |
| **3 in 10 years** | 0.600 | 1.800 | 219 |
| **1 in 10 years** | 0.603 | 0.603 | 220 |
| **1 in 10 years** | 0.603 | 0.603 | 220 |
| ***10 year average*** | ***0.547*** | ***5.465*** | |
| Expected value for annual weight gain = 0.547 kg/head/day | | | |
| Expected annual weight gain = 199.5 kg/head | | | |

The only cost difference that arises when planting Redlands compared to Wondergraze leucaena is seed price, with Redlands seed being more expensive ($70/kg versus $50/kg for commercial quantities of seed). All other aspects of planting and subsequent management during establishment are the same. The results are displayed in Table 16.

**Table 16 Gross margin analysis reflecting the expected psyllid impact on Wondergraze.**

| *Steer cohort* | *Red earth native pasture* | *Red earth Redlands leucaena* | *Red earth Wondergraze leucaena* |
|---|---|---|---|
| Number purchased | 161 | 279 | 279 |
| Starting weight | 180 | 180 | 180 |
| Starting price | $3.02 | $3.02 | $3.02 |
| Closing weight | 300 | 400 | 379 |
| Closing price | $2.85 | $2.85 | $2.85 |
| Number of days | 365 | 365 | 365 |
| Weight gain per day | 0.329 | 0.603 | 0.547 |
| **Livestock sales** | **$127,996** | **$295,743** | **$280,579** |
| Livestock purchases | $87,557 | $151,729 | $151,729 |
| Freight in | $2,635 | $4,565 | $4,565 |
| Freight out | $3,375 | $9,865 | $9,865 |
| Treatment expenses | $8,457 | $10,861 | $10,861 |
| Selling expenses | $9,269 | $19,759 | $19,001 |
| Forage growing costs | $0 | $48,230 | $46,929 |
| ***Total expenses*** | ***$111,293*** | ***$245,010*** | ***$242,951*** |
| ***Gross margin*** | ***$16,703*** | ***$50,733*** | ***$37,628*** |
| *Gross margin - after interest* | *$12,325* | *$43,147* | *$30,042* |
| ***Gross margin - after interest ($/ha)*** | ***$25*** | ***$86*** | ***$60*** |
| *Change gross margin (%)* | | *250%* | *144%* |

For Wondergraze leucaena, the expected impact of psyllids on liveweight gain is 21 kg/head/year or $26 /ha/year (gross margin). This impact is based on the probability of occurrence over a 10 year period, which expects the annual liveweight gain of steers on Wondergraze Leucaena to be 199 kg versus 220 kg for Redlands leucaena (assuming no psyllid impacts).

This translates to a significant difference in gross margin between Redlands and Wondergraze (Table 16). Leucaena (Wondergraze) gross margin/ha is about 140% higher ($60/ha) than for the base case native pasture ($26/ha), but Redlands gross margin/ha is 250% higher ($86/ha).

This analysis is predicated on psyllid damage estimated by project investigators, however this assumption requires validation and should be viewed as an investigatory analysis, not a conclusion.

## References

Bowen, M., & Chudleigh, F. (2018). *Fitzroy beef production systems: Preparing for, responding to, and recovering from drought*. State of Queensland.

Christensen, B., Buck, S., Rolfe, J., English, B., & Fletcher, J. (2019). *Redlands for Regions*. Meat and Livestock Australia Limited.

Lemin, C. (2021). *Demonstrating the productivity and profitability of cattle grazing Redlands leucaena in northern Queensland*. Meat and Livestock Australia Limited.

## 6.2 Appendix Two - Surveys

Template Core Producer Survey – Pre-Project


**MLA Producer Demonstration Sites**

**Pre project survey**

**Core Participants**

**PDS Name**: Value Chain Economics for Leucaena

**PDS Code**: 2006

The following questions are used to determine your level of understanding of leucaena – grass pastures. The knowledge and skills audit is used at the start and completion of the program to allow individuals to track their skill development and adoption of new practices. It will also be used:

1. To improve the content of future project meetings; and
2. As part of the evaluation process for the project

The information will be completely confidential and individuals will not be identified in the analysis of data.

**Name**: _____

**Date:** / /

MLA may contact me to further assess the impact of their programs? ☐ Yes ☐ No

MLA may send me newsletters and inform me of future events? ☐ Yes ☐ No

The information you are providing in this form may be personal information under the Privacy Act. Such personal information is collected for the business purposes of MLA and will not be disclosed to anyone else except as notified here, in accordance with the privacy policies of these organisations or where your consent has been obtained. MLA's privacy policy can be obtained directly from MLA by calling 1800 675 717, or from their website at www.mla.com.au. By providing your personal information, you consent to MLA collecting, holding, using and disclosing that information in the manner specified in this form and as otherwise specified in the privacy policies of these organisations. If you do not provide such personal information, MLA may not be able to provide you with products or services or keep you informed about market news, industry information and other communications from them. You can request access to and correction of your personal information by calling MLA on 1800 675 717 or 02 6332 2133.

## Section A – Demographic Information

**A1. Your contact details**

a. Property name .....

b. Business / trading name .....

c. Property address.....

d. Postal address .....

e. Email address .....

f. Phone.....

g. Mobile .....

**A2. What area do you manage?** *(please write the number of hectares that you managed)*

a. Hectares.....

*Other than the planned PDS trial plantings, please indicate your:*

b. Current leucaena plantings: ..... hectares Planned leucaena plantings: ..... hectares

c. Timeframe for planned leucaena plantings: ..... months or ..... years

**A3. What numbers of livestock do you run?** *(please write the number of head against each of the categories of livestock that you run)*

a. Number of beef breeders .....

b. Number of cattle turned off per year .....

c. Total number of cattle .....

d. Other .....

## Section B – Knowledge and Skills

**B1. What was your main motivation in participating in this PDS?**

**B2. On a scale of 1 (no knowledge) to 10 (very knowledgeable) how would you rate your knowledge and skills in relation to establishment and management of Leucaena?**

1 2 3 4 5 6 7 8 9 10

No knowledge Very knowledgeable

**B3. On a scale of 1 (no knowledge) to 10 (very knowledgeable) how would you rate your knowledge of achievable live weight gains from leucaena-grass pastures on your property?**

1 2 3 4 5 6 7 8 9 10

No knowledge Very knowledgeable

**B4. On a scale of 1 (no knowledge) to 10 (very knowledgeable) how would you rate your knowledge of the economic returns from leucaena-grass pastures on your property?**

1 2 3 4 5 6 7 8 9 10

No knowledge Very knowledgeable

**B5. What are the main THREE outcomes you hope to achieve from participation in this PDS in relation to leucaena?**

a. Knowledge of live weight gains achievable ☐
b. Knowledge of the economic returns from leucaena ☐
c. Confidence to invest further in leucaena ☐
d. Decision as to whether I want to invest further in leucaena ☐
e. Access to extension services ☐

**B6. What, in your opinion, are the three most important aspects when grazing leucaena?**

a. Consumption ratio of leucaena and grass ☐
b. Management of pasture availability ☐
c. Management of leucaena availability ☐
d. Cattle type (weaners, feeders, finishing) ☐
e. Length of grazing period ☐
f. Other (please describe) ☐

**B7. Do you currently undertake any farming based activities in addition to your grazing enterprise?**

a. No - grazing only on native pastures ☐
b. Own fodder crops ☐
c. Fodder crops for sale e.g. hay ☐
d. Other (please describe) ☐

**B1. If you undertake farming based activities, do you undertake these activities in-house or contract these services in?**

a. In-house ☐
b. Contract in ☐

## Section C – Confidence and Practices

**C1. Prior to commencing this PDS, how confident were you in being able to achieve significant live weight gains from leucaena-grass pastures?**

*(please rate out of 10, with 1 being poor and 10 being very good, by circling your choice below)*

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Poor | | | | | | | | | Very good |

**C2. Do you currently use the following services?**

| | Normal practice | Sometimes | Rarely | Never | Not Applicable |
|---|---|---|---|---|---|
| *DAF/ DPIR* | | | | | |
| *Private agronomist* | | | | | |
| *Consultant* | | | | | |
| *Other Advisor (other than accountant / solicitor)* | | | | | |

**C3. At this early stage, how confident are you that you will proceed to establishing more leucaena-grass pasture systems following the completion of this PDS?**

*(1 being definitely not confident, 5 being really not sure at this stage and 10 being very confident even without the PDS findings)*

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Definitely not confident | | | | | | | | | Very confident |

**C4. What other information about leucaena, leucaena – pasture systems or live weight gains from these systems would assist you?**

**C5. What other activities could assist you on your leucaena journey?**

**C6. What else do you need from The Leucaena Network or extension to gain the most out of your participation in this PDS?**

Template Core Producer Post Survey

**P.PSH.2006**
**Post Project Survey – Core Producers**

At the commencement of the project, in the pre-project survey, it was indicated that the motivation for participating in the trial was to ***'To gain weight gain information'.***

1. . Do you feel the trial has met this outcome and how?

2. The pre-project survey indicated your level of confidence to achieve live weight gains from leucaena-grass pastures on your property was **8** on a scale of 1-10. Has this improved through participation in project activities or as a result of other circumstances?

3. The pre-project survey indicated that our knowledge of the economic returns from the leucaena-grass pastures on your property was **8** on a scale of 1-10. Has this improved through participation in project activities or as a result of other circumstances?

4. In the pre-project survey, you indicated that the following information about leucaena or leucaena -pasture systems would assist you:
   - ***Fertiliser application***
   - ***Daily weight gain – in paddock walk over scales***

   Has this or other projects been able to assist you with this information? How else could this information be obtained?

5. What has been your main benefit of your involvement in the project?

6. Are there future plans for additional plantings and if so, the potential acreage and timeframe? Or are there alternative plans for the existing leucaena?

7. Please advise of your overall satisfaction rating with the project (1 being low and 10 being high) and any comments about this rating and how the project could have been improved.

8. What future activities could be undertaken by The Leucaena Network or MLA to assist you in undertaking leucaena grazing systems?

9. Would you **recommend** MLA's PDS program to others? ☐ Yes ☐ No ☐ Not Sure

10. Please provide any feedback to help us improve the PDS program:



P O Box 240, Theodore Q 4719 M:0488931691 E: admin@leucaena.net
www.leucaena.net

Template Observer Producer Survey – Event

the leucaena network

_____Field Day
_____2023

Interest: Grazier Ag Consultant Service Provider Other _____ Just curious

Current leucaena plantings: _____ ha Planned leucaena plantings: _____ ha

Timeframe for planned leucaena plantings: _____ months or _____ years

**C1. How valuable was your attendance today for your enterprise?**

*(please rate out of 10, with 1 being poor and 10 being very good, by circling your choice below)*

1 2 3 4 5 6 7 8 9 10
Poor Very good

**C2. Prior to attending what was your level of knowledge and confidence regarding the successful establishment and expected returns from leucaena – grass pastures?**

*(please rate out of 10, with 1 being not confident and 10 being very confident)*

1 2 3 4 5 6 7 8 9 10
Little knowledge Considerable knowledge

**C3. After attending what is your level of knowledge and confidence regarding the successful establishment and expected returns from leucaena – grass pastures?**

*(please rate out of 10, with 1 being not confident and 10 being very confident)*

1 2 3 4 5 6 7 8 9 10
Little knowledge Considerable knowledge

**C4. Are you now more likely to consider/ recommend a leucaena-grass pasture system (or additional) on your or a client's property?**

*(please rate out of 10, with 1 being unlikely and 10 being absolutely, by circling your choice below)*

1 2 3 4 5 6 7 8 9 10
Unlikey Unsure Absolutely

**C5. How could today's activity be improved?**

_____

_____

**C6. What other activities could The Leucaena Network undertake to assist you?**

_____

_____

**Would you like any further information or assistance from The Leucaena Network?**

Name _____
Address _____
Email _____ Phone _____

*Many thanks for attending the field day and for taking the time to respond!*

www.leucaena.net

## 6.3 Appendix Three - Field Day Flyers / Promotions

# SAVE THE DATE

The Department of Industry, Tourism and Trade is holding field days at Katherine Research Station and the Douglas Daly Research Farm.

**Katherine Research Station (KRS) field day -** Tuesday 27 April

- Understanding calf loss in northern Australia
- Phenobank workshop
- It's rained! Now what?
- GRDC modelling
- View DITT Brahman & Composite bulls which will be in the upcoming sale 7 July 2021.

**Douglas Daly Research Farm (DDRF) field day -** Wednesday 28 and Thursday 29 April

**Day 1:** Livestock Production

- Understanding calf loss in northern Australia
- Phenobank workshop
- It's rained! Now what?
- Adding cull cow value
- Gamba grazing management

**Day 2:** Diversification in the Douglas Region

- DDRF Leucaena trial
- Cotton in practice
- Best Management Practice workshop
- GRDC modelling

Day 2 is expected to conclude at 2pm.

Treat yourself to a day out, meet like-minded people and be immersed in informative presentations, hands on farm paddock tours, trade displays and machinery galore.

Breakfast and sign in will be held at both events from 8am for a 9.30am start. The day will conclude at 4.30pm at KRS and DDRF day 1 only with drinks and a barbeque.

Book your trade display at the field days by Monday 12 April 2021.

For more information or to book a trade display email Eleanor Fordyce at eleanor.fordyce@nt.gov.au or phone 0456 752 319.

industry.nt.gov.au

NORTHERN TERRITORY GOVERNMENT | THE TERRITORY BOUNDLESS POSSIBLE

# NORTH QUEENSLAND LEUCAENA AND PASTURE FIELD DAY

## TUESDAY 30 MARCH 2021

## 8am - 4pm

Commencing at Whitewater Station, Mt Surprise

- Field Walk and Pasture Updates

Onto Pinnarendi Station, Forty Mile

- Liveweight Gain Trial Updates
  - Pinnarendi Station NQ
  - Spyglass Research Station NQ
  - Goshen Station NQ
  - Douglas Daly Research Farm NT
  - Keys for leucaeana success
- Climate Aware - intepreting weather for better business management
- Northern Gulf Resources Project Updates

*Complimentary attendance thanks to the support of The Leucaena Network, DAF and MLA*

**Full Program and Registration Details available early 2021**

Queensland Government

the leucaena network

mla MEAT & LIVESTOCK AUSTRALIA

www.leucaena.net

NT FARMERS | NORTHERN TERRITORY GOVERNMENT | the leucaena network

# FIELD DAY

## TUESDAY 4TH APRIL

## DOUGLAS DALY RESEARCH FARM

Registrations open 8:30AM

In the paddock:

- *CRCNA project crop estalishment*
- *Gamba grass trial updates*
- *Cotton field walk @ Ruby Downs*
- *Leuceana economics*
- *Crops for cattle project overview*
- *Cattle repronomics project update*
- *Improved pasture discussions*

+ Q & A PANEL!

For more info contact:
stacey.holzapfel@nt.gov.au

Catered smoko & lunch with BBQ dinner from 4:30PM
Refreshments provided courtesy of Nutrien Ag Solutions Darwin
Self sufficient camping available

PenoBank | The University Of Queensland AUSTRALIA | mla MEAT & LIVESTOCK AUSTRALIA | CRCNA | Nutrien Ag Solutions

the leucaena network

# PASTURES FIELD DAY

## GOSHEN STATION

Mount Garnet North Queensland

## TUESDAY 9 MAY 2023

from 9.30am for smoko

10.00am start

**Goshen Station's Pasture Improvement Strategies**

Goshen Station's Brett Blennerhasset shares his own experiences of leucaena establishment, management and use

**Northern Australia Live Weight Gain Trial Results**

**DAF Leucaena and Pasture Trials**

**AgForce Land Valuation Specialist - John Moore**

**RFCS Rural Financial Counsellor - Lynette McGuffie**

**Climate Projections**

**Cows**

***and more...***

Smoko and BBQ Lunch provided

Complimentary for The Leucaena Network Members

$30 per person for non-Members

Registration required for catering purposes at

https://bit.ly/goshenfieldday

The Leucaena Network appreciates the support of

mla

MEAT & LIVESTOCK AUSTRALIA

Further Details: Bron Christensen

admin@leucaena.net

0488931691

www.leucaena.net

## 6.4 Appendix Four - Project Outputs

**DDRF Case Study**

# Value Chain Economics for Leucaena

P Shotton – Department of Industry, Tourism and Trade (DITT) of the Northern Territory Government – Agriculture Branch

Bron Christensen- CEO The Leucaena Network

## Background

Three sites across Northern Australia include Pinnarendi and Goshen Stations North Queensland and Douglas Daly Research Farm NT (DDRF) are undertaking live weight gain trials comparing the live weight gain by cattle grazing leucaena-grass pastures with cattle grazing on improved or native pastures. The 3 year PDS (Producer Demonstration Site) project is supported by The Leucaena Network and financed by MLA.

## Trial set up and treatments

Paddocks used within this trial on the Douglas Daly Research Farm are:

- ***Leucaena Paddocks*** – Cunningham and Tarramba leucaena with an inter-row mix of Sabi, Pangola and buffel.
- ***Grass Paddocks*** – Majority grass species of Pangola and buffel with some Sabi grass.
- The size of each of the paddocks used are 4 ha with past use as pasture species grazing trials.
- Cattle used in the demonstration at DDRF are steers obtained from DITT research farms.

Year 1 - the paddocks were grazed at 1.5 head per ha (set stocked) during the dry season and 1.75 head per ha during the wet season.

Year 2 - the paddocks were grazed at 2 head per ha all year but the cattle were rotationally grazed between the 5 leucaena - grass paddocks. The grass only steers were also rotationally grazed through the selected grass paddocks.

Year 3 - the paddocks were rotationally grazed at 1.5 head per ha during the Dry season and 2 head/ha during the wet season.

During the dry seasons ample dry grass pasture was available however the quality of the pasture was low compared to the wet season. The leucaena leaf on offer was variable depending on the paddock, between 3 to 38 kg/ha (dry leaf equivalent), however most had been consumed by mid – late September.

**Supplementary lick blocks**

Livestock Nutrition Technologies (LNT) Uramol® lick blocks were supplied to all cattle herds during the dry season which consumed an average of 85 gm/h/day. LNT Phosrite® were supplied during the wet season consuming approx. 75gm/h/day.

## Results and Observations

**Live Weight Gain –**

The Live weight gain (LWG) per hectare over the 3 years to date was 0.7 to 0.9 kg per hectare per day on the lighter stocking rates (1.5 head/ha) and 1.0 kg per hectare per day on the heavier stocking rate (2 head/ha).

Dry season live weight gains were generally higher in the Leucaena – grass paddocks (0.2 kg/h/day) than the grass paddocks (0.1 kg/h/d). The wet season live weight gains were similar between the grass and grass – Leucaena paddocks producing around 0.8 kg/h/d.

**Photo 1.** Cattle grazing on dry season grass Buffel grass grazing

**Photo 2.** Cattle grazing wet season Buffel grass and Leucaena

**Other Observations-**

- Cattle consumed the leucaena leaf year-round however during the dry season most was consumed fairly quickly.
- Current leucaena paddocks have reduced leucaena plant population by excess of 40 % compared to the first 10 years after establishment
- The wet season saw the leucaena plants grow vigorously producing more leaf that was consumed by the cattle with the leucaena plants growing in height.
- Wet season grasses would also have been of a higher quality, so pasture quality and quantity improved overall.

Table 1 lists the 5 Leucaena – grass paddocks and the 2 grass only paddocks used in the first year's set-stocked grazing comparison and the seasonal live weight gains from each paddock. While table 2 lists the LWG's of the completed first 2 years of the PDS trial and the 3rd year to date. Rainfall of the 1st and 3rd have been above average with the 2nd year (2021 – 22) slightly below average.

**Table 1.** 2020 – 21 LWG's of the set stocked paddocks

| | Start wt | Final wt | 307 day gain | 307 day GN/day | Dry season | Dry season GN/day | Wet season | Wet season GN/day | GN/day/ha |
|---|---|---|---|---|---|---|---|---|---|
| Buffel grass & Leucaena at 12 M. spacing | 159.8 | 355.5 | 195.7 | 0.6 | 30.6 | 0.3 | 165.1 | 0.8 | 1.5 |
| Pangola grass & Leucaena at 12 M spacing | 169.8 | 368.4 | 198.6 | 0.6 | 27.3 | 0.2 | 171.3 | 0.9 | 1.5 |
| Sabi grass & Leucaena 8 meter row spacing but poor establishment | 175.5 | 332.2 | 156.6 | 0.5 | 14.0 | 0.1 | 142.6 | 0.7 | 1.3 |
| Sabi grass & 10 M spacing Leucaena | 165.3 | 353.9 | 188.5 | 0.6 | 29.3 | 0.2 | 159.2 | 0.8 | 1.4 |
| Buffel grass & Leucaena at 8 meters apart (Leucaena only over 1/2 the paddock) | 169.5 | 359.5 | 190.0 | 0.6 | 28.3 | 0.2 | 161.7 | 0.8 | 1.4 |
| | | | | | | | | | |
| Pangola grass. | 167.5 | 346.8 | 179.3 | 0.6 | 8.4 | 0.1 | 171.9 | 0.9 | 1.5 |
| Buffel grass only | 173.5 | 343.8 | 170.2 | 0.6 | 19.2 | 0.2 | 151.0 | 0.8 | 1.3 |

**Table 2.** The LWG's completed first 2 years of the PDS trial and the 3rd year to date

| Seasonal Rainfall 1,370 mm | | | 1.5 h/ha | | 1.75 h/ha | | 1.6 h/ha |
|---|---|---|---|---|---|---|---|
| **Cohort 1 2020 - 21** | 307 day LWG per head | 307 day LWG kg/day | 111 day Dry season LWG | Dry season kg/h/d | 196 day Wet season LWG | 196 day Wet season | 309 day LWG KG per ha per day |
| Leucaena | 186 | 0.61 | 26 | 0.2 | 160 | 0.77 | 0.91 |
| Pasture | 174 | 0.58 | 13 | 0.12 | 161 | 0.77 | 0.87 |
| | | | | | | | |
| Seasonal Rainfall 988 mm | | | 2 h/ha | | 2 h/ha | | 2 h/ha |
| **Cohort 2 2021 - 22** | 306 day LWG per head | 306 day LWG kg/day | 121 day Dry season LWG | Dry season kg/h/d 62 days | 188 day Wet season LWG | 244 day Wet season | 309 day LWG KG per ha per day |
| Leucaena | 161 | 0.52 | 13 | 0.1 | 147 | 0.78 | 1 |
| Pasture | 154 | 0.50 | 12 | 0.1 | 142 | 0.75 | 1 |
| | | | | | | | |
| Seasonal Rainfall to date 1,480 mm | | | 1.5 h/ha | | 2 h/ha | | |
| **Cohort 3 2022 - 23** | 266 day LWG per head | 266 day LWG kg/day | 105 day Dry season LWG | Dry season kg/h/d 105 days | 160 day Wet season LWG | 160 day Wet season | 266 day LWG KG per ha per day |
| Leucaena | 126 | 0.47 | 20 | 0.21 | 109 | 0.71 | 0.7 |
| Pasture | 142 | 0.53 | 13 | 0.12 | 129 | 0.8 | 0.8 |

## Past results:

These paddocks and others also hosted pasture evaluation trials under grazing. The 2004 – 2009 results showed the paddock groups of grass only, grass species with companion legumes and Leucaena grass pastures. (all set-stocked and stock replacement (weaner steers) every 12 months.

- Grass/Leucaena – average 200 kg/h/yr
- Grass/Legume – average 180 kg/h/yr
- Grass only – average 150 kg/h/yr

## Pastures and land use

Grass only pasture = grazing, hay production, better control of broad leaf weeds.

Grass and Leucaena. = Historically better LWG's and pasture quality however longer time to establishment (time to graze), not suited to hay production.

Grass & companion legume = generally higher quality pastures for grazing, hay production ability but reduced Broad leaf weed control.

**Goshen Station Case Study**

the leucaena network

Case Study

## Gaining Resilience with Leucaena

## Brett and Theresa Blennerhassett

## Goshen Station, Mount Garnet


The potential to reduce the turn off time of their live export and feeder cattle was the catalyst for Brett and Theresa Blennerhassett, 'Goshen Station' at Mount Garnett, to participate in the MLA Producer Innovation Fast-Track program 'Redlands for Regions' with The Leucaena Network.

Redlands, the new psyllid tolerant leucaena variety, was officially launched in May 2019 but not before Brett and Theresa were one of six producers who trialed the variety to verify establishment capacity.

Brett and Theresa had previously planted 240 ha of Cunningham, which had been consistently decimated by psyllids, so the opportunity to trial the Redlands variety was a welcome one.

32ha of Redlands was planted on 2nd and 3rd February 2018, in 10m twin rows with one metre spacing between the rows. The 32ha comprised cleared ground that had previously been prepared by offsetting four times and ripping to 400mm deep.

Planting was undertaken with a Norseman planter set up for double rows with double press wheels, disc openers and precision depth control utilising GPS 2cm variation auto steer. Fertiliser was applied at planting at a depth of 54mm and placed at 150mm to the side of the seed.

The 29 eight hundred metre long leucaena rows (4.64ha per planted row) were planted at a seed rate of 1.8kg/ha with seed spacing at 75mm. Single Superphosphate was applied at planting at a rate of 150 kg per planted hectare (29 rows x 800 m x 2m = 46,400 sqm / 10,000 = 4.64 ha planted row).

www.leucaena.net

the leucaena network

# Case Study

Due to an imminent forecasted rain event and equipment malfunction, no herbicide was applied at planting.

The original planting depth of 35mm was found to be too deep for optimum germination with 50% germination achieved. Concurrent plantings of Redlands leucaena at the shallower depth of 21mm resulted in a more satisfactory germination of 70%.

Brett credits good germination with consistent seed depth, something the Norseman planter was able to achieve.

"Depth of the seed at planting is one of the critical factors in the successful establishment of leucaena and is dependent on each situation, soil type and characteristics," Brett said. "We found that, here on Goshen, even an additional 10 to 15mm hindered the seedlings' ability to break through the soil."

To compensate for insufficient Phosphorous being applied at planting, CK66S was applied on 12 April 2018, nine weeks after planting. The CK66S was applied at a rate of 284 kg per planted hectare. A 3- point linkage fertilizer box with the two spinners removed enabled the fertilizer to drop directly on top of the plant.

Single Superphosphate (P 8.8% S 11%) was applied in June, directly over the plant, at a rate of 500kg per planted hectare. An additional application of Single Superphosphate was undertaken in January 2019, broadscale over the entire paddock at a rate of 180 kg/ha.

Whilst weather conditions and mechanical issues did not allow for the application of herbicides within the first month after planting, both chemical and mechanical control measures were implemented for maintenance of the growing leucaena.

In April 2018, nine weeks after planting, a grubber/scuffler was used to cultivate weeds and grass from both the inner row and the outer row to one metre. Spinnaker 700 WDG and Verdict 520 were applied immediately after cultivation, using a sprayer fitted at the rear of the leucaena planter, band sprayed at a width of three metres over the plants. Spinnaker was applied at a product rate of 140g/ha with a water rate of 160 L/ha. Verdict was applied at a rate of 800 mL/ha with a water rate of 140 L/ha.

In January 2019, 11 months after planting Brett offset between the rows for weed control.

The leucaena trial on Goshen Station benefitted from consistent rain with a total rainfall of 1834 recorded in the sixteen months from planting in February 2018.

Field day at 'Goshen Station' April 2019

the leucaena network

# Case Study

Grass pastures were planted between the leucaena rows in late January 2019 at a rate of 2.5 kg/ha Callide Rhodes, 2.5 kg/ha Bissett and 1 kg/ha Secca Stylo. Favourable weather conditions in the four months following planting resulted in excellent establishment and pasture growth.

177 weaners were put into the trial paddock and the additional 32ha Redlands paddock for five weeks in May 2019. After five weeks, 90 head were removed and the remaining 87 remained in the paddocks until May 2020.

Following the full integration of the trial paddocks and concurrent plantings into Goshen Station's grazing system, Brett and Theresa agreed to participate in The Leucaena Network's Northern Australia Live Weight Gain Trial. The trial is part of the MLA assisted Producer Demonstration Site (PDS) program.

The initial twelve months of the trial averaged a daily live weight gain of 0.581kg over 375 days.

| Weighing Date | Mob Av. Weight (curfewed overnight) | No. Days | Mob Av. Gain | Av. Daily Gain |
|---|---|---|---|---|
| 07.05.19 | 222 | | kg | kg |
| 26.08.19 | 291 | 111 | 69 | 0.621 |
| 26.11.19 | 315 | 94 | 24 | 0.255 |
| 07.05.20 | 420 | 170 | 105 | 0.617 |

In addition to the leucaena live weight gain trial, Brett and Theresa have undertaken two grazing trials on native pastures.

The first trial with cattle on native pastures supplemented with dry lick and 8% phosphorous blocks resulted in an average daily live weight gain per head of 0.163kg per head over a nine-month period. The second native pasture trial was held over 92 days with cattle supplemented with a grain-based lick. This trial provided average daily weight gains per head of 0.336kg.

Whilst the native pasture trials indicate that supplementation can assist cattle weight gain on native pastures, the results further reinforce the potential benefits of the introduction of leucaena to suitable northern grazing systems.

the leucaena network

# Case Study

| | Improved Pasture + Redlands | Improved Pasture | Native Pasture-Trees |
|---|---|---|---|
| **Species** | Bisset, Seca, Rhodes, Verano, Buffel, Keppel, Redlands | Bisset, Seca, Rhodes, Verano, Buffel, Keppel | Kangaroo / Speargrass |
| **Area** | 69 | 69 | 69 |
| **Stocking Rate (ha/AE)** | 0.6 | 2 | 6 |
| **Cattle numbers** | 120 | 34 | 11 |
| **Daily LWG (kg)** | 0.6 | 0.35 | 0.27 |
| **Annual LWG (kg)** | 219 | 128 | 99 |
| **Total LW/year (kg)** | 26,280 | 4,352 | 1,089 |
| **LWG value @ $5.00/kg** | $131,400 | $21,760 | $5,445 |
| **LWG value/ha** | $1,904 | $315 | $79 |
| **Supplements cost/head/year** | $2.00 | $10-25 | $15-30 |
| **Fertiliser (DAP+S)** | $350/ha (spread) | $350/ha (spread) | |

Brett is confident the leucaena has an ongoing, valuable role to play in Goshen Station's future.

As at April 2022, Brett and Theresa have 400 hectares of leucaena-grass pastures in their grazing system with an additional 160 hectares planted in December 2021, that is expected to be fully integrated by May 2023. They anticipate planting an additional 160 to 200 hectares per annum for the next three years to complete their leucaena grazing systems.

"It's a no brainer – the results on leucaena's ability to boost productivity are clear," Brett said.

"We believe Redlands is the pathway to turning off our steers and heifers 6–12 months earlier. It's all about weight-for-age in northern beef.

"You want to own these cattle for the least amount of time, but it's also about getting yourself into a situation where you have some resilience when the harder times come."

www.leucaena.net

**Producer Vlog – Brett Blennerhassett 'Goshen Station'**

Brett Blennerhassett's video log can be seen as part of the introduction to the Goshen Field Day at www.leucaena.net

## 6.5 Appendix Five - Demonstration Project Media

# Leucaena weight gains through supply chain under the microscope

Shan Goodwin

23 Apr 2020, 9 a.m. Beef Cattle

GAINING WEIGHT: Brahmans have been grazing leucaena at Blackbull Station, Douglas Daly, in the Northern Territory with success.

TRIALS assessing live weight gains in weaners grazing the legume fodder crop leucaena across northern Australia are about to kick off.

In an interesting twist, the work will track the weight gains of the Brahman cattle through the supply chain, whether they go to feedlots, live export or direct to slaughter.



The three-year $150,000 project, co-funded by Meat & Livestock Australia and The Leucaena Network, will involve three producer demonstration sites: the Bernerhassett family's Goshen Station at Mt Garnet, Pirnarendi Station at Mount Surprise and the Northern Territory Department of Primary Industries' Douglas Daly Research Farm.

Weaners will go in at six months, grazing several varieties of leucaena until they hit their target weights for the various markets.

Executive officer with The Leucaena Network Bron Christensen said the aim was to determine whether cattle coming off leucaena demonstrated any difference in the ability to gain weight throughout the supply chain to those coming off pasture.

How the difference in wet and dry seasons affects weight gains will also be studied.

Ms Christensen said live weight gain was the focus of the latest leucaena research because its uptake largely comes back to enterprise viability.

Millions has been invested in leucaena research over the years, including the development of a psyllid-resistant variety, and it has been shown to reduce methane emissions intensity by up to 20 per cent.

It is heralded as a way to increase carrying capacity in northern and coastal Queensland, reduce age at turn-off and extend feedbase quality further into the dry season.

## Improving marketing windows

In the Northern Territory, live cattle export suppliers are finding leucaena offers the potential for weight gains during the dry season which could see more lucrative marketing windows targeted.



POTENTIAL: Two-year-old leucaena at Blackbull Station, Douglas Daly.

At Blackbull Station, Douglas Daly, Brahman steers gained up to 100 kilograms last dry season in a small trial area where the Cunningham variety was planted in improved jarra grass.

Blackbull is a 15000 hectare freehold cattle and hay operation owned by Peter Maley and Tory Angus which runs 6500 head and typically produces for the live feeder steer trade, turning off two-year-olds at 280 to 380 kilograms.

Most of the property is improved to a mixture of jarrah, buffell and strickland and 60ha of leucaena was trialled last year.

Weed competition meant the majority of that had to be replanted this year but manager Logan Reid said the 30 steers that did manage to graze one 20ha paddock, spending 70pc of their time between the end of May and October in the leucaena, put on an average of 100kg where they would normally only maintain their weight in that period.



If that could be replicated on a larger scale, it would make a massive difference to what could be achieved at Blackbull, he said.

"We could aim to market steers in that December to January bracket when the live export trade struggles for supply and prices go up.

"It could also mean a larger carrying capacity during the dry season."

Mr Reid said the initial trial went into recently-established jarra so this year they have planted another 47ha into more established pasture in the hope of reducing weed competition.

They have also tried other varieties, including Wondergraze and Redlands, and planted in three different row spacings to attempt to determine the right balance of leucaena-to-pasture for their region.

The trials are being run in conjunction with Meat & Livestock Australia.

"Our hope is to eventually get 1000ha of leucaena in. It's a supplement to the other improved pasture, when it backs off over the dry season," Mr Reid said.

"It's challenging to work out where and how to plant and it also needs to be managed - if it is let go to seed it will spread where you don't want it and it has to be kept at a grazable height.



"In the east, they are cultivating prior to planting but our high rainfall (1100mm) means erosion could be an issue."

ALSO IN BEEF: Wet markets in global firing line sparks live-ex concerns

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The story Leucaena weight gains through supply chain under the microscope first appeared on Farm Online.

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# Leucaena weight gains through supply chain under the microscope

Shan Goodwin
@shangoodwinbeef

23 Apr 2020, 9 a.m. Beef

GAINING WEIGHT: Brahmans have been grazing leucaena at Blackbull Station, Douglas Daly, in the Northern Territory with success.

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# Pinnarendi Redlands vs Wondergraze leucaena liveweight gain trial

30 July 2019

Featured articles

**Photo 1** Trial steers at Pinnarendi grazing improved pastures amongst stands of leucaena.

Leucaena is a legume fodder crop that provides high quality feed for ruminant animals that boosts liveweight gain, both per animal and per hectare, compared to grass-only pastures. However the adoption of leucaena in the northern Australian beef industry has been slow partly due to the prevalence of leucaena psyllid (*Heteropsylla cubana*). Recently, a new variety of psyllid resistant leucaena called Redlands has been developed, presenting a significant opportunity for the northern Australian beef industry. From 2016 to 2018 a large scale trial was established at Pinnarendi Stat on near Mt Garnet to measure liveweight gains (LWG) of cattle grazing the new Redlands variety, compared to the conventional and psyllid suscepti ble, Wondergraze variety.

The 61 ha trial site was split into eight replicated paddocks (four planted with the new Redlands variety and four planted with Wondergraze). The leucaena was planted at 10 m row spacing with the existing inter-row pasture retained (mainly Wynn cassia, native and introduced grasses and Seca stylo). Weaner steers from Pinnarendi averaging 208 kg were replaced into the trial in mid-April 2018 and another mob of steers averaging 207 kg were added in late June from the Department of Agriculture and Fisheries' Spyglass Beef Research Facility. The 28 steers were evenly split into four groups and were grazed continually in the trial from June 2018 to May 2019. In April 2019, 26 more steers were added to the trial—14 head to the leucaena treatments and 12 head into an adjoining 25 ha paddock containing buffel and stylo. The buffel paddock will be used as a comparison to the cattle in the leucaena paddocks.

## Results

Over the 319 days to 13th May 2019, the average daily gain for all animals across both varieties was 0.69 kg. There was no significant difference between variety or the source of cattle. There was very little psyllid pressure during the first year of grazing and no significant damage to Wondergraze at the site. Annual LWG for cattle grazing on the leucaena should be close to 250 kg/head which is more than double typical LWG for cattle grazing native pastures in the same environment.

Average daily liveweight gains at Pinnarendi Leucaena trials (2018 – 2019)

| Grazing period | Average daily gain (kg liveweight) | | |
|---|---|---|---|
| | All | Wondergraze | Redlands |
| 28 June to 7 August (40 days) | 0.5 | 0.53 | 0.47 |
| 7 August to 20 September (44 days) | 0.38 | 0.43 | 0.32 |
| 20 September to 8 November (49 days) | 0.15 | 0.12 | 0.18 |
| 8 November to 19 December (41 days) | 0.4 | 0.44 | 0.35 |
| 19 December to 5 March (76 days) | 1.51 | 1.46 | 1.56 |
| 5 March to 1 April (27 days) | 0.73 | 0.78 | 0.69 |
| 1 April to 13 May (42 days) | 0.64 | 0.7 | 0.58 |
| Overall (319 days) | 0.69 | 0.71 | 0.68 |

**Photo 2** Principal Beef Extension Officer, Joe Rolfe, presents the structure of the liveweight gain trial to the audience.

On Tuesday, 28 May, Meat and Livestock Australia, Department of Agriculture and Fisheries, the Leucaena Network and the University of Queensland hosted a field day with producers at Pinnarendi to share of the initial results from the grazing trial and launch the Redlands variety to industry. Over 70 beef producers and industry representatives attended. It was a successful day with some great comments from people that attended.

Some producers with cleared country said "We are really excited about the potential Redlands will provide for our property." Another producer from the Wet Tropical Coast said "We are excited to give Redlands a try and see the benefits it has on our business."

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Page published July 30, 2019 | Page reviewed July 31, 2019

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**Leucaena proves it's worth across Northern Australia**

Concurrent live weight gain trials for cattle grazing on leucaena-grass pastures across Northern Australia have reinforced the benefits of investment in the legume based grazing system.

The Central Queensland based Fairview Live Weight Gain Trial concluded last month with the final weighing of the 100 trial steers and subsequent sale of a large proportion of the cattle through the CQLX Special Weaner and Feeder Sale on 31 May.

The Fairview Trial, organised and hosted by Bruce and Lucinda Mayne with cattle supplied by neighbouring properties Calliope Station, Voewood Brangus and Wycheproof, and supported by The Leucaena Network, DAF and agronomist Ross Newman. Animals recorded an average weight gain of 0.68 kg per day and a weight gain per hectare of 145 kg over the 361 days of the trial. This compared favourably to the of 0.56kg per day and 107kg per hectare for the control group grazing native pastures with access to some areas of ponded pasture species. .

"The comparisons with the improved pasture weight gains were possibly not as significant as expected due to the inclusion of ponded pastures in the grass only trial and the higher quality feed provided by the hymenachne and para grass. We believe that the weight gain differences comparing leucaena with native coastal pastures would have shown a more dramatic difference and further demonstrated the potential of leucaena – perhaps something for a future trial," trial host Bruce Mayne said.

"The overall weight gains demonstrated by the cattle on leucaena have certainly shown that the inclusion of leucaena can significantly improve a property's carrying capacity and pasture quality," he said.

"Achieving weight gains of 246 kg per year in relatively poor coastal country is quite impressive."

Seventy-seven head of the trial cattle were sold at the CQLX Special Weaner and Feeder sale on 31 May, with the leucaena pastured cattle achieving an average sale price of $1,762.

The Northern Australian Live Weight Gain trial, organised by The Leucaena Network and supported by Meat and Livestock Australia measures live weight gains achieved on leucaena-grass pastures at three properties across far north Queensland and the Northern Territory over a period of three years. The first twelve months of the trial has recorded improved live weight gains from leucaena-grass pastures compared to native or improved pastures at all three sites located at 'Goshen Station', Mount Garnett and 'Pinnarendi Station', Forty Mile, both in far north Queensland, and at the Douglas Daly Research Farm in the Northern Territory.

The most significant improvements have been recorded by Brett and Theresa Blennerhassett of 'Goshen Station' who have 600 acres of Redlands leucaena as part of their grazing operation, with an additional 400 acres currently undergoing establishment. Improved pastures of Bisset, Rhodes grass, Urochloa, seca stylo and buffel form the inter-row pastures. The station's native pastures, augmented with a mix of Callide Rhodes, Bisset bluegrass and seca stylo, average a 0.3kg live weight gain daily throughout the year so the live weight gains ranging from an average of 0.52kg

Bron Christensen Executive Officer - The Leucaena Network
P O Box 240, Theodore Q 4719 M:0488931691 E: admin@leucaena.net
www.leucaena.net

to 0.7kg per day, with the annual average daily live weight gain of 0.59kg provide a significant boost for Goshen's carrying capacity and turnoff rate.

Brett believes leucaena's ability to boost productivity is clear.

"It's a no brainer -we believe Redlands leucaena is the pathway to turning off our steers and heifers 6–12 months earlier," he said. "It's all about weight-for-age in northern beef."

"You want to own these cattle for the least amount of time, but it's also about getting yourself into a situation where you have some resilience when the harder times come."

Consistent live weight gains were also demonstrated at Pinnarendi Station and the Douglas Daly Research Station.

Pinnarendi Station hosts the DAF run trial, not only comparing the live weight gains between leucaena and an improved pasture paddock (buffel grass with seca stylo), but also weight gains between the psyllid tolerant Redlands leucaena and the conventional Wondergraze variety. Trial leader Craig Lemin reports that Redlands and Wondergraze with inter-row pastures – a mix of Urochloa, Indian couch, black spear, wynn cassia and seca stylo – have recorded average daily gains of 0.65 kg and 0.69 kg respectively (over 321 days). the improved pasture paddock has been similar to the leucaena, with an average daily gain of 0.66 kg over the same period. However, when stocking rates are taken into consideration the leucaena has outperformed the improve pasture paddock. Productivity of the leucaena over the period has been 0.45 kg/ha/day versus 0.25 kg/ha/day for the improved pasture. These are annual productivities of 165 kg/ha and 90 kg/ha respectively. Cattle will remain on the trial until early August when the365-day grazing will be complete.

Peter Shotton, NT DITT trial lead at the Douglas Daly Research Farm has been instrumental in more than 20 years of leucaena trials in the Northern Territory which have consistently shown improved weight gains from leucaena. The current trial has achieved dry season live weight gains between 0.1kg to 0.4kg per head per day and wet season live weight gains ranging from 0.82kg to 1.0kg per head per day. The leucaena paddocks achieved and average live weight gain of 1kg per day per hectare over the 307 trial period to date.

*Photograph: Brett Blennerhassett of Goshen Station looks over his Redlands leucaena*

Bron Christensen Executive Officer - The Leucaena Network
P O Box 240, Theodore Q 4719 M:0488931691 E: admin@leucaena.net
www.leucaena.net

## 6.6 Appendix Six - MER Report

**Project name** P.PSH.2006 Value Chain Economics for Leucaena
**Date:** 23 July 2023

| **Evaluation level**[1] | **Project Performance Measures** *(Please fill in and delete example)* | **Evaluation Methods** *(Please fill in and delete example)* | **Update as at 01.11.2022** |
|---|---|---|---|
| **Inputs – What did we do?** | • Three producers undertaking on-farm demonstration sites representing 23,000 ha and covering 4,200 head of cattle.<br>• Three demonstration plots investigating the economic returns of high value beef from Leucaena based pasture systems into three alternative pathways to market – processing, feedlotting and live export.<br>• 100 observers at Field Days representing an additional 100,000 ha and 50,000 head of cattle. | • Budgets<br>• Detailed expense reconciliation<br>• Attendance records including acreage and holdings of each producer participant.<br>• Attendance records including acreage and holdings of each observer participant<br>• Steering committee notes | • 3 sites and trials commenced in May/June 2020 and finalised by June 2023. The live weight gains of three to four cohorts were able to assessed at each site. Economic analysis undertaken after first cohort.<br>• Field days held at Pinnarendi (QDAF) with attendance of approximately 20; Douglas Daly Research Farm (NT DITT) with attendance of approximately 30; Douglas Daly Research Farm (NT) with attendance of approximately 30 with the final field day held at Goshen Station with approximate attendance of 23.<br>• Interim and final live weight gains were presented as part of other Network events including the Fairview LWG Trial Field Day (20 February 2021), the final Fairview field day (27 May 2021), the Introduction to Leucaena field days at Gin Gin (26 June 2021) and Thangool (11 September 2021), the Leucaena Network Carbon Forum in Rockhampton (October 2021),the Whitewater Field Day, Mount |

[1] Note: The headings in column 1 are also listed in the PDS Final Report template.

| | | | |
|---|---|---|---|
| | | | Surprise, Far North Queensland – 15 March 2022, the Douglas Daly Leucaena Field Day at 'Malilangwe' and 'Blackbull Station', Northern Territory – 4 May 2022; and the Network's Sterile Leucaena Industry Update at the Redlands Research Station in October 2022.<br>• Outcomes were included in presentations at Etheridge Shire Council Forum, Esk Beef Up Forum, The Developing Northern Australia Conference and the Australian Association of Animal Science (AAAS Conference),<br>• The data from this demonstration site has been presented in a Fact Sheet / Handout / Case Study that was provided to all visitors to The Leucaena Network stands at the Northern Territory Cattlemen's Association Conference ( 25 – 26 March 2021), Beef 2021 (3 – 7 May 2021), Food Futures Conference (18-20 May 2021), the Northern Beef Producers Expo in Charters Towers (3-4 June 2022), the NT Farmers Food Futures Roadshow in Mareeba<br>• A Case Study featuring Goshen Station has been updated to include data from this trial and this Case Study has been provided to all attendees at 2022 and 2023 events; and included in information packs and handouts to new enquirers. |
| **Outputs - What did we do?** | • Provision of live weight gains from each site.<br>• Determination of the economic value, through three | • Live weight gain data from demonstration sites | • Live weight gains for all cohorts have been provided by the three sites. Weight gain data for both Leucaena-grass pastures and grass only pastures has included individual animals, |

| | | | |
|---|---|---|---|
| *Describe the outputs planned/expected from your project, including engagement activities & products from demonstration sites* | alternative value chains, of cattle turned off through Leucaena.<br>• Hosting of a minimum of three field days targeting 100 additional graziers representing 100,000 ha and 50,000 head of cattle.<br>• Regular blog providing project updates and outcomes to date supported by video footage available at www.leucaena.net<br>• Case studies for dissemination<br>• 6 media releases featuring the PDS, MLA and individual trial producers and outcomes. | in milestone reports.<br>• Live weight gain data from the appropriate supply chain in milestone reports (where available)<br>• Collation of media coverage<br>• Copies of all physical outputs documented and provided in milestone reports.<br>• Case studies developed and disseminated through Network, MLA, FutureBeef. | average total weight gain between weighing periods, average daily weight gain for each animal and each herd and weight gain per hectare. Comparisons between the weight gains achieved from the Leucaena-grass pastures and the grass only pastures have been calculated where available.<br>• Results and those of the Fairview LWG trial were disseminated as above.<br>• One producer (Brett Blennerhassett) provided information about weight gains achieved as part of the Network's 'Let's Talk Leucaena' video launched at Beef 2021 and shown at the Food Futures Conference and available on Facebook and at www.leucaena.net |
| **Changes in knowledge, attitudes and skills - How well did we do it?**<br>*Describe the changes in KASA that you are planning to achieve.* | • 100% of core producers have key knowledge of live weight gains achievable from their Leucaena – grass pastures.<br>• 100% of core producers have knowledge of the economic benefits of their appropriate supply chain.<br>• 90% of observer producers will have access to the live weight gain data from each site. | • Initial survey of core and observer producers to assess knowledge base and confidence.<br>• End-term survey of core and observer producers to assess practice change, knowledge base and confidence. | • Core producers surveyed pre and post demonstration project.<br>• Surveys of field day attendees (where survey process was available) indicated. |

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| | • 90% of observer producers will have access to the economic outcome of the site's chosen supply chain.<br>• 10% of observer producers will intend to initiate or increase their Leucaena – pasture systems within the project timeframe.<br>• 70% of observer producers will have increased their knowledge and skills of the establishment and management of Leucaena-grass pasture grazing systems. | | |
| **Practice changes – Has it changed what people do?** *Describe the practice changes that you are expecting to achieve by the end of your project* | • 100% of core producers exhibit intention to continue with existing Leucaena plantings or increase Leucaena plantings<br>• 10% of observer producers exhibit intention to initiate or increase their Leucaena – pasture systems within five years of the project completion. | ○ Baseline surveys (practice change and impact) as above. | • As above. |
| **Benefits – Is anyone better off?** *Describe the benefits that you are expecting to* | • Live weight gain productivity of established Leucaena-grass pasture systems at three sites – two in North Queensland and one in the Northern Territory will be quantified, adding to | • Economic analysis of the relevant supply chain options chosen by each individual producer. | • Each individual site has been able to record qualified data on live weight gains achieved by their Leucaena-grass pastures and compare to their grass only pastures. This is invaluable in the assessment of the investment to-date in |

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| *achieve as a result of the project* | the data available to graziers considering Leucaena-grass grazing systems in Northern Australia.<br>• All core producers will have a minimum of 2 years of live weight gain data from Leucaena – grass pastures for their own property.<br>• All core producers will have economic analysis of their chosen supply chain.<br>• Core and observer producers will have knowledge of region-specific live weight gains on Leucaena pastures enabling better informed decisions about pasture options.<br>• Significant benefit to Northern Australia through the adoption of strategies to increase long term, viable, high value beef production.<br>• | • Data from demonstration sites | Leucaena and assist with the decision regarding future plantings.<br>• Graziers in close proximity to the trial sites have also been able to utilise the data provided at the trial sites to assist with their own decision-making regarding investment and potential benefit of Leucaena pastures (if similar soil type and location).<br>• The industry has the opportunity to observe the data of the weight gains achieved from Leucaena throughout the distinct wet and dry seasons experienced by the top end of Northern Australia. This data is also invaluable in assessing the suitability and value-add of Leucaena-grass pastures.<br>• Economic Assessment undertaken. |
| **General observations / outcomes – Is the industry better off?** | • Leucaena – grass pastures adopted by an additional 10% of graziers across northern Australia (in suitable areas) by 2023 significantly increasing industry viability and profitability.<br>• Live weight gains increases correlated to economic returns | • Survey of core producers and observers at the completion of the project.<br>• Feedback from core producers on unexpected occurences in | • As above<br>• Information dissemination has been undertaken as documented and the demonstration information will continue to be included in the Leucaena Network's information packs. |

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| | will provide improved enterprise and industry viability.<br>• Increased profitability and viability for Northern Australian graziers and their communities. | achieving live weight gains.<br>• Dissemination of report, case studies, blog and video overview to applicable areas. | |