

# Final report

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## Supporting The Leucaena Network; national research and the regional adoption outcomes for a highly productive beef industry

Project code: P.PSH.1226

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Date published: 10 January 2023

PUBLISHED BY  
Meat & Livestock Australia Limited  
PO Box 1961  
NORTH SYDNEY NSW 2059

This is an MLA Donor Company funded project.

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

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## **Abstract**

This project addressed the lack of specialist extension services across northern Australia for Leucaena-based grazing systems and delivered a comprehensive package of information, resources, services, and events to graziers, existing and new Leucaena producers, service providers, government, and industry associations. The Project developed a comprehensive suite of assistance programs and material linking existing graziers with established Leucaena to new industry entrants, and established the Leucaena Research Hub, a central repository of research information for the industry.

During the project, the Leucaena Network provided information and assistance to more than 1,400 graziers and industry personnel through trade stands, presentations, workshops, and field days. Further, the Leucaena Network responded to over 400 direct enquiries via the website, email, or phone. These engagement activities ensured producers establishing Leucaena grazing systems had the best opportunity for success and compliance with industry standards.

Complimentary research projects included Northern Territory establishment trials, fertiliser trials, and live weight gain studies, thereby further enhancing confidence in the northern Australian red meat industry in the use of Leucaena to increase productivity, profitability, and environmental stewardship. Development of the Northern Territory Leucaena Code of Practice provided a 'linchpin' for ongoing development of the Northern Territory Leucaena industry and relationships with Queensland local government.

## Executive summary

### Background

The inclusion of Leucaena grazing systems into northern Australian beef enterprises provides multiple benefits to the grazing industry including productive feed, seasonal risk management and the capacity to assist northern graziers to reduce the carbon footprint of their enterprise.

Current plantings of Leucaena and research about successful establishment and management practices remain centred in Central Queensland; however, the release of a psyllid-tolerant Leucaena variety provides northern and coastal graziers with the opportunity to capitalise on the benefits of this leguminous tree.

The ability for new Leucaena graziers to access information on establishment and management strategies, and adherence to the Leucaena Code of Practice, is essential for successful Leucaena establishment and maintenance. Unsuccessful establishment is a costly exercise for the producer, which has a flow-on effect to the industry as a whole and particularly to the reputation of Leucaena as a viable grazing option.

The focus of the *'Supporting The Leucaena Network; national research and the regional adoption outcomes for a highly productive beef industry'* project was the expansion of the Network's extension and adoption activities to the emerging areas of northern Australia.

### Objectives

**1. This project will address the ongoing lack of specialist and extension services across northern Australia for Leucaena-based grazing systems by:**

**1.1 *Education of suitable industry advisors including agronomists and beef industry extension officers in areas where Leucaena as a grazing system is undergoing significant growth, particularly in northern Australia to ensure producers have access to the correct information from trusted sources. This will be achieved through 'Leucaena for Industry' workshops.***

- The provision of more than 11 workshops and field days, including five 'Introduction to Leucaena' workshops, presentations at ten complementary industry events and a trade stand or presence at nine key grazing industry events provided the Network with extensive opportunities to build capacity in each region's agronomists and extension officers.
- Initiations to all Network events were extended to all service providers in each region of the event.
- Each event was attended by representatives of service providers.
- Working relationships with agronomy service providers and extension officers were developed and have been maintained in each region.

**1.2 *Promotion of the MLA Future Livestock Consultant (FLC) program to provide a key opportunity for industry service providers including government agricultural departments in Northern***

***Australia and private consultancies to place a graduate to advance the capacity building of the Leucaena industry's service providers.***

- The Future Livestock Consultant program was promoted to agronomy services in emerging Leucaena establishment regions however no graduate placement eventuated. The interest demonstrated by agricultural service providers in capacity building in all aspects of Leucaena establishment and management through attendance at network events and liaison with the Network provided confidence that emerging areas for Leucaena have access to qualified, local agronomy assistance.

***1.2.1 Capitalising on the "Leucaena 101" workshops provided as part of the existing Redlands project (P.PSH0920) aligned with the MLA adoption program.***

- The 'Leucaena 101' workshop was reinvigorated into a comprehensive, two-hour presentation 'Introduction to Leucaena', which was supported by experienced producer input and/or a producer panel.
- Five 'Introduction to Leucaena workshops' were held, with four of these workshops hosted on-farm by experienced Leucaena producers.
- The basics of successful establishment and management of Leucaena were covered in an additional seven workshops/field days hosted by the Network.

**1.3 Continuation of the sourcing and provision of current research into Leucaena through the 'Leucaena Research Hub' via the Network's website [www.leucaena.net](http://www.leucaena.net) to assist existing and new growers to utilise Leucaena effectively for high value, high quality red meat/beef production. This initiative will include promotion of the 'Leucaena Research Hub' to research organisations and extension services as an appropriate aggregator for Leucaena focussed research.**

- The Leucaena Research Hub continues to develop and grow at [www.Leucaena.net](http://www.Leucaena.net)
- The Network is also providing service to the research activities of the grazing sector through involvement in three key research steering committees and the provision of producer amalgamation to two research projects.

**1.4 Continuation of the one-on-one connections with regional and rural Councils to ensure they are aware of the benefits of Leucaena to their area and the weed mitigation strategies being undertaken by producers in adherence to the Code of Practice.**

- The Network has established ongoing working relationships with eight Queensland local Councils. Invitations to all local events are issued to the local Council and invitations to state-wide events are issued to all local Government agencies in Leucaena growing or suitable areas.
- All Councils were invited to the Network's Carbon Forum held in October 2021 and will be invited to the Network's Sterile Leucaena Forum to be held in November 2022.

**1.5 Expansion of the Code of Practice to meet industry requirements across northern Australia, potentially including a State specific Best Management Practice program that will bring the current code in line with other sectors.**

- In collaboration with the Northern Territory Government and local graziers, the Network has developed the Northern Territory Best Management Code of Practice for Establishing and Managing Leucaena Pastures.
- The Network continues to investigate the applicability and provision of the Code of Practice in a Best Management Practice (BMP) format that will indicate a producer's knowledge of and adherence to the Code. Online programs are currently being considered.

**1.6 Expansion of the Network's industry presence at the Northern Beef Research Update Conference (NBRUC) 2019, Northern Territory Cattlemen's Association (NTCA) Conference 2020, KPCA Conference 2020, RedMeat 2020, Australian Society for Animal Production (ASAP) 2020, and BEEF 2021.**

- The Network hosted stands at four key industry events
- The Network had a presence at an additional five key industry events
- At the request of complementary organisations, the Network presented on Leucaena establishment, management, benefits, or trials at ten industry events.

**1.7 Reinvigoration of the biennial The Leucaena Network Conference commencing in 2020.**

- The Leucaena Network hosted the 2020 Leucaena Network Conference at The Ville, Townsville on Tuesday 8<sup>th</sup> September 2020, followed by the Conference Field Day incorporating visits to the CSIRO Lansdown Research Station and Don and Laurel Heatley's 'Byrne Valley', Ayr on Wednesday 9<sup>th</sup> September 2020.
- The 2023 Leucaena Network Conference will be held in Mackay in April 2023.

**Results/key findings**

- Emerging areas of Leucaena development require establishment and management methods that deviate from the traditionally-accepted methods used in more established areas.
- Key barriers to increased adoption are the initial investment required, the transition from a grazing enterprise to a 'farming' activity and associated lack of skills and equipment, and the limited information regarding successful establishment strategies, productivity, and environmental benefits in emerging areas.
- There is great opportunity for Leucaena to assist northern Australian graziers to fulfil the CN30 commitment with the reduction of enteric methane emissions by up to 28% and increased soil carbon sequestration.
- There remains ongoing concern regarding the environmental impacts of unmanaged Leucaena grazing systems by government and the community, and a lack of understanding of the history and use of common and grazing Leucaena.

**Benefits to industry**

- A northern Australian beef industry that has access to current information and advice about successful and responsible Leucaena establishment.

- Improved potential for improved productivity, profitability and environmental benefits for northern Australian beef producers through the establishment of Leucaena grazing systems.
- Ongoing social licence for the Leucaena grazing industry by addressing concerns of government and community, and the development of tools to meet the needs of both industry and government.

### **Future research and recommendations**

Subsequent extension and adoption to:

- promote the environmental benefits of Leucaena
- promotion of the capacity for Leucaena to assist graziers to attain carbon neutral status
- continue to assist emerging Leucaena regions to successfully establish responsibly planted Leucaena grazing systems

Further development of the Leucaena Code of Practice to increase quantifiable adoption.

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## 1. Background

The inclusion of Leucaena grazing systems into northern Australian beef enterprises provides multiple benefits, including accelerated live-weight gain and the capacity for increased herd numbers, increased profitability, capacity to meet diverse supply-chain specifications, reduced erosion, salinity control, improved soil health, and reduced enteric emissions.

With the industry aiming to be carbon neutral by 2030, Leucaena has the potential to play an important role in contributing to lower emissions through improved herd productivity efficiencies, reduced emissions intensity, carbon sequestration in Leucaena/grass pastures, and production of high-quality beef to MSA standards.

Approximately 16% (88,106,354 ha) of northern Australia fits the broad temperature/rainfall/soils requirement for growing Leucaena, comprising 6,048 properties and 6,302,595 cattle. The network currently estimates that 200,000 ha are planted to Leucaena, although this needs further exploration as the network does not have access to seed sales data, nor is there a planting register at this stage. Whilst these findings do not consider land tenure, they clearly indicate the potential of Leucaena-based finishing systems and a huge opportunity for producers across northern Australia.

The focus of information and support for Leucaena producers has traditionally been centred on Central Queensland, where the industry has had significant growth over more than 30 years. The release of the psyllid-tolerant Leucaena variety Redlands generated new interest in Leucaena grazing systems in northern and coastal Australia. The ability for new Leucaena graziers to access information on establishment and management strategies, and adherence to the Leucaena Code of Practice is essential for successful Leucaena establishment and maintenance. Unsuccessful establishment is a costly exercise for the producer, which has a flow-on effect to the industry as a whole and particularly to the reputation of Leucaena as a viable grazing option.

With a background of successful project management, industry interaction, and producer assistance and representation, The Leucaena Network is strategically placed to provide this assistance to northern Australian graziers and augments this information with establishment, management, and grazing trials.

In addition, The Leucaena Network fulfils a pivotal role by working with State, Territory, and Local governments to ensure a fit-for-purpose Code of Practice for each State or Territory's regulatory requirements, thereby assisting the improvement of the industry's social licence to operate.

## 2. Deliverables

### 2.1 This project will address the ongoing lack of specialist and relevant extension services across northern Australia for Leucaena-based grazing systems by:

#### 2.1.1 Education of suitable industry advisors including agronomists and beef industry extension officers

The identification key agronomy service providers in significant growth areas for Leucaena establishment as a focus for The Leucaena Network enabled the development of valuable and on-going working relationships with these essential service providers, providing significant benefit to the grazing industry in these areas.



During the tenure of the project, the Network has hosted more than 11 workshops and field days, attended by more than 600 producers, industry, and service representatives, including five 'Introduction to Leucaena' workshops. These workshops covered both, the basics and the intricacies for successful establishment and management of Leucaena, and included either an experienced producer panel or an on-site field day at a successful Leucaena grazing enterprise.

The Network ensured knowledge of and invitation to these events to agronomy and consulting service providers and local producer and industry groups. This resulted in approximately 40% overall event attendance by this sector, ensuring graziers interested in Leucaena in each locality had access to on-ground, knowledgeable support.

The Leucaena Network 2020 Conference held in Townsville on 8-9 September 2020 included attendance by agricultural advisors and service providers from across Northern Australia, who also participated in the field day visits to CSIRO's Lansdown Research Station and Don & Laurel Heatley's 'Byrne Valley' at Ayr.

At the request of Fitzroy Basin Association (FBA), the Network organised a dedicated workshop for FBA advisory staff in late 2020. This was attended by FBA field staff with material provided for those staff who were unable attend. The Network recruited Ross Newman, Agricultural and Pastoral Consultant; and Stuart Buck, Senior Agronomist Sown Pastures with Queensland Department of Agriculture and Fisheries (QDAF), to co-present to the staff members. Feedback from the workshop was very positive with a valuable working relationship established and all staff indicating they felt more confident in providing generic advice and referrals for Leucaena when 'in the paddock'.

The Network's presence at nine major industry trade events or conferences, and presentations at ten key grazing industry events, has further expanded the opportunity for interaction with, and knowledge sharing with, service providers across northern Australia.

The establishment of working relationships with service providers in each region has enabled ongoing, informal communication between the Network and the service providers to ensure their clients have access to current and correct information and assistance. This has been reciprocated with the referral of graziers to the Network for specific enquiries or referrals to other producers or services.

The Network was able to introduce the Leucaena grazing industry to 47 University of Queensland (UQ) agricultural and veterinary students with the organisation of a site visit to organic and regenerative agriculture property 'Bonnie Doone', Thangool in 2021 and 2022. Students were able to see and hear how graziers Grant & Carly Burnham are using Leucaena as an integral part of their focus on soil health, regenerative agriculture, and carbon emissions reduction.

### 2.1.2 Promotion of the MLA Future Livestock Consultant (FLC) program

The Future Livestock Consultant program was promoted to agronomy services in emerging Leucaena establishment regions. The interest demonstrated by agricultural service providers in capacity-building in all aspects of Leucaena establishment and management through attendance at Network events and liaison with the Network provided confidence that emerging areas for Leucaena have access to qualified, local agronomy assistance. Coupled with referrals directly from the Leucaena Network, the producers in these regions have access to support for their Leucaena plantings.

### 2.1.1.3 Capitalising on the 'Leucaena 101' workshops

The Leucaena Network refurbished the 'Leucaena 101' workshops developed as part of the Redlands for Regions (P.PSH.0920) project as a comprehensive two-hour presentation 'Introduction to Leucaena', which provided participants with the productivity and economic benefits of Leucaena and the basics of successful establishment and management, with a heavy focus on compliance with the Leucaena Code of Practice.

These workshops are augmented with presentations by local, experienced producers who can provide attendees with their own experiences, successes and challenges. The majority of workshops were presented on-farm as part of an 'Introduction' field day, providing attendees with the opportunity to view Leucaena in various stages of establishment, through to full integration into a grazing system. Local agronomists were invited to present on local soils and soil testing processes which assisted to develop a working relationship between the attendees and the agronomy service. Local beef extension officers, producer group representatives NRM bodies, and state farming organisations were also invited and attended.

An addition to many workshops was an introduction to the University of Southern Queensland's (USQ) Climate program via a presentation from the program's local 'Climate Mate' on accurate interpretation of weather and climate forecasts for improved management decisions.

All workshop attendees are provided the Network's comprehensive information package including fact sheets (Appendix 1), case studies (Appendix 2), MLA's Leucaena guide, workshop printouts, referrals, and network contact details for future reference.

These resources are available electronically at The Leucaena Network's website [www.leucaena.net](http://www.leucaena.net). Two videos were developed to provide producers who were unable to attend a workshop or field day with an introduction to the basics of Leucaena establishment and management, and to provide first hand experiences of six experienced Leucaena producers. The 'Introduction to Leucaena', and the 'Let's Talk Leucaena' videos were on display at the Leucaena Network stand at Beef 2021, NTCA Conference 2021 and Food Futures 2021, and are available for viewing at the Network's website [www.leucaena.net](http://www.leucaena.net).

Introduction to Leucaena Workshops and supporting Field Days were held at multiple locations throughout Queensland and the Douglas Daly region of the Northern Territory.



#### Millmerran

- Hosted by Bill & Nikki Macqueen of 'Murrallah' Millmerran
- Guest speakers included Bill & Nikki Macqueen and Craig Antonio
- 36 attendees

#### Innisfail

- Co-hosted by QDAF and the Network at the Innisfail Showgrounds
- Guest speakers including established Leucaena producers from surrounding areas
- 23 attendees

#### Gin Gin

- Hosted by Chris & Beth Jensen of 'Boxvale' Gin Gin
- 28 attendees
- The day included a field visit to Paul & Karla Tobin at 'Greenleaf' to view established Leucaena and hear of their planting strategies and Leucaena use
- Co-supported by Gin Gin Community Bank

#### Thangool

- Hosted by Scott & Judy Smith of 'Glenlivet', Thangool
- 21 attendees
- The day included paddock visits to several areas of Leucaena on the property, at different stages of grazing, growing, or chopping, and a viewing and explanation of machinery for establishment and management

#### Mundubbera

- A more informal 'smoko' chat about the establishment and management of Leucaena at the invitation of Joel & Emma Muirhead at 'Twin Rivers' Mundubbera
- Ten attendees

In addition to the Introduction to Leucaena workshops and field days, the Network also presented an overview of successful establishment and management principles at other Network activities supporting trials or activities in which it was involved. These included:

#### Mount Surprise

- Hosted by Tom & Christine Saunders 'Whitewater Station'
- 32 attendees
- Focus on establishing and managing Leucaena plantings in uncleared land 'under trees'
- Presentation included an overview of the establishment and management basics of Leucaena and productivity, economic, and environmental gains
- Presentations were also invited from MLA (overview of grass-fed beef activities), Goshen Station (successful establishment of Leucaena in FNQ), USQ Climate Mate (forecast interpretations), and the Queensland Rural and Industry Development Authority (QRIDA assistance)

### Calliope

- Hosted by Bruce & Lucinda Mayne 'Fairview'
- Two Field Days (interim and final results) to present the results of a twelve-month live weight gain trial organised in collaboration with Mayne Seeds, QDAF, local graziers, and industry partners.
- Attendance of more than 130 over the two field days
- Presentation included an overview of the establishment and management basics of Leucaena and productivity, economic, and environmental gains
- Presentations by all project partners including QDAF and Ross Newman (agricultural consultant)

### Douglas Daly

- Four field days as part of the Network's Northern Territory Establishment Trial (P.PSH.1226) including an initial, producer-only orientation site visit
- More than 90 attendees across the four field days
- Field day locations included three of the demonstration sites – Bindaroo Pastures, Blackbull Station, and Malilangwe, and the Department of Industry, Tourism and Trade's (DITT) Douglas Daly Research Farm (DDRF)
- The focus of the presentations from The Leucaena Network progressed from the basics of successful establishment to management strategies and the productivity gains from the live weight gains undertaken as part of this project and as part of Producer Demonstration Site P.PSH.2006
- Presentations at the different field days included trial producer experiences, DITT, USQ's Climate Mates, Northern Territory Cattleman's Association (NTCA), NT Farmers, and local service providers and agronomy services

The Network also addressed concerns voiced by graziers and Leucaena producers regarding the benefits of Leucaena in addressing the industry's commitment to CN30 and the capacity for Leucaena to be included in the herd methodology for the accumulation of Australian Carbon Credit Units (ACCU) and participation in the carbon market.

This was undertaken with the provision of a 'Carbon Forum' held in Rockhampton in October 2021 attended by more than 60 graziers and industry representatives in person and an additional 12 online attendees. The forum's 12 presenters provided a comprehensive overview of the benefits of Leucaena in the reduction of on-farm carbon emissions and improvement in carbon sequestration and soil health for long term sustainability. Presentations also included current research on the capacity for the Australian grazing industry to successfully meet carbon emission targets and a dissection on the efficacy of proposed methodologies. Several carbon market providers were also invited to present. The forum was highly regarded by all attendees and the Network is currently investigating the provision of a second forum in northern Australia.

The Network continues to address a significant level of enquiry regarding the provision of Sterile Leucaena. A Sterile Leucaena Forum will be held in early November 2022 at the QDAF Redlands Research Station and will be hosted by the Network, UQ, and the Western Australian Department of Primary Industry and Regional Development (DPIRD). Key invitees will include graziers, local government agencies, and natural resource management representatives. The Forum will follow the morning's planned Introduction to Leucaena and Producer Forum at the same venue.

## **2.2 Continuation of the sourcing and provision of research into Leucaena through the 'Leucaena Research Hub'**

The Leucaena Network's 'Leucaena Research Hub' (available to Network members at [www.Leucaena.net](http://www.Leucaena.net)) continues to expand with more than 100 categorised research items, including International Leucaena Conference (ILC) and Australasian Association of Animal Sciences (AAAS) Conference presentations. In addition, final reports from Network projects are uploaded to both the 'Leucaena Research Hub' and the relevant project page of the Network's website.

Higher education provider partners with the Network include the UQ, Queensland University of Technology (QUT), and the Central Queensland University (CQU), state agricultural departments (including DITT, QDAF, and the Western Australian DPIRD), and these collaborators have assisted with the identification and provision of research papers of relevance to Leucaena enterprises and the grazing industry as a whole.

In addition to disseminating research, the Network is involved in the current research and adoption projects:

### **Sterile Leucaena Working Committee**

- Research into the development of a Sterile Leucaena is being undertaken by both the Western Australian DPIRD and UQ. The working committee provides guidance and feedback to these research entities.
- The Network plays an active role as a member of the Sterile Leucaena working committee, providing practical input into the ongoing research into sterile Leucaena.
- Two members of The Leucaena Network contribute to the committee – the Executive Officer and one Executive Member.

### **Livestock Emissions Industry Working Group**

- At the invitation of the Clean Energy Regulator, The Leucaena Network is a participant in the Livestock Emissions Industry Working Group.
- This group has identified Leucaena as one of the four key strategies for the reduction of livestock emissions although a submission from the Leucaena Network to include Leucaena in the 2022 methodology was unsuccessful. It is anticipated that further submissions will be made in further methodology reviews.

### **Central Queensland Regional Beef Research Committee**

- The Leucaena Network's Executive Officer represents The Leucaena Network on the Central Queensland Regional Beef Research Committee (CQRBRC)
- The CQRBRC provides input into MLA's research priorities through the North Australia Beef Research Council (NABRC).
- The Committee meets quarterly.

### **DAF Steak 'n' Wood Steering Committee**

- The Leucaena Network is part of the steering committee for QDAF's CN30 Steak 'n' Wood project to demonstrate livestock productivity and environmental service benefits of trees on farm in northern grazing systems.

### Leucaena in Silvopastoral Systems Industry Immersion

The Network, with the assistance of a A.W.Howard Memorial Trust, led a producer delegation to Colombia and Paraguay in 2019 to investigate the regenerative benefits of using Leucaena in silvopastoral systems. This visit was hosted by the Centre for Research in Sustainable Agricultural Production Systems (CIPAV) based in Colombia and coincided with the Tenth Annual Global Silvopastoral Congress in Paraguay.

A Council on Australia Latin America Relations (COALAR) submission has been made for a delegation from CIPAV to attend and present at the 2023 The Leucaena Network Conference in April 2023 with a producer delegation to Mexico in August 2023. This submission is currently pending.

### Industry Research Assistance

The Network has provided assistance to two current research projects through the aggregation of experienced producers to provide input into the research:

- ‘Defining the pathway for remediating mining land for productive, profitable, and sustainable beef production’ – CQU
- ‘Rumen inoculum efficacy trial’ – QDAF

## **2.3 Continuation of the one-on-one connections with regional and rural Councils**

The Leucaena Network has an ongoing commitment to open communication with local and regional councils and relevant government agencies to ensure the Network is aware of concerns which councils may have regarding the establishment and management of Leucaena in their jurisdiction. The Network continues to communicate with councils and governments to ensure continual awareness of the productivity, economic and environmental benefits of Leucaena and producers’ adherence to the Leucaena Code of Practice.

To coincide with events or workshops in each region, the Network met with nine Queensland local government councils to discuss the potential of Leucaena and the existing Code of Practice. This initial contact has fostered the ongoing communication between councils and the Network.

Invitations to all events and workshops were issued to the relevant councils or government agencies to provide the opportunity for interested representatives to view the activities of the Network, including on-farm responsible Leucaena establishment and individual producers’ experiences.

An invitation for complimentary attendance to The Leucaena Network’s 2020 Conference, held in Townsville on 8-9 September 2020, was issued to all Queensland councils where Leucaena is, or could, be grown in cattle grazing systems. This invitation was accepted by the Banana Shire Council, the Townsville City Council, Whitsunday Regional Council, Central Highlands Regional Council and Charters Towers Regional Council. Council representatives experienced a full day of presentations on successful establishment and management of Leucaena and the potential of Leucaena for productivity, financial security and to address environmental issues. They also took part in the Conference Field Day highlighting grazing and enteric emission trials at CSIRO’s Lansdown Research Station and Leucaena best management strategies at ‘Byrne Valley’.

## **2.4 Expansion of the Code of Practice**

### **2.4.1 Northern Territory Code of Practice**

An integral, but unplanned component of the Sustainable Long Term Leucaena Grass Production in Northern Australia project (L.PDS.1909) was reinforcing the social licence of the Leucaena industry in the Northern Territory through the development of a bespoke Northern Territory Best Management Code of Practice for Establishing and Managing Leucaena Pastures. This code of practice builds on the existing Queensland-based code to provide specific guidelines for paddock, property and waterway boundaries, as well as additional information regarding the benefits of Leucaena and the delineation between common and grazing Leucaena.

The development of the Code was a three-year, consultative process between The Leucaena Network, the Northern Territory Government and local producers.

The final Northern Territory Best Management Code of Practice for Establishing and Managing Leucaena Pastures was launched at the final project field day held in the Douglas Daly in May 2022.

A copy of the Northern Territory Best Management Code of Practice for Establishing and Managing Leucaena Pastures is attached in Appendix 3.

### **2.4.2 Cassowary Coast**

During consultation with the Cassowary Coast Regional Council (CCRC), it was highlighted that whilst Leucaena is not mentioned as a primary plant of concern, the CCRC has nominated Leucaena as a local prohibited 'weed', preventing its inclusion in the region's grazing systems. The Network subsequently convened meetings with representatives of the CCRC, the Tablelands Regional Council (TRC), and the Far North Queensland Regional Organisation of Councils (FNQROC) to develop a bespoke Leucaena biosecurity plan to enable local graziers to include Leucaena in their grazing systems. These meetings and negotiations also included local graziers and Councillors. A bespoke Leucaena biosecurity plan for the CCRC has been developed and is awaiting confirmation and endorsement by the CCRC Councillors and adoption by The Leucaena Network.

### **2.4.3 Best Management Practice**

The Network continues to investigate the applicability and provision of the Code of Practice in a Best Management Practice (BMP) format that will indicate a producer's knowledge of and adherence to the Code. Online programs are currently being considered.

## **2.5 Expansion of industry presence**

The Leucaena Network has expanded its presence across northern Australia through hosted information stands at several major industry events. Resources available on the stands included the 'Let's Talk Leucaena' video, showcasing the experiences and advice of six experienced Leucaena producers, the 'Introduction to Leucaena' video, providing an introduction to the basics of successful establishment of Leucaena and inter-row pastures, key fact sheets, case studies highlighting the establishment and management of Leucaena pastures by experienced producers, and live weight gain data from northern Australian trials.

### **Northern Territory Cattlemen's Association (NTCA) Conference, Alice Springs – 24-26 March 2021**

- Information stand
- Attended by more than 500 delegates
- Key opportunity to meet interested graziers and establish key working relationships with complementary organisations and service providers
- All stand visitors were followed up to address any queries following the Conference
- The Network also attended the NTCA 2022 Conference in Darwin in March 2022

### **Beef Australia, Rockhampton – 3-8 May 2021**

- More than 250 people visited the stand
- Stand was always manned by experienced Leucaena producers who were able to provide first-hand advice to enquirers
- All stand visitors were followed up to address any queries following the exhibition
- 'Members Only' networking event provided the opportunity for The Leucaena Network members to meet each other and network
- Enquiries identified the opportunity for the presentation of several Introduction to Leucaena workshops in developing areas which was followed up

### **NT Farmers Food Futures Conference, Darwin – 18-20 May 2021**

- Attended by more than 300 delegates
- Key opportunity to promote both the benefits of leucaena to the economy and environment, and the responsible management practices undertaken by leucaena graziers in accordance with the Leucaena Code of Practice, to graziers, other agricultural industries and the general public.
- Opportunity to develop relationships with complementary Northern Australian industries
- Ability to develop closer relationships with NT Farmers, particularly utilising agronomy services to assist the NT Leucaena industry
- Attended the NFF Roadshow as part of the Conference
- Followed up with all enquiries generated from attendance at the stand
- The Network also attended the 2022 Food Futures Roadshows in Katherine NT and Mareeba FNQ

### **Developing Northern Australia Conference, Darwin – 17-19 August 2021**

- A COVID-19 outbreak in the Northern Territory on the morning of the Conference commencement on the 17<sup>th</sup> August resulted in the last-minute conversion of the Conference to on-line
- Despite ongoing communications from the organisers and provision of capabilities for online attendance and networking, the sessions were not well attended compared to the physical attendance registrations

### **Northern Beef Producers Expo**

- Attended by more than 2000 graziers and industry personnel
- The Leucaena Network stand was visited by more than 40 graziers
- All enquiries were followed up following the Conference



The Network's industry presence has also expanded through presentations at complementary industry events.

#### **Northern Beef Research Update Conference (NBRUC) 2019**

- The Network was selected to present a 20-minute overview on the basics of Leucaena establishment and management, and the economic, productivity, and environmental benefits as part of a NBRUC panel session on pasture development
- The session was attended by more than 80 Conference delegates

#### **Pinnarendi Field Day - March 2021**

- Organised by QDAF to showcase the liveweight gain trial and variety comparison (Redlands and Wondergraze) being undertaken at Pinnarendi Station, Forty Mile Scrub, North Queensland
- 30 attendees
- The day comprised of the presentation of the live weight gain results to date by QDAF and viewing of pastures and pasture trials (both at Pinnarendi and Whitewater Station), followed by presentations at Undarra Station
- The Leucaena Network presented on the activities of the Network, the Code of Practice, and the interim live weight gain results achieved by the two other sites as part of the Northern Australian Live Weight Gain trial (NALWG – P.PSH.2006) and the Fairview Trial
- Network member and NALWG trial producer, Brett Blennerhassett provided an overview of his Leucaena activities and the interim live weight gains achieved to date as part of the trial

#### **Etheridge Shire Council Development Workshop and Field Day – April 2021**

- The Leucaena Network was invited to present on the basics of Leucaena establishment and the live weight gains to date across the Northern Australian trials as part of the workshop
- The Network also attended the field day the following day to gain an overview of emerging industries in the North Queensland region and to provide additional opportunity to liaise with interested graziers and industry representatives

#### **Northern Territory Agricultural Field Day – April 2021**

- The Leucaena Network presented at the two-day Northern Territory Agricultural Field Day at the DDRF, providing a basic overview of the establishment and management of Leucaena and the presentation on the live weight gains to date achieved from the NALWG trial and the Fairview Trial
- Trial participant and representative of the DDRF, Peter Shotton provided an update on the current and previous live weight gain and pasture trials undertaken on the DDRF and hosted a field walk to view the farm's Leucaena plantings
- Attended by more than 40 people

#### **Esk Beef Up Forum – November 2021**

- The Leucaena Network presented a snapshot of Australia's Leucaena industry and the key requirements for successful establishment, as well as the presentation of the live weight gains achieved to date by both the NALWG and the Fairview trials.
- Attended by more than 80 people

### **Australasian Association of Animal Science Conference – June 2022**

- The Leucaena Network presented an overview of the productivity, economic, and environmental benefits of the inclusion of Leucaena in northern Grazing systems including live weight gain trial results from four sites across northern Australia
- The Conference was attended by more than 250 research, industry, and producer representatives

### **Banana Regenerative Field Day – August 2022**

- The Leucaena Network was invited to present on the productivity and environmental benefits of Leucaena at a two-site regenerative farming day in Banana Central Queensland
- The day was attended by more than 100 graziers and industry representatives

### **Reinvigoration of the biennial The Leucaena Network Conference**

The Leucaena Network hosted the 2020 Leucaena Network Conference at The Ville, Townsville, on Tuesday 8<sup>th</sup> September 2020, followed by the Conference Field Day incorporating visits to the CSIRO Lansdown Research Station and Don and Laurel Heatley's 'Byrne Valley', Ayr, on Wednesday 9<sup>th</sup> September 2020.

The Conference included presentations by successful Leucaena producers and agronomists, and updates on MLA-funded establishment, management, long-term management, and live weight gain trials currently being undertaken by The Leucaena Network. The field day included presentations on enteric methane emission trials for cattle on a variety of forages including Leucaena; and Leucaena live weight gain trials at Lansdown Research Station; and intensive Leucaena grazing systems at 'Byrne Valley'.

The Conference and Field Day was attended by more than 80 graziers, industry personnel, agricultural advisors, and local, state, and federal government representatives. Due to COVID-19 restrictions, planned attendance by international delegates and inter-state delegates from Western Australia, Northern Territory, New South Wales, and the Australian Capital Territory was not able to proceed. Presentations were published in the Conference Wrap-Up segment of [www.Leucaena.net](http://www.Leucaena.net).

Attendee feedback from the Conference and Field Day indicated a very high level (rating 9) of satisfaction and value in attendance and an increase in knowledge of Leucaena by attendees from an average of basic knowledge (rating 5) of Leucaena prior to the event to an average of high knowledge (8) following the Conference and Field Day.

Due to a plethora of activities resulting from the deferral of activities from 2020-2021 to 2022 due to Covid-19, the decision was made to postpone the 2022 scheduled Conference to March 2023 to be held at Mackay, North Queensland.

## **3 Outcomes**

During the tenure of the 'Supporting The Leucaena Network; national research and the regional adoption outcomes for a highly productive beef industry' project, the Leucaena Network has provided qualified information and assistance to more than 1,400 graziers and industry personnel through trade stands, presentations, events, workshops and field days. A comprehensive suite of assistance programs and material has been developed, including:

- a series of ten succinct fact sheets on responsible management and establishment

- a range of case studies profiling successful Leucaena producers
- a standard 'Introduction to Leucaena' presentation and workshop format
- bespoke presentations
- a 'Let's Talk Leucaena' video highlighting the experiences of six experienced graziers and an 'Introduction to Leucaena' video (including key points for successful establishment and management by two renowned agronomy consultants)
- the Leucaena Research Hub where research information about or complementary to the Leucaena industry can be found in one place.

Fact sheets and case studies are provided in hard copy to all event attendees and enquirers and all items may be find online at [www.Leucaena.net](http://www.Leucaena.net). In addition, the Network has provided direct assistance to more than 400 enquiries received through the website, email or phone. These activities ensure that those graziers embarking on a Leucaena grazing system have the best opportunity for success and compliance with industry standards.

Research projects complementary to this project have included Northern Territory establishment trials, fertiliser trials and live weight gain studies. The information gleaned from these previous and ongoing activities provides confidence for the northern Australian red meat industry in the efficacy of Leucaena to increase productivity, profitability and environmental stewardship.

The Network instigated and has maintained open communication pathways with eight local government departments in Leucaena-suitable shires and the development of a fit-for-purpose Northern Territory Leucaena Code of Practice, thereby providing the 'linchpin' for the ongoing development of the Northern Territory Leucaena industry. This and the development on ongoing working relationships with both the Northern Territory and Queensland government agencies provides a level of security of tenure for the northern Australian Leucaena industry.

### **3.1 Key findings**

- There is still substantial interest in investing in Leucaena grazing systems across northern Australia with constant demand in established areas (including Central Queensland) and emerging areas, including north and far north Queensland and the Northern Territory.
- Emerging areas of Leucaena development require establishment and management methods that deviate from the traditionally accepted methods utilised in more established areas.
- Key barriers to increased adoption are the initial investment required, the transition from a grazing enterprise to a 'farming' activity and the associated lack of skills and equipment, and the limited information regarding successful establishment strategies, productivity, and environmental benefits in emerging areas provided by the only four (two undertaken by QDAF and two undertaken by the Network) Leucaena-focussed projects in northern Australia.
- There is a substantial opportunity for Leucaena to assist northern Australian graziers to fulfil the CN30 commitment via the reduction of enteric methane emissions (by up to 28%), improved productivity (with associated reduction of GHG CO<sub>2</sub> emissions intensity per unit product), and increased soil carbon sequestration.
- There remains ongoing concern regarding the environmental impacts of unmanaged Leucaena grazing systems by government and community.

- There remains a lack of knowledge regarding the difference between common (*Leucaena spp leucocphla*) and grazing (*Leucaena ssp glabrata*) Leucaena, and the previous and current use of both by government and community.

### **3.2 Benefits to industry**

- A northern Australian beef industry that has access to current and relevant information and advice about successful and responsible Leucaena establishment
- Improved potential for improved productivity, profitability, and environmental benefits for northern Australian beef producers through the establishment of Leucaena grazing systems.
- Ongoing social licence for the Leucaena grazing industry by addressing concerns of government and community, and the development of tools to meet the needs of both industry and government.

## **4 Future research and recommendations**

Leucaena continues to provide the opportunity for improved productivity, market diversification, and increased profitability for northern beef grazing enterprises. The focus of the Australian red meat industry on becoming carbon neutral by 2030 must include strategies for ongoing carbon neutrality for grass fed beef through pasture development. Leucaena, with the potential reduction in bovine enteric emissions by up to 28% (McSweeney and Tomkins 2015) and increased soil organic carbon by up to 267 kg C/ha/yr (Radrizzani et al., 2011) provides a key opportunity to contribute to long-term carbon neutral compliance for grazing enterprises located in areas suitable for Leucaena production. Currently, there is no alternative, long-lived (30+ years) pasture that provides this opportunity.

The success of and the high level of producer and industry engagement from the 'Supporting The Leucaena Network: national research and the regional adoption outcomes for a highly productive beef industry' product, provides the opportunity to capitalise on the momentum of the previous years' activities with an ongoing focus on assisting graziers to meet their CN30 obligations. The opportunity for the Network to contribute to MLA's Carbon EDGE workshop program would provide attending graziers with comprehensive information on a grazing system that requires minimal maintenance and can provide a reduction in enteric emissions by up to 28% for its lifespan of 30 years plus.

It is recommended that a subsequent extension and adoption project be undertaken to promote the environmental benefits of Leucaena and to continue to assist northern Australian beef producers in successfully establishing and maintaining responsibly planted Leucaena grazing systems for optimising productivity, profitability, and sustainability.

## **5 References**

McSweeney C; Tomkins N. 2015. Impacts of Leucaena plantations on greenhouse gas emissions in northern Australian cattle production systems. Final Report. Meat & Livestock Australia, Sydney, Australia. [bit.ly/2KfLxgy](http://bit.ly/2KfLxgy)

Radrizzani A; Shelton HM; Dalzell SA; Kirchhof G. 2011. Soil organic carbon and total nitrogen under *Leucaena leucocephala* pastures in Queensland. Crop and Pasture Science 62:337–345. doi: 10.1071/CP10115

## 6 Appendices

### 6.1 Fact sheets



The Leucaena Network is a leading producer group in the Australian grass-fed beef industry. Members include livestock producers, leucaena and pasture seed growers, industry representatives, researchers and extension personnel. The Network remains true to its message, to 'promote the responsible development of leucaena in productive and sustainable ecosystems to build stronger rural communities', focusing on the responsible management of the legume while working to promote the industry and provide current and relevant information and research to its members.

The Network encourages membership to foster ongoing activities and research to assist the industry to prosper. The Network addresses the ongoing high demand for the provision of qualified information and strategies for successful leucaena establishment for new producers and strives to provide established producers with research and extension information. A linchpin of The Leucaena Network's information provision is its website, [www.leucaena.net](http://www.leucaena.net). Current information on Network activities and member information may also be accessed through the Network's Facebook site or via the Network's regular newsletters.

### Benefits of Leucaena

**Production**

- High crude protein levels ranging from 25 to 30%
- 30 year plus productive lifespan
- Improved live weight gain (LWG)
  - Ranging from 0.5kg to 1.5kg per day (average 0.7kg to 0.8kg per day)
  - Average LWG of 255 – 292 kg per head per annum
  - Average 135 kg LWG per hectare per annum
- And increased stocking rate up to 1.5 times


**Pasture**

- Ability to 'fix' 75–150 kg Nitrogen per hectare per annum (equivalent to 160–325 kg urea/ha)
- Improved pasture growth in the vicinity of the legume's leaf drop and roots

**Environment**

- Reduction of up to 28% enteric emissions (methane)
- Reduction of total emissions due to shorter time to turn off
- Improved soil carbon in leucaena-grass pastures up to 267kg/ha/annum compared to native grass pastures.
- Deep roots can assist with rising water tables

### Contact



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## fact sheet 1. *Leucaena (Leucaena leucocephala subspecies glabrata)*

*Leucaena (Leucaena leucocephala subspecies glabrata)* is a palatable and nutritious perennial legume shrub / tree that is ideal for cattle production in the sub-tropics and tropics of Australia.

### A Brief History

The distribution of the genus *Leucaena* ranges from southern Texas in north America through Mexico and into central and south America. Wild or common leucaena (*Leucaena leucocephala subspecies leucocephala*) arrived in coastal Northern Queensland in the late 1800s.

Whilst cultivated *Leucaena (Leucaena leucocephala ssp. glabrata)* is better known in Australia as high-quality livestock (predominately cattle) fodder, a range of species have been used for human food, timber and other uses for several thousand years.

In the 1600s, leucaena was utilised in the Philippines and South East Asia for use as a shade plant in tea and coffee plantations, a use that is still predominant today.

In the Philippines and Indonesia, leucaena has many purposes – timber, wood fuel, furniture, agroforestry as well as forage for ruminant livestock.

In Australia, the CSIRO released the first forage variety of leucaena in the 1960s. The first commercial plantings occurred in the 1970s and since the mid-1980s, leucaena has been used extensively as a commercial cattle feed system in Australia. Approximately 150,000 hectares of leucaena is planted in Australia, predominately in the ideal growing conditions of central Queensland however with the introduction of the psyllid tolerant variety, Redlands, plantings in northern Queensland and the Northern Territory are increasing.

### Benefits of Leucaena

*Leucaena* is suited to deep, fertile soils in sub-humid environments where annual rainfall averages 600–800 mm. With its tap root, leucaena is able to exploit deep soil moisture beyond the reach of grasses and so can remain productive well into the dry season.

A significant benefit of leucaena as a forage crop is the ability to efficiently fix nitrogen. Nitrogen fixation is caused by a symbiotic relationship between the plant and an introduced rhizobium bacteria (CB3060), which is applied to the seed prior to planting. Successfully nodulated leucaena will produce sufficient nitrogen for its own needs. However, incorporating a vigorous companion grass maximises pasture production where the grass, that is in close proximity to the leucaena plant, will utilise excess nitrogen to improve soil fertility, organic matter, soil health and structure.

The *Leucaena*-grass pasture is a productive and sustainable grazing system that will increase animal liveweight gain (250-300 kg/hd/yr), increase beef production per hectare (125-150kg/ha), maximise



business returns and provides flexibility to meet the carcass requirements of beef markets compared to grass-only pastures.

Once established and with periodic maintenance, well managed leucaena-grass pastures can remain productive for over 40 years.

### Mimosine

Leucaena contains a mimosine, a toxin that can directly cause weight loss, hair loss and potential eventual death in cattle. However, mimosine is quickly converted to dihydroxypyridine (DHP) in the rumen but this compound is also toxic to grazing animals. To overcome DHP toxicity, 10% of animals grazing leucaena should be inoculated with the anaerobic bacteria *Synergistes jonesii* or the 'leucaena bug'. Over a number of weeks this bacteria spreads to the non-inoculated animals to eventually protect the whole herd from the reduction in productivity this toxin can cause over time. The Leucaena bug is available for purchase through the Queensland Department of Agriculture and Fisheries (QDAF) Tick Fever centre at Wacol, Brisbane.

### Maintenance

Given the tree-like nature of leucaena, under light grazing pressure and favourable growing conditions (deep, fertile soils and warm and wet weather conditions) Leucaena can grow beyond the reach of cattle. Periodic intense grazing pressure can assist to minimise the growth of branches beyond cattle reach, keeping the plant more branched and leafy as well as reducing the opportunity for reproductive growth (flowering and pod production). However under certain circumstances mechanical trimming will be required to re-set plants back to a height to allow full grazing utilisation.

### Code of Practice

Leucaena produces viable seed that can cause weed problems in un-grazed areas such as gullies, banks of watercourses and road verges. The 'common' leucaena that arrived in Australia over 120 years ago has shown the colonisation potential in un-grazed situations. Cultivated leucaena will also colonise un-grazed areas if allowed to escape from grazed plantations, and precautions should be taken to prevent this.

The Leucaena Network recognised this risk and developed the Code of Practice. The Code is consistent with the Queensland Government's policy to reduce the weed threat of leucaena.

### Principles of the Best Management Code of Practice.

The Principle of the Best Management Code of Practice is to plant leucaena ONLY if you intend to manage it and are prepared to accept responsibility to control leucaena that establishes outside the planted area on your property, including watercourses.

Practices to comply with the Code are documented in The Leucaena Network's Fact Sheet 8.



## fact sheet 2. Which Cultivar?

Five cultivars of Leucaena are now available for planting by graziers. These include Cunningham, Wondergraze, Redlands, Tarramba and Peru. Each cultivar has specific attributes that provide benefits for individual locations (climate) which impacts on establishment, grazing, height, and insect management requirements.

### Cunningham

Cunningham was developed by CSIRO who crossed the Peru cultivar with another variety from Guatemala. It was released in Australia in 1976.

Cunningham is a highly productive variety with a shrubby growth habit. Cunningham is a prolific seeder and is very susceptible to psyllids and frost which can cause significant productivity losses in the more humid, coastal environments.

Despite being released more than 40 years ago, Cunningham is still widely sown today. Cunningham seed is often harvested by graziers who take the opportunity to harvest and sell seed during favourable seasonal conditions.

### Wondergraze

Wondergraze is an intraspecific hybrid and was released to the market in 2011.

Wondergraze has early seedling vigour and some cold tolerance and is a bushier plant than the other leucaena cultivars, putting its growth into foliage and branches rather than woody stems, increasing its attractiveness for grazing and crop maintenance.

Wondergraze seed is under Plant Breeder Rights (PBR) and may only be sourced from one seed supplier.

### Redlands

The Redlands variety is named after the Queensland Department of Agriculture and Fisheries (QDAF) research station where the University of Queensland variety development site is located in Brisbane.

Redlands is an inter-specific hybrid between *Leucaena pallida* and *Leucaena Leucocephala subsp. glabrata*.

Redlands was released in 2017 for commercial plantings with successful establishment trials undertaken in northern Queensland. On-farm trials investigating palatability and cattle weight gains are currently being conducted with interim results being consistent with weight gains generally achieved with leucaena.

Redlands has a very high tolerance to psyllids, making it highly suitable for planting in coastal areas or other locations prone to high psyllid incidence.

Redlands seed is governed by plant-breeders rights (PBR) and is available from two seed suppliers.

### **Tarramba**

Tarramba was bred by the University of Hawaii and released in Australia in 1994. It has a taller, more tree-like (arboreal) growth habit. Specific grazing management is required to promote basal branching during establishment. Once established, Tarramba requires careful grazing management to minimise the need for mechanical trimming.

Tarramba typically produces less seed than other varieties, and while forage yield can be high, stem yield can make up the majority of the total biomass. Other advantages include early seedling vigour and some psyllid and cold tolerance, which can provide production advantages under certain environmental conditions.

Tarramba is under Plant Breeders Rights (PBR) and can be only sourced from one seed supplier.

### **Peru**

Peru, named after its originating country, was first released as a cultivar by CSIRO in 1962. Peru has shrubby growth with good basal branching. Peru is very susceptible to psyllid damage and produces large amounts of seed.

Peru has been superseded by newer varieties although seed is still available for sale typically from graziers with older stands of leucaena who take the opportunity to harvest and sell seed when seasonal conditions are favourable.

### **Seed Quality**

Irrespective of the cultivar and the seed provider, it is essential to ensure your seed is of high quality. All seed sold should have a germination and purity test which will determine if further scarification is needed (to reduce the percentage of hard (dormant) seed), or if weed seeds are present (eg parthenium). The uniformity of seed size is an important aspect that may impact seed flow through a planter, the uniformity of placement in the planted row and the planting rate. Grading of the seed is usually undertaken by established seed sellers to ensure seed size uniformity. Other aspects to consider include how long the seed has been stored for and the storage conditions, and whether there is any bruchid beetle damage (small holes in the seed).

## fact sheet 3. Location

### Climate

Although established leucaena can tolerate extended dry spells and droughts, the plant performs best in tropical climates (hot wet summers and mild winters with an average rainfall above 600mm).

The majority of plant growth occurs in the warmer months with growth slowing when daily maximum temperatures fall below 25°C. Growth stops entirely when minimum temperatures fall below 10°C.

The optimum growing environment is in a sub-humid area with 700 – 800mm annual average rainfall which not only provides the plant with the necessary climate but reduces psyllid insect pressure associated with the more humid areas. The new 'Redlands' psyllid-tolerant variety is now enabling plantings in coastal areas with rainfall above 800mm.

### Location

Leucaena grows best on deep, fertile, well-drained neutral to alkaline soils. Leucaena is well suited to Brigalow and scrub soils, black basalt soils, red volcanic soil and deep, fertile alluvial soils.

Leucaena is difficult to establish or provides limited production in heavy grey clays (Brigalow melon-hole country) and infertile sandy or sandy-loam soils (Cypress pine, light box country). Leucaena is unproductive in shallow infertile soils (Narrow-leaf ironbark forest country) or soils where prolonged waterlogging can occur (heavy clay flood plains).

Soil temperature needs to be above 18°C for leucaena seed to germinate rapidly. Plant leucaena in a deep fertile soil but avoid cold hollows or flats that regularly frost. Frost can kill seedlings and can severely reduce the productivity of established plants. Mild frosts (0°C to -3°C) result in leaf drop whilst severe frosts (below -3°C) will kill above-ground stems to ground level although established plants can grow vigorously from the root crown in spring with adequate soil moisture.

If your paddock has frost-prone and frost-free areas, consider fencing to allow for management of each area. Alternatively, if areas of your paddock are prone to frost, graze the entire paddock evenly prior to the first frost and then rest to allow regeneration in the warmer spring season.

Ensure planting is undertaken in accordance with the Leucaena Code of Practice and avoid planting near watercourses such as creeks, rivers and flood ways. Keep Leucaena some distance away from boundary fences and provide a buffer of strong, grass pasture. Never plant leucaena in areas where livestock will be excluded.



## fact sheet 4. Soil

Leucaena will grow in a wide range of soils but is most productive in fertile (high phosphorus and alkaline pH), deep (>1 m), well-drained soils (intolerant to waterlogging).

Leucaena performs best in soils with high phosphorus and sulfur, and good levels of trace elements particularly potassium and zinc.

It's imperative to soil test paddocks selected for leucaena production prior to sowing to ensure adequate soil nutrient supply and soil depth. Soil testing can determine the suitability of a paddock for leucaena and so assist with paddock selection. Planting leucaena can require a significant investment in your property, so ensuring that it is planted in areas where the soil can sustain the plantings for many years to come is pivotal to success.

### Why Soil Test

Soil testing enables an assessment of the chemical, physical and biological aspects of your soil. This can provide insight into the capacity of your soil to support the successful establishment and long-term sustainability of leucaena, and deliver productive yields, high fertiliser and water efficiencies, livestock performance and profit.

Soil testing can answer the following questions:

- What is the nutritional status of my soil? Do plant nutrient deficiencies or toxicities occur?
- What is the effective root depth of my soil?
- What chemical or physical properties are causing underperformance or affecting yield and limiting my production?
- What physical or chemical soil imbalances are present, and what are the relationships between each component?

### How to Soil Test

It's advisable to seek advisor assistance as this makes collecting multiple, representative, soil cores over a paddock to a depth of about 1 metre much easier. Collect at least 10-15 soil core samples (depending on paddock size and number of soil types) and break into increments of 0-10cm, 10-50cm, 50-90cm. Bulk each increment from each core together, break-up and thoroughly mix, then subsample about 500g of soil into a labelled bag.

Whilst undertaking your soil testing, it is imperative that the condition of the soil, the depth of usable soil and the structure of the subsoil is noted. This may indicate physical impediments to root depth or soil degradation such as soil compaction, which potentially could require mechanical intervention to solve.

## Interpreting your Soil Test

It is important that your agronomy advisor provides you with a complete interpretation of the soil test, specifically for leucaena. However the most important aspects are:

### **pH**

Soil pH is measured on a scale from 0 (strongly acidic) to 14 (strongly alkaline), with 7 being neutral. Leucaena prefers soil with neutral to alkaline pH. A pH of 5.5 is the lower tolerance limit. It's also important to measure the subsoil pH as this will influence root depth and hence nutrient and water extraction.

### **Phosphorus (P)**

Phosphorus is an important soil nutrient for legumes. Leucaena has a higher requirement for phosphorus compared to other legumes, with a critical value (Bicarb or Colwell) in the 0-10cm soil layer of greater than 20mg/kg. Phosphorus is largely immobile in most soils, and is concentrated in the top (0-30cm) part of the soil profile.

### **Sulphur (S)**

Sulphur is another soil nutrient important for legume production with a moderate requirement of 9-12mg/kg. A minimum of 5mg/kg S is required otherwise fertilizer is required. Sulphur is required for the production of amino acids, which make up the proteins critical to plant growth. Sulphur is a mobile nutrient so can be found in the deeper part of the subsoil, requiring deeper soil sampling to fully measure the plant availability of sulphur.

### **Potassium (K)**

Potassium is required for enzyme activation in leucaena which, through the production of adenosine triphosphate (ATP), can regulate the rate of photosynthesis. Potassium levels in soil should be above 0.3 meq/100g.

### **Zinc (Zn)**

Zinc is utilized for the formation of chlorophyll and conversion of starches to sugars. The availability of zinc is influenced by pH; when pH above 7 the critical level is 0.8mg/kg, when pH below 7, the critical level is 0.4mg/kg.

### **Cation exchange capacity (CEC)**

Cation exchange capacity is a measure of the ability of the soil to hold positive ions (cations) and is usually the summation of calcium, magnesium, potassium and sodium. While these are important plant nutrients, they also have a large influence on the structure of the soil. High sodium (sodicity) and magnesium levels in the top soil can weaken the bond between soil particles, causing dispersion and soil crusting which reduces seedling establishment. High levels in the subsoil increase bulk density (reduced pore space) and so restricts root depth.

## fact sheet 5. Planting

### Land Preparation

The key to reliable and successful Leucaena establishment is adequate planning and paddock preparation. Ensuring high levels of soil moisture before planting from fallowing is one of the most critical success factors, especially in non-monsoonal or drier in-land locations.

Best establishment is achieved through ensuring a fine seed bed with competition from grass and weed removed through repeated cultivation or herbicide application. Deep ripping (50cm+) along the rows at the start of the fallow period may be beneficial in non-cracking or tight soils.

Producers may consider total removal of existing grass with subsequent re-planting of an improved grass; or retaining grass strips to allow some grazing during the fallowing period and reduce preparation costs, reduce the potential of soil erosion, and enable grass re-establishment without planting grass seed. However, if the existing grass pasture is either rundown or contains undesirable species, it is highly recommended to totally remove the existing pasture across the whole paddock and replace with improved pasture.

If the location is unsuitable for cultivation due to erosion concerns, herbicide application to a strip of at least 4-5 metres centered over the intended planting zone to remove competition from grass and weeds may be required.

### Timing

The right planting time and adequate soil moisture are critical for reliable leucaena establishment. In sub-tropical regions (Central and North Queensland), plant as early as possible between September and March (depending on winter temperatures and frost potential), but only when there is at least 60-90cm (preferably 1 metre minimum) of sub-soil moisture and soil temperature is rising above 18°C.

Tropical Monsoonal (Northern Territory, coastal and NQ) plantings may have a shorter planting window to avoid seed or seedling losses due to heavy wet-season rain earlier in the season and the potential of an early cessation to the wet-season. Typically, the most reliable establishment occurs by planting between mid- December and mid-February. If multiple storms with heavy rain are typical during this period of time, pushing planting into autumn (mid-February to April-May) could be suitable while temperatures are still warm enough for quick seed germination and initial growth. Young seedlings can struggle if they emerge in extremely hot conditions in January and February in lighter textured soils, but can survive if roots are growing into a good soil moisture profile.

### Inoculate the planting seed

The productivity of the leucaena stand and the companion grass depends upon efficient nitrogen fixation. Nitrogen fixation is caused by a symbiotic relationship between the plant. Native rhizobium present in the soil do not form effective nodules, so the seed must be treated with commercial rhizobium inoculum (either CB3060 or CB3126). The rhizobium inoculant is available in both a peat and freeze-dried form for either direct seed application or water injection. Seed should be inoculated immediately before planting. Store the rhizobium in a refrigerator before use and observe the expiry date. Rhizobium is sensitive to drying out, heat, sunlight, fertilisers and chemicals. Consider the further step of water injecting the inoculum in the seed trench to maximise plant nodulation.

### Seed quality and planting rate

Planting quality seed with high germination percentage (scarified seed) and high viability (low percentage of dead seed) is another critical success factor. Ensure seed germination percentage is known prior to planting by either obtaining a commercial test certificate or testing the germination yourself.

Aim to place each seed 5cm apart in the row (20 seeds / metre row), which equates to a planting rate of between 1 – 2kg/ha depending on row spacing, row configuration and seed size.



#### **Row Spacing**

Row spacing chosen is highly dependent on soil type and climate. The aim in determining the appropriate row spacing is to have sufficient leucaena and grass to graze both evenly all year round. Very close rows can result in insufficient grass pasture to go with leucaena when cattle are actively consuming the grass (typically in summer) whilst very wide rows can result in a lack of leucaena to match the pasture at times when cattle are actively consuming leucaena (typically throughout autumn, winter and spring).

Depending on the orientation, overgrown or tall leucaena planted on narrow rows may reduce sunlight penetration needed for adequate grass growth.

Suggested row spacings are between 7m to 15m depending on soil type, rainfall (or irrigation), and the grass:leucaena forage balance required. These spacings allow maintenance of a strong grass sward between rows, machinery access for leucaena maintenance and optimal grazing pressure. Planting twin rows (as opposed to single) can ensure a continuous hedge if one row doesn't establish.

If sowing Leucaena into fallowed strips, ensure the strips are at least 5m wide (if planting twin rows on 1m centres) to allow about 2m of weed free conditions either side of the rows until Leucaena is at least 1.5m high to minimise competition from grass.

#### **Seed planting depth**

Seed planting depth is also dependent on the soil characteristics however generally a fairly shallow planting depth of 25mm to 50mm (maximum) has the highest rate of successful germination. It is preferable to ensure the seed is in wet soil for 5-7 days for reliable germination. Shallower seed placement will provide quicker emergence as long as soil moisture isn't quickly depleted which might be risky in marginal moisture conditions or on lighter soil types.

#### **Germination and early emergence**

Germination and emergence should occur within 7 days but this time is influenced by a range of factors including soil moisture, temperature, seed quality and scarification level, uniformity of planting depth, and seed-soil contact. Using presswheels to ensure seed-soil contact is very important for reliable establishment, however too much pressure can be detrimental. Presswheels ideally need to run beside the planted row, not over the top. Dual press wheels are ideal.

In the early stages of establishment, the seedling is very susceptible to predation from soil insects, native animals and weed competition. Ensure weeds are controlled after planting, assess the need for soil insect control, and plant a large enough area (at least 40ha) to allow for native animal predation.

#### **Weed Control after planting**

Young leucaena seedlings initially concentrate on developing a strong root system, rather than above ground shoot growth. Effective weed control for the first 3-6 months is generally required. This slow shoot growth increases susceptibility to weed and grass competition, therefore post planting weed control (either mechanical or herbicide) is essential to ensure vigorous early growth. Mechanical options include over-the row (scufflers) or inter-row (tined or off-set disc) implements which need precision placement to minimise damage to Leucaena and effective weed control.

Chemical options include herbicides (for example Spinnaker and Fusilade Forte) applied either over the entire area or in a band along the planting rows prior to planting, at planting or after planting depending on the situation and weed control needed.

## fact sheet 6. Companion Grasses

A productive and persistent companion grass is required for sustainable leucaena-pasture systems in tropical Australia. Combining grasses with leucaena provides forage all year round to maximize weight gain. Grasses promote nitrogen fixation by leucaena which improves overall pasture and soil health, and ground cover. This reduces the opportunity for weeds and stray leucaena seedlings to establish, and minimises runoff and erosion.

Consider your location, soil type and rainfall when choosing your companion grass.

### Bambatsi panic

Bambatsi *panic* is a palatable and perennial summer-growing grass that is well adapted to medium to heavy-cracking clay soils in Queensland where the average yearly rainfall is greater than 600 mm. Bambatsi can tolerate waterlogging, drought, frost and saline soil. It performs well on melon-hole (gilgai) soils in Brigalow lands; is unsuited to sandy and loamy soils of low fertility.

Bambatsi can be difficult to establish and is slow to develop in its first year. But once established it is tolerant of drought and will grow into the cooler months.

### Green and Gatton panic

Green and Gatton Panic are very productive and palatable grasses that are well suited to high fertility soils. **Green Panic** is better suited to higher rainfall regions or under irrigation, whereas **Gatton Panic** is regarded as being more vigorous and drought tolerant. Both are shade tolerant and thrive on high nitrogen supply so can grow vigorously beside leucaena rows.

### Buffel grass

Buffel grass is the most common improved species planted into fertile soils across southern and central Queensland. It is a deep rooted, drought resistant, palatable and very productive grass that responds quickly to moisture and fertility. Buffel prefers higher fertility scrub soil but will grow on a range of soil types, but not low fertility sands or very heavy clay soils. Three cultivars are commonly sown; American (USA), Gayndah and Biloela, with Biloela typically sown on heavier soils. Buffel is commonly sown with Leucaena in new pasture situations, or naturally colonises in paddocks where it has already been planted. Buffel is extremely competitive for moisture and will limit the productivity of established leucaena in dry years. To ensure successful establishment of leucaena into existing buffel grass paddocks, it's critical to cultivate or spray out buffel grass for at least 6mths prior to planting, and control any buffel seedlings for 3-6mths after planting.

### Rhodes grasses

Rhodes grasses can be productive and persistent on a range of soil types, however are not as hardy as other improved grasses (eg buffel). Rhodes grasses are quick to establish and provide high biomass production and require greater than 700mm annual rainfall and high soil fertility to persist.



A large range of cultivars are available and the more palatable types are late flowering with high leaf to stem ratio. Rhodes grass is commonly sown with other grasses in new Leucaena pastures due to its quick establishment and good biomass production during the initial years of pasture establishment.

### Signal grass

Signal grass is a low-growing creeping perennial, with trailing stems that root at the nodes. It forms a dense soil cover, with a canopy usually shorter than 40 cm when grazed. Signal grass is well adapted to a wide range of soils in the (more than 1000 mm annual rainfall) tropics, but also grows well in the coastal subtropics with lower rainfall due to moderate tolerance to dry periods and cold temperatures. Signal grass has not been commonly used in Leucaena pasture systems due to its main applicability to coastal environments, however this might change with the release of the psyllid resistant variety 'Redlands'. The released cultivar is Basilisk.

### Pangola grass

Pangola is a very productive and palatable creeping grass on a range of soil types. Pangola can withstand heavy grazing and high rainfall conditions however needs to be planted from runners as it does not produce fertile seed. Pangola is highly suitable for tropical and subtropical coastal locations with annual rainfall greater than 800mm and mild winter temperatures, therefore will be a suitable companion grass for leucaena pasture systems in coastal environments.

### Humidicola

Humidicola is a very productive and aggressive creeping grass that is highly suited to high rainfall (greater than 1000mm) or irrigated conditions in the tropics. Like Signal grass, Humidicola has not been commonly used in Leucaena pasture systems, but this could change with the release of the variety 'Redlands'. The released cultivar is Tully.

### Digit and Finger grasses

Digit and Finger grasses are well adapted to the lighter soils (sands to loams) across a range of climatic conditions in Queensland. These grasses are related to pangola however have a more tufted growth habit, are taller, and produce viable seeds. A number of cultivars have been released (Premier, Strickland, Jarra), however seed supply has been variable in recent years. All are palatable and tolerant of low soil fertility, however are highly responsive to high nutrient supply eg from fertiliser. Digit and Finger grasses have not commonly being planted in Leucaena pasture systems, but would be highly suited on deep and fertile loam soils where a productive, persistent and palatable grass is required.

### Creeping bluegrass

Creeping bluegrass is suitable for a range of soil types from low fertility forest soils to self-mulching clays. It is a strong creeper and whilst slow to establish, it can withstand heavy grazing once fully established. It flowers late in the growing season so maintains leaf quality for longer compared to other grasses. Creeping blue grass provides very high ground cover due to its strong creeping habit, and so is suitable to sloping country that might be prone to erosion. The main cultivar available is Bisset, which is a harder variety than the superseded Hatch.

## fact sheet 7. Psyllids

### What Are Leucaena Psyllids?

The psyllid, *Heteropsylla cubana*, is native to Cuba and is found only on Leucaena species and hybrids. Psyllid was first noted in Bowen Qld in 1986 and can now be found wherever Leucaena is grown across northern Australia.

Eggs of the leucaena psyllid are laid on or in unopened leaves. The adult psyllids are aphid-like, 2 mm in length, winged, and light green in colour. The infant psyllids or nymphs, are similar to adults, but smaller. All growth stages of the insect affect the plant by sucking the sap of terminal leaves, buds and flowers.

A black sooty mould may be seen where psyllid infestations are in large numbers. This mould grows on the psyllid's sugary excretions, preventing light from reaching the leaf surface and decreasing photosynthesis and plant growth.

### Where is Leucaena Most at Risk of Psyllids?

Psyllids prefer high humidity and mild temperatures (20°C to 35°C) therefore Leucaena plantings in coastal areas are highly susceptible to psyllid infestation.

Psyllids are sensitive to changes in temperature and humidity so areas of less than 800 mm rainfall and lower humidity are not usually subject to psyllid infestations.

Yield loss in research trials in psyllid-prone areas averaged 28%, ranging from 8% to 49%, with losses as high as 75% in conditions ideal for psyllid activity.

### What Varieties are Best to Plant in Psyllid Prone Areas?

'Redlands' is a psyllid tolerant leucaena variety, which is vigorous, high yielding and has excellent forage quality, longevity and tolerance to grazing.

'Redlands' was developed as a joint initiative of the Meat and Livestock Association (MLA) and the University of Queensland and was named after the research facility where it originated.

The variety is approximately 90% *Leucaena leucocephala* subsp. *glabrata* (the standard grazing leucaena) and 10% *Leucaena pallida*, which provides the psyllid tolerance.

## What to do about psyllids in established paddocks?

It is difficult to provide a definitive answer due to the uncertainties of weather conditions, but there are a couple of options.

1. Assess psyllid numbers and damage first
2. Graze available leaf – this will maximise the utilisation of remaining leucaena while removing the food source for the psyllid. Cattle moving through the plants will also disturb feeding and encourage the psyllid to move to another location.
3. Assess whether spraying will be economical. Psyllids can be effectively controlled with diomethoate at 340ml/ha, and will provide about 3-4 weeks residual control. However it is commonly more economical to graze established paddocks unless conditions are such that prolonged psyllid attack occurs. Spraying establishing leucaena (<1.5m tall) with high psyllid pressure is recommended.
4. Do nothing. In inland districts weather conditions for psyllids activity is relatively uncommon as temperatures are high and humidity low. Also, by the time psyllids are noticed (defoliated an area of leucaena), the weather conditions could have changed. In locations closer to the coast where weather conditions conducive to psyllid activity are more common, or occur for longer, immediately grazing or spraying the paddock are more than likely better options.

## How to Use the Psyllid Damage Rating Scale – What to Look For

| Rating | Symptoms   |
|--------|--|
| 1      | No damage observed   |
| 2      | Slight curling of leaves                                     |
| 3      | Tips and leaves curling and yellow                           |
| 4      | Tips and leaves badly curled, yellowish and covered with sap |
| 5      | Loss of up to 25% young leaves                               |
| 6      | Loss of 25 – 50% young leaves                                |
| 7      | Loss of 50 – 75% young leaves                                |
| 8      | 100% loss of leaves and blackening of lower leaves           |
| 9      | Blackened stems with total leaf loss                         |



## fact sheet 8. Best Management CODE OF PRACTICE for Establishing and Managing Leucaena Pastures

### Preamble

Leucaena (*Leucaena leucocephala subspecies glabrata*), when planted with improved grass species provides a sustainable forage grazing system in northern Australia. Leucaena has been grown commercially in Queensland since the late 1970s. Leucaena is recognised as a valuable forage when managed properly, but it may constitute a threat to the natural environment if not contained in those areas in which it has been planted, or controlled in those areas that it has invaded.

### Weed Potential

The most significant weed trait of leucaena is its potential to form dense thickets in ungrazed areas over time. Any ripe seed that escapes flower-eating caterpillars and bruchid beetles can stay viable in the soil for several years.

The current major weed impact comes from ungrazed 'common' leucaena (*L. leucocephala subspecies leucocephala*). This has been naturalised in coastal and urban areas of Northern Australia for more than 100 years - long before the release of commercial cultivars for grazing. However, it must be noted that commercial cultivars of subspecies *glabrata* have similar weed potential. When planted as ungrazed ornamentals in urban areas, plants can contribute to the weed threat. Commercial leucaena pastures must not be allowed to contribute to the weed problem.

### Purpose of the Leucaena Code of Practice

The Best Management Code of Practice (CODE) targets those features of leucaena that pre-dispose it to weediness and advocates management to limit their impact. It aims to promote the responsible, sustainable and productive development of combined leucaena/grass pastures. It is essential that the CODE be adopted by all landowners who have leucaena on their properties.

The use of leucaena for any purpose other than as a highly managed and well contained forage for animal production is not supported by industry bodies and Government agencies and should be discouraged.

## Principles of the Best Management Code of Practice

Plant leucaena **ONLY** if you intend to manage it and are prepared to accept responsibility to control leucaena that establishes outside the planted area on your property, including watercourses.

This can be achieved by adopting the following practices:

1. Do not plant leucaena in areas where rivers, creeks and flood channels can disperse seed pods/seed.
2. Keep leucaena at least 20m away from external fence lines
3. Maintain a buffer strip of strong grass pasture between leucaena plantings and creeks or boundary fences
4. Fully fence leucaena paddocks to avoid the unlikely risk of stock spreading ripe seed
5. Graze or cut leucaena to keep it within the reach of animals and minimise seedset
6. Chemically manage leucaena escapes with Access
7. Establish and manage vigorous grass in the inter-rows to:
  - a. provide competition to minimise establishment of volunteer leucaena seedlings
  - b. minimize the risk of seed being transported during heavy rain
  - c. productively utilize fixed nitrogen the system produces
- d. maintain ground cover and prevent soil erosion
8. Maintain the practice of:
  - a. regularly monitoring creeks and major watercourses to detect any escaped leucaena seedlings and plants
  - b. controlling all plants detected adjacent to property boundaries
    - i. on creek banks and other adjoining areas where cattle do not normally have access
    - ii. on public roadsides (after first obtaining a permit from Main Roads or Local Council)
9. Comply with local laws (weed declarations etc) and assist Local Government agencies to identify any escaped leucaena so that action can be taken to control it
10. Promote the responsible management of leucaena in accordance with this Code
11. Keep abreast of best practice developments in the management of leucaena.

Leucaena must be grown to this Best Management  
LEUCAENA CODE OF PRACTICE

[www.leucaena.net](http://www.leucaena.net)

## fact sheet 9. Rumen Inoculant for managing mimosine

### Leucaena

The Leucaena-grass pasture is a productive and sustainable grazing system that can increase animal liveweight gain (250-300 kg/hd/yr), increase beef production per hectare (125-150kg/ha), maximise business returns and provides flexibility to meet the carcass requirements of beef markets compared to grass-only pastures. When eaten with grass, leucaena improves the balance of nutrients consumed, increases overall feed intake and greatly improves feed conversion efficiency – resulting in more LWG per kg DM consumed. However, Leucaena also contains mimosine which needs to be managed to achieve these gains.

### Mimosine and DHP

Leucaena contains an amino acid called mimosine which, in the ruminant animal is degraded to DHP (3,4- and 2,3-dihydroxypyridine). DHP is also toxic.

Mimosine toxicity stops cell division and cattle can exhibit symptoms within three days of consuming significant amounts of leucaena. Whilst rare, this effect is predominantly seen where cattle, unaccustomed to leucaena have unlimited access to leucaena exhibiting young, lush growth as may be seen after the break of a drought or if limited to no grass is present in the grazed paddock.

Symptoms include loss of appetite, sudden hair loss, ulcers and sores on the tongue and in the mouth and throat, conjunctivitis and damaged liver and kidney tissue. Severe cases may result in death of the animal.

DHP poisoning is more common, and the effects are cumulative with symptoms appearing after several months of leucaena consumption. DHP toxicity affects the thyroid and symptoms may include lethargy, hair loss around the pizzle, tail and rump, excessive salivation, early foetal abortion and/or loss of appetite which can reduce weight gain by up to 30%. Acute poisoning may result in death of the animal.



## The rumen 'bug'

To mitigate the risk of leucaena toxicity a bacteria, *Synergistes jonesii*, can be introduced to the rumen, which will detoxify DHP (3,4- and 2,3-dihydroxypyridine). Generally, ruminants do not naturally possess the bacteria in abundance to degrade DHP. Across Indonesian herds where 100% leucaena diets can be fed there are indications of a lesser-known pathway in which the DHP is neutralised by conjugation in the liver. However, until suitable research has been completed under Australian conditions, it is still advisable to undertake the rumen inoculation of cattle grazing leucaena to prevent possible leucaena toxicity.

The Queensland Department of Agriculture and Fisheries (DAF) developed an in vitro, fermentor-based, mixed culture bacterial inoculum which includes *Synergistes jonesii* (the 'bug') that is administered to cattle via an oral drench. It is recommended that 10% of the herd is inoculated, the other cattle obtain the bug via close interaction (typically through grooming). Despite a belief that the 'bug' can be transmitted by adding into water troughs, the bacteria is anaerobic and cannot survive in oxygenated environments including water in troughs.

Cattle should be grazing leucaena for 7 – 10 days prior to drenching to ensure cattle have consumed leucaena so that there is mimosine in their rumen for the bacteria in the inoculant to survive.

## How to Order the Leucaena Inoculum

Further information on the use and management of the leucaena inoculum can be obtained from <https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/livestock/cattle/leucaena-inoculum-cattle>. The inoculum must be kept cool and is dispatched frozen to be used imminently upon thawing to ensure its efficacy. A 500ml bottle contains 5 doses (ie 100ml/ animal) which effectively treats 5 head (inoculating 10% of a 50 head mob) and costs \$237 plus freight (current March 2021).

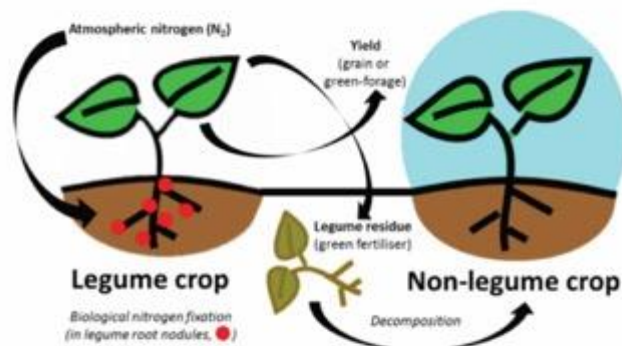
## Introducing Leucaena

Whilst inoculation with the rumen bug does provide protection from mimosine and DHP toxicity for a mob, it is not recommended to introduce new PTIC cows to leucaena for the first time or after a substantial break. It is recommended to introduce cows to leucaena prior to joining.

## fact sheet 10. Leucaena and Rhizobia

### Legumes and Rhizobia

Nitrogen is essential for plant growth and development. It is a major component of chlorophyll, which is required for photosynthesis and amino acids, the building blocks of protein. Whilst approximately 80% of the Earth's atmosphere is nitrogen gas ( $N_2$ ), plants, animals and microorganisms can only use a reduced form, ammonia ( $NH_3$ ). Biological nitrogen fixation (BNF) is required to convert  $N_2$  to  $NH_3$ . This process can occur naturally by nitrogen fixing rhizobia bacteria. In legumes, including leucaena, the rhizobium bacteria stimulate the growth of nodules on the roots. It is within these nodules that nitrogen fixation occurs to produce  $NH_3$  that is directly taken up by the plant. In return, the plant provides rhizobia nutrients and some of the micronutrients required by the rhizobia to live – a symbiotic relationship. This 'fixation' process allows leucaena to utilize nitrogen from the atmosphere for growth and development. This process also benefits the surrounding pasture with nitrogen supplied through leucaena leaf drop and if lateral roots are expelled off the main root systems. It should be noted that this nitrogen is only available where the leaf drop or lateral root removal occurs, typically in close vicinity (1 – 2 m) of the leucaena plant, rather than over the full row spacing.



Soil already contains nitrogen fixing bacteria however nitrogen fixation with leucaena is most efficient with specific types or strains that are not generally present in the soil. Inoculating the seed is a cost effective method to maximise leucaena growth and leaf quality, grass yield and overall soil health. All are very important advantages of including a legume into the pasture.



## How to Inoculate the Seed

The correct rhizobia to use for Leucaena is CB3126. It is relatively inexpensive and can be purchased through agricultural suppliers or seed providers.

The inoculant is available in two forms –

**Nodule N** - a peat-based mix. Peat contains a high level of humic materials to help the rhizobium bacteria establish. This peat base is mixed with water to form a slurry and then applied to the seed prior to planting or via water injection.

**Easy Rhiz** – freeze-dried vial of concentrated inoculant that is suitable for liquid injection or the slurry inoculation method.

The inoculant is heat sensitive. It is recommended to store the inoculant in a cool place between 4°C - 10°C prior to use and plant seed as soon as possible after inoculation.

## Identifying Nodulation

Young nodules on leucaena are not yet fixing nitrogen and are often whiteish. As nodules grow in size, they will turn pink or reddish in colour due to leghemoglobin (similar to hemoglobin in blood) that controls oxygen flow to the bacteria. This colour change indicates that nitrogen fixation is occurring.

Pink or red nodules should predominate on leucaena during the growing season. If there is an abundance of white, grey or green nodules, there is little nitrogen fixation occurring which may be due to lack of rhizobia, poor plant nutrition or other plant stress.

Any stress that reduces plant activity, such as temperature extremes, drought or lack of sufficient nutrition and minerals, will reduce nitrogen fixation.

Nodules that are no longer fixing nitrogen may be green or grey or may be shed.

## Nitrogen Run Down

Older stands of leucaena may suffer from nitrogen run down where the plant is no longer fixing sufficient nitrogen for its needs and the surrounding pasture. This may be exacerbated by the depletion of other elements essential for leucaena productivity including phosphorous, potassium and trace elements.

Ongoing management of leucaena may require the addition of suitable fertiliser periodically (possibly at a 10-year period) to address the nutritional deficiencies and assist the plant for long-term productivity.

Once the nutritional stress has been corrected and additional inputs applied, the leucaena will respond not only to the inputs but also to the increased nitrogen resulting from the improved nitrogen fixation.

Lindemann, W.C., Glover, C.R. (2015). Nitrogen Fixation by Legumes. Agronomy Publications – Guide A-129, New Mexico State University

## 6.2 Case Studies

All Case Studies are available electronically at [www.leucaena.net](http://www.leucaena.net)

### 6.2.1 Goshen Station



#### 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 2<sup>nd</sup> and 3<sup>rd</sup> 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).



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





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.

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



## 6.2.2 Malilangwe

the  
leucaena  
network

Case Study

### Maximising Grazing Productivity with Leucaena

**Brett and Suzanne Gill**  
**Malilangwe, Douglas Daly NT**



Northern Territory graziers Brett and Suzanne Gill purchased crown lease NT portion 6071 from the NT government in late 2001 as part of the second greenfield land release in the Stray Creek land development precinct in Douglas Daly. As part of the NT government covenant requirement, they began developing the 2063 ha property and secured freehold title in 2004. They continue to work hard to transform Malilangwe into a viable and sustainable mixed grazing and cropping enterprise.

An interest in maximising Malilangwe's grazing productivity led Brett and Suzanne to participate in The Leucaena Network's Northern Territory Leucaena Establishment Producer Demonstration Site, a program supported by Meat and Livestock Australia, to establish trial leucaena plantings in Douglas Daly.

Brett and Suzanne's interest in participation in the project focused on the potential improved productivity from the introduction of leucaena.

"We had been considering the introduction of leucaena to Malilangwe for quite a while so the opportunity to undertake a trial to assist in determining if leucaena would suit our grazing system was a valuable opportunity," Brett said

[www.leucaena.net](http://www.leucaena.net)



"The ability to assess on our property, the three different leucaena varieties – Cunningham, Wondergraze and Redlands, as well as determine the optimum row spacings for our soils and climate for maximum productivity, were the key drivers of our participation."

A soil test prior to commencing the trial confirmed the Malilangwe's soils were suitable for successful establishment of leucaena with a soil type of grey to red earth and pH of 6.2. The site will require adequate fertiliser to achieve long-term best production and growth from leucaena. An average rainfall of 1250 mm supported the decision to trial leucaena.

Brett and Suzanne commenced site preparations for the trial in March 2019 with the application of broad leaf weed herbicides across the entire paddock. This was followed by banded application of a selective herbicides across the planned row spacings prior to planting in late January 2020. Malilangwe had experienced a drier start to the 2019-2020 wet season with only 281mm rain received prior to planting, providing the opportunity to assess the potential for a 'dry' plant with projections of imminent increased rainfall. 10ha each of Cunningham, Wondergraze and Redlands were planted with row spacings at 7m and 14m.



Whilst 250mm in 13 falls were received in the month following planting, final germination of 40% was deemed insufficient to continue with this initial trial and the plantings were removed.

Preparations for the trial re-plant commenced in January 2021 with the 29ha trial paddock ploughed in its entirety. Roundup was applied at 3lt/ha with Pulse surfactant at 400ml/100lt across the entire paddock after weed germination. This was done using a 21.5m Hardi linkage boom sprayer with 04 air induction nozzles.



Planting was undertaken on 20 January 2021 using a Lightning Mechanical two row Planter (2BFY-2C) with a picker finger seed drill and fertiliser hopper on a John Deere 6150R tractor with GPS auto steering. Additional soil moisture allowed the planter to form a small hill over the top of the centre of the leucaena row which Brett believes allowed for improved germination. 7ha of each of the three varieties – Cunningham, Wondergraze and Redlands were planted with 3.5ha of each planted at 7m rows and 3.5ha at 14m rows. All leucaena was planted at a depth of 13mm and in twin rows with 750mm centres.

The fertiliser AgFert Legume Extra was applied at planting, placed slightly beside and at the depth of the seed at a rate of 77kg/ha. No insecticide was used. A light rainfall of 14mm was received on the day of planting with no detrimental effects.

Improved pasture of Jarrah grass was planted the following day in five metre strips between the seven metre leucaena rows and ten metre strips between the 14 metre rows. This spacing allowed for a buffer between the leucaena seedlings and the grass. Application of Verdict and Spinnaker selective herbicides was undertaken post plant within the first month of planting to prevent the faster growing Jarrah from impeding the successful establishment of the leucaena. The pasture planting was undertaken with a five metre Williams planter/combine with gravity feed and disc openers.

60mm rain was received in the evening following the planting of the pasture which resulted in some pasture seed displacement and some minor erosion over the paddock resulting in some small gaps in the leucaena rows. An additional 60mm rain was received in three falls within the first week of the planting of the leucaena.



Three weeks after planting the leucaena seedlings were approximately five centimetres tall with 80% germination.

The new leucaena plantings were affected by some predation by wallabies, mainly affecting rows closest to retained bush areas however the impact was not severe enough to warrant the construction of exclusion fencing. Whilst the heaviest impact from wildlife was experienced at the end of the 2021 dry season, the leucaena was well-enough established to recover well after the first wet season rains in October.

Malilangwe was able to undertake an initial light graze of the leucaena in late 2021, 11 months after establishment, with 240 two-year old heifers in the trial for 10 days. The paddock was fully incorporated into Malilangwe's rotational grazing system over the subsequent 2021-2022 wet season.

It was noted that initially the cattle preferred the grass pasture however once they had acquired the taste for leucaena, the cattle proceeded to feed evenly in further grazings.

Brett continues to be impressed with the speed of re-growth of the leucaena after grazing.

"We have been able to graze the trial paddock three times for about 10 days and once for a month during the current 2021-2022 wet season," he said.

"Two of the grazes was with 240 head for ten days and one graze had 420 head of smaller one-year old cattle for ten days with about two weeks rest between grazes. We have just completed a 27-day graze of 90 male cattle on the 13<sup>th</sup> April 2022."

At the end of wet season rainfall and leading into the beginning of the dry season, Brett believes the leucaena could handle further grazing however this will solely depend on timing of the last rainfall.



Brett and Suzanne have been able to use the trial to assess the most suitable variety and row spacing for Malilangwe's location, climate and soils.

"We have found that this area of the Northern Territory does not have significant psyllid pressure, and this has been verified by the findings of more than 20 years of trials at the Douglas Daly Research Farm," Brett said.

"Based on this, we are leaning towards the Wondergraze variety for Malilangwe, due to its strong establishment, branching, amount of available fodder and resilience."

The row spacing of 14 metre, 750mm twin leucaena rows was the preferred option at Malilangwe. This is due to the amount of jarrah grass required to balance with the high amount of available leucaena fodder.

"We feel we will be able to take the cattle out of the paddocks with both the leucaena and grass at similarly grazed levels at the 14m row spacings, ensuring the cattle receive sufficient nutrients from both pasture species for maximum weight gain. This is still to be confirmed though."

Brett and Suzanne have undertaken some informal live weight gain assessments and noted that the leucaena trial paddock carried 88 head for a period of 27 days and achieved an average weight gain of 1.3kg per head per day. The lightest beast achieved a 1 kg/day average gain with the heaviest gaining an average of 1.8kg/day. The entire mob gained an average of 123kg/day. The cattle were removed following rain to enable both the leucaena and the jarrah grass to recover for further grazes prior to and into the coming dry season.

Malilangwe's irrigated jarrah pastures have previously achieved an average 1kg per day per head live weight gain so the dryland leucaena has compared favourably.

Brett believes the improved nutrition provided by the inclusion of leucaena in the cattle's diet is a key factor in the improved productivity.

"Whilst key determinants of increased weight gain would be each individual's sex, age and stage of life, and we are confident that our genetic selections are a key factor in our improved productivity, the leucaena feed resource is the most important driver in realising our investment in animal genetics," he said. "The trial is certainly indicating that leucaena has the potential to be an important addition to our grazing system, increase our overall carrying capacity, our ability to turn off heavier cattle faster and heightened productivity of our entire cattle enterprise."



## 6.2.3 Blackbull Station

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Case Study

### Leucaena – A Game Changer for the NT

#### Logan Reid – Blackbull Station Douglas Daly Northern Territory



'Blackbull Station' is one of the pick of properties in Douglas Daly region of the Northern Territory however manager Logan Reid is continually looking for ways to improve Blackbull's grazing potential.

When the opportunity arose to be a part of The Leucaena Network's MLA funded Producer Demonstration Site to determine the best leucaena variety and row spacing for the Douglas Daly region, he was keen to involve Blackbull and find out this information, specifically for Blackbull Station.

The demonstration site involved a comparison of germination, establishment and longer-term productivity of the Cunningham, Wondergraze and Redlands leucaena varieties as well as trialing different row spacings at 6m, 12m and 18m across a 47ha trial site.

Logan recognised the need to ensure that Blackbull's soil was suitable for leucaena as the first step.

"Soil tests identified that Phosphorous, Sulphur and Calcium were satisfactory for leucaena with Potassium in the high range but still suitable" he said.

"Once we were assured that we could grow leucaena without the need for a huge amount of external inputs, we were eager to see what the potential of leucaena on Blackbull could be."

Due to erosion concerns, no cultivation was undertaken with herbicides used for site preparation. Planting was undertaken on the 12<sup>th</sup> and 13<sup>th</sup> January 2020 with a Lightning Mechanical two row planter with a picker finger seed drill and fertiliser hopper. Fertilizer Legume Extra (Agfert) was applied at planting.

Details of the ground preparation and plant were:

| SITE PREPARATION       |  |
|------------------------|--|
| Date:                  | 16 December 2019   |
| Herbicide Application: | 2,4-D Amine 625 Herbicide (ADAMA)<br>Active Ingredient: 700 g/L 2,4-D present as dimethylamine and monomethylamine salts<br>Product Rate: 1.5 L/ha<br>Application: Blanket spray over entire paddock |

Blackbull Station

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|                                |   |
|--------------------------------|---|
| Implement Used:                | Hardy 30m boom spray. Lilac hardy mini drift nozzles  |
| Date:                          | 17 December 2019  |
| Herbicide Application:         | <u>Wipe-Out Bio Herbicide (ADAMA)</u><br>Active Ingredient: <u>Isopropylamine salt of glyphosate</u><br>Product Rate: 540g/L 2L/ha<br>Application: Banded spray over rows |
| Implement:                     | 700lt 3-point linkage 2.2m boom with yellow t jet   |
| Date:                          | 4 <sup>th</sup> January 2020  |
| Herbicide Application:         | <u>Wipe Out Bio-Herbicide ADAMA)</u><br>Active Ingredient: <u>Isopropylamine salt of glyphosate</u><br>Product Rate: 540g/L 2L/ha<br>Application: Banded spray over rows  |
| Implement:                     | 700lt 3-point linkage 2.2m boom with yellow t jet   |
| PLANTING:                      |   |
| Date:                          | 12 – 13 January 2020  |
| Implement (for all plantings): | Lightning Mechanical two row Planter (2BFY-2C) with a picker finger seed drill and fertiliser hopper.   |
| Variety:                       | Cunningham  |
| Total Plantings                | 10ha plus an additional 17ha outside of trial (to fill paddock)   |
| Row Spacing:                   | Twin rows with 60cm centres<br>10ha (trial site) at 6 m row spacing<br>17ha (additional) at 7m row spacing to finish the paddock  |
| Rate:                          | 2.9 kg/ha Seed at 5cm intervals   |
| Depth:                         | 25mm  |
| Variety:                       | Redlands  |
| Row Spacing:                   | Twin rows with 60cm centres<br>10 ha at 12m row spacing   |
| Rate:                          | 2.9/ha Seed at 5cm intervals  |
| Depth:                         | 25mm  |
| Variety:                       | Wondergraze   |
| Row Spacing:                   | Twin rows with 60cm centres<br>10 ha at 18m row spacing   |
| Rate:                          | 2.9/ha Seed at 5 cm intervals   |
| Depth:                         | 25mm  |
| Fertiliser                     |   |
| Date:                          | 12 January 2020<br>Applied at planting  |



|                        |   |
|------------------------|---|
| Fertiliser Used:       | <u>Legume Xtra AgFert</u><br>Composition: 7% N, 14 % P, 12% K + 1% zinc<br>Implement Used: Fertiliser hopper on Lightning Mechanical 2 row planter.<br>Product Rate: 220g/m<br>Placement: Placed slightly beside and at depth of seed at planting – 2 – 5 cm.                                   |
| Herbicide              |   |
| Date:                  | 13 January 2020 (day after planting)  |
| Herbicide Application: | <u>Wipe Out Bio-Herbicide ADAMA</u><br>Active Ingredient: <u>Isopropylamine salt of glyphosate</u><br>Product Rate: 540g/L 2L/ha<br>Application: Banded spray over rows<br><br><u>Spinnaker 700 WDG Application (BASF)</u><br>Active Ingredient: 700 g/kg Imazethapyr<br>Product Rate: 140 g/ha |
| Implement:             | 1 m shielded sprayer on buggy   |
| Pesticide              |   |
| Date:                  | 13 January 2020 (day after planting)  |
| Pesticide Application: | <u>Regent 200SC (BASF)</u><br>Active Ingredient: 200g/L Fipronil<br>Product Rate: 10m/ha<br>Application: targeted shield spray over rows  |
| Implement:             | 1m shielded sprayer on buggy  |
| Germination            |   |
| % Emergence:           | 80%   |
| Resilience:            | 70%   |
| Comments:              | Due to heavy rains, 1% of newly established leucaena is showing signs of waterlogging – slightly off colour.<br>A review on 29 January 2020, indicated that Wondergraze had the highest emergence at 14 spm. Other varieties were around 12 spm.  |

Logan believes that good site preparation and aiming to get the weed seed bank down prior to planting is essential for good germination and successful early establishment.

“Our wet season provides the ideal time for establishment of leucaena here in the Territory however it brings with it the potential for a prolific amount of weed pressure on the emerging and young seedlings,” he said.



Early Establishment Field Day  
Blackbull Station November 2020

"It is constant work to stay on top of the weed pressure in those first few weeks, even with the herbicides used on the mature plants prior to planting so to plant without trying to reduce the weed pressure before you start would mean so much extra work in the long run.

"Unless you are doing all the preparation required, don't think about planting."

An unplanned fire ravaged the paddock three months prior to planting the demonstration site which Logan believes may have assisted with the weed control.

"I am certainly not advocating for fire to be used in pre-plant weed eradication but to look on the bright side, it may have contributed to the easier establishment by the removal of much of the trash which gave a better spray coverage," he said.

"It's not a planting strategy we will aim for in our future plantings!"

To combat that early weed pressure, Wipe-Out Bio-Herbicide was applied using a shielded sprayer over the top of the rows about a month after planting. An additional application of Legume Extra was broadcast over the entire paddock a week after this to provide a boost to the young seedlings and pasture between the rows.

Blackbull Station has since undertaken additional leucaena plantings with a total of 67 hectares planted and more planned within the next few years.

The initial trial site has been included into Blackbull's grazing rotation with a live weight gain trial planned.

"We know that leucaena produces additional live weight gain but it will be good to formalise this with the documentation of actual weights and the assessment of what feed is actually available to the cattle and what they are consuming," Logan said.

"I believe if leucaena is planted in suitable grazing areas and is managed well, it provides the Territory's grazing industry with amazing potential."



*Early established leucaena on Blackbull Station November 2020*



*Leucaena and pasture on Blackbull Station March 2021*



## 6.2.4 Quincan Springs

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Case Study

### Leucaena Provides Choice Peter and Colleen McLucas Quincan Springs, Peeramon



With exceptionally fertile soil and an ongoing commitment to maximise outputs from their enterprise, Peter and Colleen McLucas had to consider whether the potential benefits of participating in the MLA Producer Innovation Fast-Track program 'Redlands for Regions' with The Leucaena Network would improve their bottom line.

Redlands, the new psyllid tolerant leucaena variety, was officially launched in May 2019 with Peter and Colleen being one of six graziers undertaking establishment trials prior to its release.

Peter and Colleen run a beef finishing enterprise on 'Quincan Springs' at Peeramon on the Atherton Tablelands on their 375 hectare property.

Peter and Colleen improved 'Quincan Springs' original grasses of setaria and brachiaria (signal grass) with rhodes grass, green panic and legumes including clover and glycine. Runners of pinto peanut were also planted. Prior to commencing with the Redlands trial, these improved pastures achieved weight gains of up to 250kg/hd per annum so Peter and Colleen were doubtful if adding leucaena to their grazing system would result in significant enough improvement to warrant the establishment costs.

"We purchased 'Quincan Springs' in 2005 and since that time have improved our pastures with the implementation of rotational grazing" Colleen said.

"This area provides exceptional pasture growth with improved pastures and legumes so we needed to seriously assess what the benefits of adding leucaena into our mix would be prior to committing to the trial."

Quincan Springs

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The McLucas family proceeded as part of the 'Redlands for Regions' trials and were able to demonstrate exceptional establishment of the 32 hectare trial and a greatly reduced timeframe from planting to the first graze.

The Redlands trial commenced with planting on 'Quincan Springs' on 30<sup>th</sup> January 2018 in single rows with 15 metres between each row. The planting rate was 1.3kg/ha. There was good soil moisture at planting with 224mm received in the last week of January 2018 and 8mm rain in the first few days after planting.



Peter McLucas and Bernie English (DAF) inspect the Redlands leucaena seedlings

Early establishment of 75% was observed at 6 days after planting.

The successful establishment was not without some issues.

The very high grass and legume biomass and ground cover, normally of great benefit to a grazing operation, required extensive cultivation to prepare the paddock for planting, resulting in significantly higher site preparation costs. This issue has since been addressed in subsequent leucaena plantings on 'Quincan Springs' with site preparation being undertaken much earlier to enable the grass stubble and root mass to break down prior to planting.



Quincan Springs early establishment seedlings



*Weed pressure on the newly established leucaena*

Heavy rain in early February 2018 resulted in some erosion in small areas of the site. Replanting of this area was undertaken on 14<sup>th</sup> February 2018 at the same planting rate. Once again establishment of 75% was achieved.

Weed pressure on the leucaena seedlings was a significant issue, particularly signal grass and pinto peanut. This required herbicide use as well as mechanical control. Peter and Colleen were determined to capitalize on the initial successful establishment and even undertook hand weeding in some areas.

Peter and Colleen were able to undertake an initial light graze with 276 steers for five days only on the trial site in July 2018 at only six months since planting. This graze was to encourage the leucaena to establish lateral branches and to address the minor psyllid load. Although psyllids were detected on the new growth, there were no significant detrimental effects.



*Cattle on 'Quincan Springs' during the first light graze*



Throughout the second half of 2018, the leucaena trial contributed to 'Quincan Springs' ability to continue their finishing operation despite dry conditions. The paddock was spelled throughout January 2019 with Peter and Colleen commencing their own live weight gain trial in February 2019.

Leucaena has proven to be a viable addition to Quincan Springs' grazing system with weight gains averaging 1 kg per day achieved.

Peter and Colleen have expanded their leucaena plantings with an additional 30 hectares in January 2020 however they are increasing the Leucaena/Grass ratio by reducing their row spacing from 15 to 7 metres.

"Whilst our increased weight gains are not as dramatic as those in a lower rainfall and less fertile soil environment, leucaena allows us to increase our carrying capacity to 2.5 A/E to the hectare," Colleen said.

"It provides us with the ability to continue to meet our market commitments during unseasonal dry spells – basically leucaena provides us with the opportunity to ride out weather and market fluctuations and take greater control of when we sell."





## 6.2.5 Cherwondah

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network

## Case Study

### Lifting Leucaena Yields with Fertiliser

#### Laurie and Gwen Peake 'Cherwondah' Wandoan

As leucaena producers for more than 18 years, Laurie and Gwen Peake have significant knowledge of the legume and the benefits it brings to their property Cherwondah at Wandoan in Central Queensland.

The couple attribute the legume to increasing their carrying capacity and the ability to turn off their Wagyu feeder steers and heifers at the maximum weight prior to winter compared to grass only pastures.



Laurie and Gwen commenced their leucaena journey in 2001 when a neighbour extolled the increased weight gain he was experiencing with leucaena. Over the next ten years, Cherwondah's 260 hectares of cultivation was developed to leucaena.

"My neighbour told me it would be like having oats for nine months of the year, so I gave it a go!" Laurie said.

"Another neighbour said, 'the only problem with is that I've only got half enough! He only had 400 ha of leucaena! So without further ado I got to and systematically planted my wheat country to leucaena."

Having previously taken part in a University of Queensland fertiliser trial on a small segment of their established leucaena and having observed the benefit of increased leucaena and pasture biomass, Laurie and Gwen were keen participants in The Leucaena Network's MLA funded Producer Demonstration Site (PDS) project - Improving the Productivity of Leucaena in Grass Pastures with Fertiliser.

As part of the project, Laurie fenced off two 8.1 ha (20 acre) plots of Tarramba leucaena, planted in 2005 – 'Beta' which was fertilised in July 2016 with off-the-shelf product Granulock Z Extra at a rate of 244kgs/ha. The fertiliser was applied by tyne at a depth of 100 – 150mm and at 300 – 500mm away from each row.

The increased growth and more vibrant colour visually observed was ground-truthed with three biomass assessments throughout the project. The analysis of both the pasture and leucaena growth indicated a doubling of the available pasture comprising slight improvement in the leucaena yield and significant improvement in the grass yield at almost seven times the unfertilised plot.

| Fertiliser treatment   | Pasture  | Nov-16 | May-18 | May-19 | Across years | Total pasture yield |
|--|----------|--------|--------|--------|--------------|---------------------|
| No fertiliser  | Leucaena | 302    | 427    | 491    | 1220         |                     |
|  | Grass    | 591    | 2085   | 2487   | 5163         | 6383                |
| Granulock Z extra<br>@ 244kg/ha  | Leucaena | 301    | 430    | 421    | 1152         |                     |
|  | Grass    | 4020   | 5265   | 4586   | 13871        | 15023               |
| Custom blend<br>@ 250kg/ha   | Leucaena | 412    | 379    | 590    | 1381         |                     |
|  | Grass    | 650    | 1665   | 2673   | 4988         | 6369                |
| Fertiliser applied: July 2016.   |          |        |        |        |              |                     |
| Granulock Z extra: 29kg/ha N; 48kg/ha P; 13kg/ha S; 5kg/ha Zn.                                   |          |        |        |        |              |                     |
| Custom blend: 60kg/ha P; 80kg/ha S; 120kg/ha K; 140kg/ha Ca; 5kg/ha Cu; 5kg/ha Zn; 0.13kg/ha Mo. |          |        |        |        |              |                     |

Cherwondah

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The increased biomass was correlated with two years of live weight gain trials which commenced 14<sup>th</sup> August 2016. Eight Wagyu steers, aged thirteen months were inducted into each paddock – fertilised and unfertilised.

Dry weather and declining feed required the cessation of the trial on 14 November 2016 however the live weight gains were measured for the 90-day duration. Those cattle on the fertilised leucaena achieved an average weight gain of 114kg and 1.7kg/day compared to 63kg and .7kg/day on the unfertilised leucaena. Total group weight advantage for the eight cattle in the fertilised paddock was 408kg or 51kg per head.

A second live weight gain trial commenced in October 2017 with a reduced number of cattle per paddock. On the 19<sup>th</sup> October 2017, five weaner steers with similar weights were inducted into each paddock. The youngest steers possible were used to allow for the longest trial time.



Laurie and Gwen report that the trial was almost at termination point again in January 2018 due to another very dry summer however February produced good rains with 68mm over three days from the 2<sup>nd</sup> to the 4<sup>th</sup> February and another 110mm received from the 18<sup>th</sup> to the 24<sup>th</sup> February. The cattle achieved market weight of at least 420kg by 20<sup>th</sup> April 2019 (183 days), one month earlier than expected.

Cattle on the fertilised leucaena achieved an average weight gain of 181kg and .99 kg/day compared to 170kg and .93kg/day on the unfertilised leucaena. Total group weight advantage for the five cattle in the fertilised paddock was 55kg or 11kg per head.

In total, over the two trials, the total group weight gain of the cattle on the fertilised leucaena compared to the unfertilised leucaena was 463kg.

Laurie recognises that the increased weight gains did not come without a cost.

“The cost of the fertiliser was \$2016 and I would estimate that the application costs were around \$15.00 per hectare so it is not an insubstantial investment,” he said.

Laurie estimates that in the short 18-month term of the live weight gain trials he would be about \$517 out of pocket. However, he is adamant that he will continue to see benefits in the years to come.

“We have had some shocking, dry years during this trial period and yet we have continued to see weight gain from the leucaena and particularly from the fertilised leucaena and grass pastures.

“Based on my experience with the previous fertiliser trials with UQ, I do not believe we will truly see the benefit of the fertiliser until we get a significant rain event but when that happens, and let’s hope it is soon, I hope that the fertilised paddocks will go ahead in leaps and bounds and pay dividends for many years to come.”



## 6.2.6 Fairview

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### Fairview 'Coastal Country' Live Weight Gain Trial

*Interim Results as at 20 February 2020*

The Fairview 'Coastal Country' Live Weight Gain Trial is a collaboration between Bruce and Lucinda Mayne of 'Fairview' Calliope, Central Queensland; Queensland Department of Agriculture and Fisheries (DAF) Rockhampton; The Leucaena Network; Agricultural and Pastoral Consultant, Ross Newman; Qld Beef Consultancy and Nutrien. The cattle for the trial were provided by Calliope graziers Philip and Claire Mann of Wycheproof, Edward and Kara Quinn of Voewood and Will and Kate Wilson of Calliope Station.



|                        |  |
|------------------------|--|
| <b>Aim</b>             | Compare the performance of cattle on a Redlands leucaena and sown grass pasture with cattle on native grass pastures for 12 months (May 2020 - May 2021).  |
| <b>Trial paddocks</b>  | <ul style="list-style-type: none"> <li>• Two paddocks with Redlands leucaena and signal grass established on black soil flats. Balance of paddocks is ironbark hills and a creek line with thatch grass and black spear grass.</li> <li>• Leucaena and signal grass is 46 ha in the total area of 114 ha.</li> <li>• Grass paddock of 38 ha on frontage country with access to Hymenachne and Para grass in a lagoon.</li> </ul> |
| <b>Cattle</b>          | <ul style="list-style-type: none"> <li>• 40 Calliope Station No 0 steers, used to allocate 20 to the Grass and Leucaena paddocks.</li> <li>• Groups of 20 No 0 steers from Calliope, Voewood and Wycheproof also run in the Leucaena paddocks.</li> </ul>  |
| <b>Data collection</b> | <ul style="list-style-type: none"> <li>• Steers inducted 29 May 2020, after a week together on grass at Fairview.</li> <li>• Weighed every 8 weeks.</li> <li>• Faecal samples collected at weighing and from paddock between weighings for Faecal NIRS to assess diet quality.</li> </ul>  |

Fairview Live Weight Gain Trial

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|                   |                   |  |
|-------------------|-------------------|--|
| Health treatments | 29 May 2020       | 5 in 1, Longrange Botulism & Tick Fever vaccine  |
|                   | 31 July 2020      | 5 in 1 & Three day sickness vaccine<br>Leucaena inoculum given to 10 Leucaena steers (Two steers in each of the four groups plus another two steers) |
|                   | 25 September 2020 | Three day sickness vaccine<br>Taktic plunge dip  |
|                   | 2 November 2020   | Taktic plunge dip  |
|                   | 20 November 2020  | Taktic plunge dip  |
|                   | 18 January 2021   | Fly tags<br>Taktic plunge dip  |

**Paddock areas and grazing periods**

| Paddock                    | Grass             | Greenbank         | Greenbank & Farmer Creek |
|----------------------------|-------------------|-------------------|--------------------------|
| Total area (ha)            | 38                | 131               | 160                      |
| Leucaena & sown grass (ha) |                   | 37                | 46                       |
| Native grass (ha)          | 38                | 94                | 114                      |
| Number of steers           | 20                |                   | 80                       |
| Grazing periods            | 29/05/20-15/02/21 | 29/05/20-15/10/20 | 16/10/20-15/11/20        |
|                            |                   | 16/11/20-05/12/20 | 06/12/20-15/02/21        |
| Grazing days               | 262               | 159               | 103                      |

**Liveweights**

| Date     | Grass | Leucaena | Voewood Leucaena | Wycheproof Leucaena | Calliope Leucaena |
|----------|-------|----------|------------------|---------------------|-------------------|
| 29/05/20 | 3.5   | 3.4      | 3.6              | 3.2                 | 3.5               |
| 31/07/20 | 2.9   | 3.2      | 2.9              | 2.8                 | 3.1               |
| 25/09/20 | 2.8   | 3.2      | 2.8              | 2.8                 | 3.1               |
| 20/11/20 | 2.8   | 3.3      | 2.9              | 3.0                 | 3.1               |
| 18/01/21 | 3.2   | 3.6      | 3.2              | 3.3                 | 3.4               |
| 15/02/21 | 3.5   | 3.9      | 3.8              | 3.9                 | 3.9               |

**Body condition scores (Range: 1 (Low) - 5 (High))**

| Date     | Grass | Leucaena | Voewood Leucaena | Wycheproof Leucaena | Calliope Leucaena |
|----------|-------|----------|------------------|---------------------|-------------------|
| 29/05/20 | 3.5   | 3.4      | 3.6              | 3.2                 | 3.5               |
| 31/07/20 | 2.9   | 3.2      | 2.9              | 2.8                 | 3.1               |
| 25/09/20 | 2.8   | 3.2      | 2.8              | 2.8                 | 3.1               |
| 20/11/20 | 2.8   | 3.3      | 2.9              | 3.0                 | 3.1               |
| 18/01/21 | 3.2   | 3.6      | 3.2              | 3.3                 | 3.4               |
| 15/02/21 | 3.5   | 3.9      | 3.8              | 3.9                 | 3.9               |



Interim liveweight gain (kg/hd)

| Period            | Days | Grass | Leucaena | Voewood -<br>Leucaena | Wycheproof<br>Leucaena | Calliope -<br>Leucaena |
|-------------------|------|-------|----------|-----------------------|------------------------|------------------------|
| 29/05/20-31/07/20 | 63   | 6.4   | 19.2     | 10.1                  | 17.9                   | 19.9                   |
| 1/08/20-25/9/20   | 56   | 8.1   | 37.0     | 34.3                  | 31.9                   | 38.5                   |
| 26/9/20-20/11/20  | 56   | 18.2  | 44.5     | 45.4                  | 49.8                   | 48.0                   |
| 21/11/20-18/01/21 | 59   | 54.5  | 48.4     | 54.3                  | 54.0                   | 52.6                   |
| 19/01/21-15/02/21 | 28   | 28.8  | 23.2     | 26.1                  | 29.0                   | 26.7                   |

Total liveweight gain (kg/hd)

| Period            | Days | Grass | Leucaena | Voewood -<br>Leucaena | Wycheproof<br>Leucaena | Calliope -<br>Leucaena |
|-------------------|------|-------|----------|-----------------------|------------------------|------------------------|
| 29/05/20-15/02/21 | 262  | 115.2 | 171.1    | 169.7                 | 182.7                  | 181.6                  |

Interim average daily gain (kg/hd/day)

| Period            | Days | Grass | Leucaena | Voewood-<br>Leucaena | Wycheproof<br>Leucaena | Calliope-<br>Leucaena |
|-------------------|------|-------|----------|----------------------|------------------------|-----------------------|
| 29/05/20-31/07/20 | 63   | 0.101 | 0.304    | 0.161                | 0.284                  | 0.316                 |
| 1/08/20-25/9/20   | 56   | 0.144 | 0.660    | 0.613                | 0.570                  | 0.687                 |
| 26/9/20-20/11/20  | 56   | 0.325 | 0.794    | 0.811                | 0.890                  | 0.857                 |
| 21/11/20-18/01/21 | 59   | 0.923 | 0.820    | 0.921                | 0.914                  | 0.891                 |
| 19/01/21-15/02/21 | 28   | 1.027 | 0.829    | 0.932                | 1.036                  | 0.954                 |

Overall Average Daily Gain (kg/hd/day)

| Period            | Days | Grass | Leucaena | Voewood -<br>Leucaena | Wycheproof<br>Leucaena | Calliope -<br>Leucaena |
|-------------------|------|-------|----------|-----------------------|------------------------|------------------------|
| 29/05/20-15/02/21 | 262  | 0.440 | 0.653    | 0.648                 | 0.697                  | 0.693                  |

**Paddock Liveweight Gain 29/05/2020 – 15/02/2021 (262 days)**

| Paddock                    | Grass paddock | Leucaena & signal grass area only* | Total area Leucaena paddocks |
|----------------------------|---------------|------------------------------------|------------------------------|
| Area (ha)                  | 38            | 41                                 | 142                          |
| Number of steers           | 20            | 80                                 |                              |
| Total liveweight gain (kg) | 2,304         | 14,101                             | 14,101                       |
| Liveweight gain (kg/ha)    | 61            | 348                                | 99                           |

\* The leucaena area and the total area of the leucaena paddocks, are the mean areas available to the steers, calculated from the areas and grazing periods in Table 1.

**Adult Equivalents / paddock (1AE = 455 kg liveweight)**

| Date     | Grass Paddock | Leucaena Paddocks |
|----------|---------------|-------------------|
| 29/05/20 |               | 12.1              |
| 31/07/20 |               | 12.6              |
| 25/09/20 |               | 12.7              |
| 20/11/20 |               | 13.5              |
| 18/01/21 |               | 15.9              |
| 15/02/21 |               | 17.2              |
| Mean     |               | 14.7              |

**Stocking rate (Adult equivalents /hectare)**

| Date     | Grass Paddock | Leucaena & signal grass area only* | Total area Leucaena paddocks |
|----------|---------------|------------------------------------|------------------------------|
| 29/05/20 | 0.32          | 1.05                               | 0.30                         |
| 31/07/20 | 0.33          | 1.12                               | 0.32                         |
| 25/09/20 | 0.34          | 1.28                               | 0.36                         |
| 20/11/20 | 0.36          | 1.48                               | 0.42                         |
| 18/01/21 | 0.42          | 1.70                               | 0.48                         |
| 15/02/21 | 0.45          | 1.81                               | 0.52                         |
| Mean     | 0.39          | 1.43                               | 0.41                         |

## 6.3 Northern Territory Leucaena Code of Practice

the  
leucaena  
network



### NORTHERN TERRITORY Best Management Code of Practice Establishing and Managing Leucaena Pastures

*"Promotes the responsible establishment and management of combined leucaena grass pastures"*

#### Preamble

Leucaena (*Leucaena leucocephala* subspecies *glabrata*), when planted with improved grass species has the capacity to provide a sustainable and profitable forage grazing system in northern Australia. Leucaena has been grown commercially across parts of Australia since the late 1970s. It is recognised that Leucaena is a valuable forage when managed properly, but it constitutes a threat to the natural environment if not contained in those areas in which it has been planted or controlled in those areas that it has invaded. This document is based on the "Code of Practice for Managing the Weed Potential of Grazed Leucaena Pastures" first developed in Queensland in 2010. It has been adapted for Northern Territory conditions.

#### Weed Potential

If Leucaena is ungrazed or unmanaged there is potential to form dense thickets over time. The current environmental impacts come from **both** ungrazed 'common' Leucaena (*L. leucocephala* subsp. *leucocephala*) and commercial cultivars of the subspecies *L. leucocephala* subsp. *glabrata*. Mature plants in these situations can produce a quantity of seed which has a dormancy period (that can be many years) before germination occurs. Leucaena seed can be unintentionally spread multiple ways including via wind, birds, grazing animals, and water flow if near waterways. Leucaena seed has the potential to stay viable in the soil for many years and if established in dense thickets, can be difficult and time-consuming to eradicate.

#### Common Leucaena

The common Leucaena (*L. leucocephala* subsp. *leucocephala*) has been naturalised in coastal and urban areas of northern Australia for more than 100 years, long before the release of commercial cultivars for grazing. In the Northern Territory, Leucaena is commonly referred to as Coffee Bush and is typically found in peri-urban, disturbed, and roadside areas.

#### Cultivated Leucaena

It must be noted that commercial cultivars of the subspecies *L. leucocephala* subsp. *glabrata* are managed on-farm for productive purposes. Nevertheless, where unmanaged it also has a similar weed potential to the common Leucaena. The Leucaena Network actively promotes this **Code of Practice** for responsible management of commercial Leucaena varieties.

Commercial Leucaena pastures **must not** be allowed to contribute to a weed problem beyond the extent of the Leucaena plantation or property boundary.

## Commercial Benefits

Leucaena presents an opportunity for Northern Territory beef producers to diversify their grazing operations. Once Leucaena is established, it can be used to significantly improve animal productivity compared to unimproved native pastures, mainly through superior live weight gains for the breeding herd and for finishing steers. Grazing trials in established Leucaena areas have demonstrated at least 50 kg/hd/year live weight gain benefit for Leucaena over grass only pastures. Preliminary desktop analysis for the Katherine and Victoria River District indicates an increase in gross margin per steer of approximately \$150 when Leucaena is used.

## Environmental Benefits

The effects of Leucaena-finishing of cattle on greenhouse gas emissions, production, and profitability at the whole farm level has also been modelled using the Beef Greenhouse Accounting Framework. Finishing steers on Leucaena has been shown to effectively increase animals carried and live-weight turnoff by 15% and 31%, respectively, compared to grass pastures. The National Livestock Methane Program determined that average methane output (g/kg live weight gain) was 28% less on Leucaena – grass pastures compared to grass (Rhodes) only pastures.

In addition, Leucaena enhances nitrogen (N) supply to the soil which improves grass growth and groundcover, and enhances soil reserves of organic matter which in turn stimulates soil biological activity and improves the soil structure.

## Recommendations for Producers

In order to promote the sustainable and long-term economic benefits of Leucaena, it is essential that the risks of weed spread are mitigated by the adoption of the Code of Practice (NT) by all landowners who have Leucaena planted on their properties.

The Leucaena Code of Practice (NT) is actively promoted by The Leucaena Network in the Northern Territory and provides clear guidelines to minimize the environmental risk of unmanaged Leucaena in regional and rural areas.

The use of Leucaena for any purpose other than as a highly managed and well contained forage crop for animal production is **not** supported by industry bodies and Government agencies and should be discouraged.

## Aims of the Code

- Limit the unplanned spread of Leucaena through responsible planting strategies
- Minimise seed set in grazed stands
- Minimise the risk of seed dispersal
- Control escaped plants from grazed stands



## NT LEUCAENA CODE OF PRACTICE PRINCIPLES

Plant Leucaena **ONLY** if you intend to manage it and are prepared to accept responsibility to control Leucaena that establishes outside the planted area on your property. Under this Code of Practice, it is necessary to implement **ALL** the following management practices in order to mitigate the risk of Leucaena spreading from planted areas.

- a) Fully fence Leucaena plantations to manage grazing operations and avoid the risk of stock spreading seed.
- b) Maintain a Leucaena-free minimum separation distance between Leucaena plantation fencing and the property boundary, in accordance with corresponding property boundary buffer widths recommended in the Northern Territory Planning Scheme Land Clearing Guidelines (NTPS Guidelines) (see **Table 1**).

**Table 1** - Minimum separation distance between property boundary and Leucaena fencing

| Property size (ha) | Minimum distance from property boundary to Leucaena fence (m) |
|--------------------|---|
| <8                 | 25  |
| 8 to 20            | 50  |
| 20 to 100          | 100   |
| >100               | 200   |

- c) Maintain a Leucaena-free minimum separation distance of 250 m between Leucaena plantation fencing and the boundary of NT and Commonwealth National Parks, Conservation Reserves, and private Conservation Reserves.
- d) Only plant Leucaena in areas where rivers, creeks, floodways and other sensitive drainage features cannot disperse or collect seed. Maintain a minimum Leucaena-free separation distance between Leucaena plantation fences and the outer edge of the features described in **Table 2**.

Stream order can be determined from a topographic map of an appropriate scale (generally 1:100,000 or 1:50,000) (see **Figure 1**). A stream order spatial dataset is also available on NR Maps <https://nrmaps.nt.gov.au/nrmaps.html>. Use this dataset as a guide only and field verify the location of riparian areas prior to planting.

- e) Establish and maintain a minimum 10m wide Leucaena-free buffer of vigorous grass-pasture between Leucaena plantation fences and Leucaena plantations.

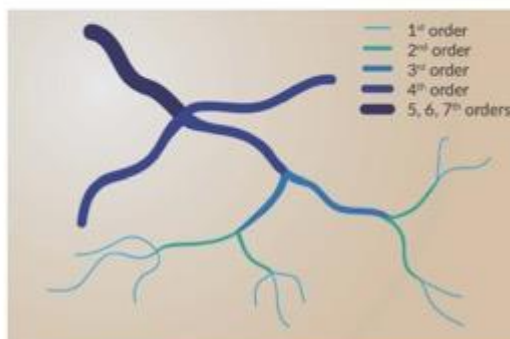


Figure 1 – Stream orders (NTG, 2019).

Table 2 – Minimum separation distances between Leucaena plantation fencing and drainage features (adapted from the NTPS Guidelines)

| Drainage feature   | Stream Order  | Minimum separation distance (m) | Measured from (see Appendix 1)   |
|--|---|---------------------------------|--|
| Drainage depression  | Not applicable  | 100                             | The outer edge of the drainage depression, which is the extent of the associated poorly drained soils and associated vegetation                            |
| Intermittent Streams and Creeks                                | 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , and 4 <sup>th</sup> | 100                             | The outer edge of the riparian vegetation or levee (whichever is the greater). If braided channels are present, the edge of the outer-most stream channel. |
| Rivers   | 5 <sup>th</sup> or higher   | 250                             |  |
| Low/Medium Value Wetlands and Groundwater Dependent Ecosystems | Not applicable  | 100                             | The outer edge of areas that are dominated by plants adapted to seasonally saturated and/or inundated conditions   |
| High Value Wetlands and Groundwater Dependent Ecosystems       | Not applicable  | 250                             |  |
| Sinkholes  | Not applicable  | 100                             | The outer edge of the sinkhole perimeter.  |

- f) Establish and maintain vigorous grass-pasture in the Leucaena plantation inter-rows to:
- provide competition to minimise establishment of volunteer Leucaena seedlings
  - minimise the risk of seed being transported during heavy rain events
  - productively utilize fixed nitrogen that the legume-based system produces
  - maintain groundcover and prevent soil erosion.
- g) Graze or cut Leucaena to a height of less than 3 m to keep it within the reach of cattle and to minimise flowering and seed set.
- h) Monitor for Leucaena spread by regularly inspecting buffer zones, drainage areas, watercourses and property boundaries to detect and control Leucaena seedlings and plants. Control Leucaena plants found within buffer zones or outside of paddock or property boundaries. Chemical control is recommended in these areas. Refer to the Northern Territory Weed Management Handbook for recommended chemicals [www.nt.gov.au/weeds](http://www.nt.gov.au/weeds).
- i) Report the location and control of any Leucaena plants that have escaped from dedicated grazing paddocks to areas outside Leucaena plantation fencing to the Northern Territory Weeds Management Branch of the Department of Environment, Parks and Water Security (DEPWS) on (08) 8999 4567 or email [weedinfo@nt.gov.au](mailto:weedinfo@nt.gov.au).
- j) Register Leucaena plantations with The Leucaena Network
- k) Promote the responsible management of Leucaena in accordance with this Code including communicating the requirements of the Code to new managers and/or owners of the property.
- l) Keep abreast of developments in best management practices for Leucaena and adaptively manage related operations according to any changes or developments.
- m) Remove any Leucaena plantations on your property that you do not intend to manage in accordance with the requirements of this Code.

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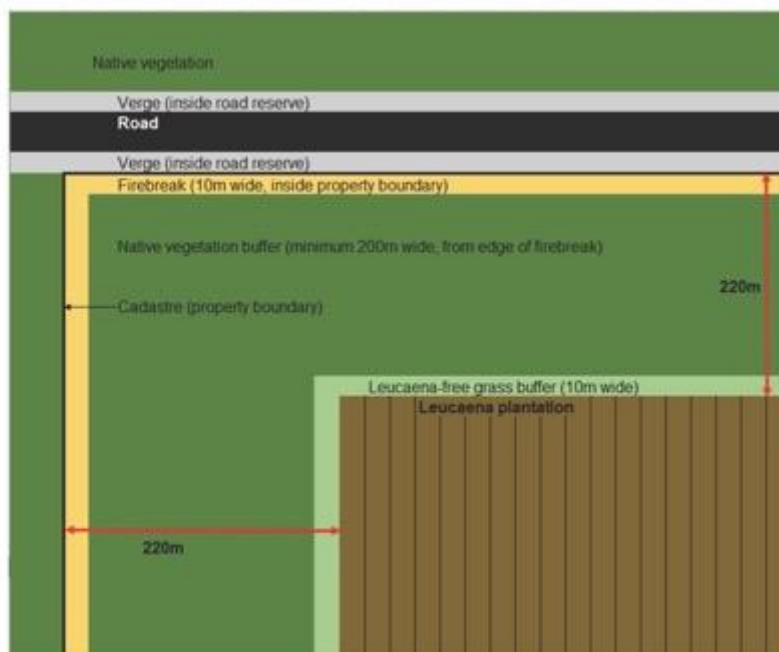
The Northern Territory Leucaena Best Management Code of Practice was developed in consultation with the Department of Environment, Parks and Water Security and Northern Territory grazing representatives. The following organisations endorse the adoption of the Code of Practice to maintain a sustainable and profitable beef industry using Leucaena pastures:

NT Department of Industry, Tourism, and Trade  
NT Farmers  
Northern Territory Cattlemen's Association

## Appendix 1. Examples to assist interpreting the NT Leucaena Code of Practice in relation to NT Land Clearing Guidelines

### Example Scenario 1:

*Typical example for pastoral lease or unzoned freehold property where new clearing of native vegetation in accordance with an approved permit will be required in order to establish a Leucaena plantation.*

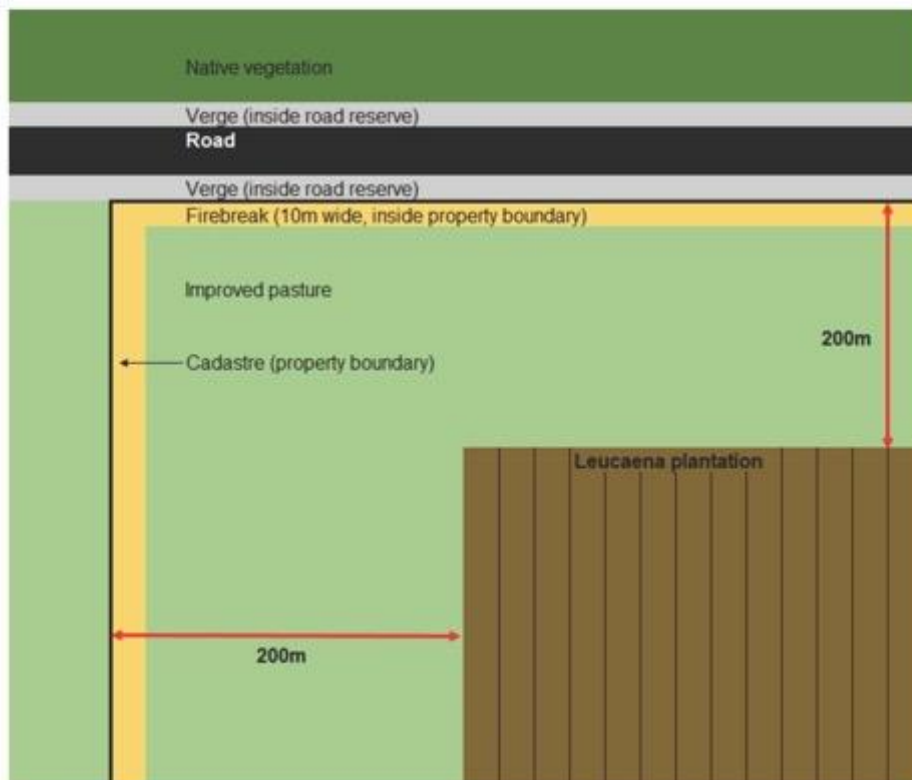


- ✓ Property is >100 ha and cadastral (property boundary) is fenced.
- ✓ Area surrounding Leucaena plantation is characterised by native vegetation and has not previously been cleared.
- ✓ A land clearing permit has been approved for the Leucaena plantation under the relevant legislation.
- ✓ As per the Code and in accordance with the NTPS Land Clearing Guidelines, a native vegetation buffer with a minimum width of 210 m (including a 10 m wide firebreak) has been retained along the cadastral boundary.
- ✓ As per the Code, the Leucaena plantation has been fenced. The property boundary fence line acts as part of the Leucaena plantation fence line; and as per the Code, a (minimum) 10m wide Leucaena-free grass buffer has been retained adjacent to the Leucaena plantation. The total distance from the cadastral boundary to the external edge of the Leucaena plantation is a minimum of 220 m.



### Example Scenario 2.

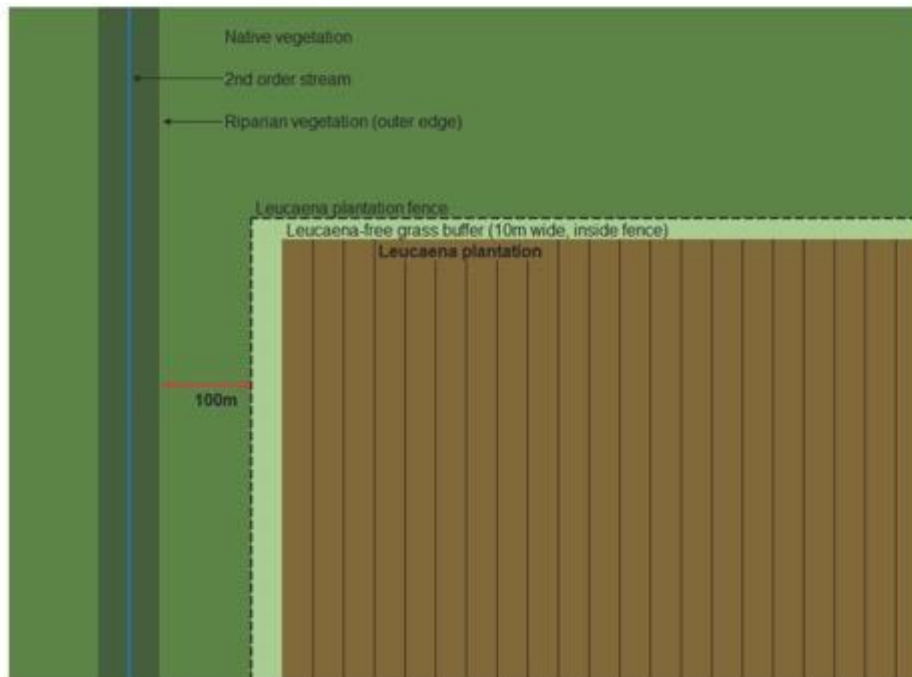
*Typical example for pastoral lease or unzoned freehold property where clearing of native vegetation has previously occurred and has been maintained free of native vegetation to date.*



- ✓ Property is >100 ha and cadastre (property boundary) is fenced.
- ✓ Native vegetation has previously been cleared within the property, to the cadastral boundary.
- ✓ **Note: Before planting Leucaena, contact DEPWS for advice regarding whether a new clearing permit or variation to an existing permit is required.**
- ✓ As per the Code, a minimum separation distance of 200 m (including a 10 m wide firebreak) has been retained along the cadastral boundary.
- ✓ The property boundary fence line acts as the Leucaena plantation fence line; and as per the Code, a (minimum) 10m wide Leucaena-free grass buffer has been retained inside the fence line.
- ✓ The total distance from the cadastral boundary to the external edge of the Leucaena plantation is a minimum of 200 m.

### Example Scenario 3:

*Typical example for pastoral lease or unzoned freehold property.*



- ✓ Leucaena plantation is within proximity of a second order stream.
- ✓ A land clearing permit has been approved for the Leucaena plantation under the relevant legislation.
- ✓ The NTPS Land Clearing Guidelines requires a native vegetation buffer with a minimum width of 50 m to be retained along second order streams, from the outer edge of the riparian vegetation.
- ✓ As per the Code, a 100 m wide native vegetation buffer has been retained from the outer edge of the riparian vegetation to the Leucaena plantation fence line.
- ✓ As per the Code, a 10 m wide Leucaena-free grass buffer has been retained between the Leucaena plantation fence line and the external edge of the Leucaena plantation.

## References

NTG (2020). Land clearing guidelines Northern Territory Planning Scheme, Department of Environment and Natural Resources, Darwin. Available at: [https://nt.gov.au/\\_data/assets/pdf\\_file/0007/236815/land-clearing-guidelines.pdf](https://nt.gov.au/_data/assets/pdf_file/0007/236815/land-clearing-guidelines.pdf)