

final report

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Accelerating uptake of leucaena-based pastures

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Abstract

Leucaena-based pastures offer one of the most productive feed-base options for northern beef producers where rainfall and soils are suitable. The Leucaena Network (TLN) aims to provide beef producers with a range of industry information and education tools to meet the increasing integration of Leucaena into pasture management. This project has also assisted in the establishment of two producer demonstration sites (PDS) and provided a level of financial support for activities coordinated by the Network.

The project work has focussed on reviewing and re-invigorating the leucaena industry Code of Practice, providing industry management and training materials and facilitating workshops and training days. TLN has also initiated work on fertiliser applications in established leucaena pastures and is currently facilitating a number of trials to gain additional environmental chemical permits to control unwanted wild leucaena that exists across Queensland. This work is in collaboration with AgForce, Dow Agro Science and DAFF Qld.

Estimates indicate that leucaena production in Queensland has surpassed 250,000 ha. A sustained dry period throughout Queensland together with a single leucaena seed supplier has slowed adoption during the project period. The 'early adopter' phase has past; the task of moving into second phase of broader adoption is far more challenging. There is a major requirement to continue the promotion and education of leucaena's grazing value for high value beef production.

Redlands leucaena will play a significant role in expanding leucaena's adoption as a primary legume for pasture fed cattle. The new variety has enormous economic benefits to the beef industry in coastal, tropical regions where psyllid infestation has limited the adoption of leucaena based pastures in northern Australia.

Executive summary

The Leucaena Network (TLN) was established in 2000 by a small group of concerned growers who felt leucaena production was under threat by lobby groups wishing Leucaena to be declared a noxious weed. TLN is the voice for all Leucaena growers and its Mission Statement “Promoting the responsible establishment and management of Leucaena” clearly states its role in supporting a productive and sustainable industry. TLN in response to these lobby groups developed a voluntary Best Management Code of Practice, outlining critical guidelines to establish and manage Leucaena responsibly.

The main activities of the project

- Review and upgrade the Leucaena Code of Practice into a Best Management Code of Conduct consulting with MLA, DAFQ, Agforce, producers and other industry bodies so as to address all current issues concerning Leucaena use, particularly the leguminous weed potential. The presence of the BMP code and adherence to its guidelines is critical to the Industry.
- Produce information materials on responsible and productive use and management of leucaena and sponsor training opportunities to assist producers increase their skills and knowledge.
- Support and be engaged in the consultation process with MLA and UQ for the commercialisation of the psyllid resistant variety, Redlands.
- Support the release of Redlands variety through the coordination of field and training activities.
- Facilitate and conduct field trials to support environmental permit registrations for use of herbicides to control weedy leucaena.
- Facilitate and conduct on-farm field trials in commercial paddocks to determine the impact of fertiliser on leucaena growth and cattle production, with support from graziers.

Expansion of Leucaena

There has been a dramatic increase in the area planted to leucaena across Queensland and northern Australia. The exact area under production at present in Australia is unknown; however current estimates put it at greater than 250,000 ha with the majority in Queensland. There has been significant interest in the Northern Territory and Western Australia, with some smaller test plantings in NSW. Overseas interest has been growing with enquiries from Thailand, Chile, Madagascar, Ethiopia, South Africa and Israel.

Training and Information

During the three-year project, TLN has held 20 successful events with close to 1000 participants. Events included seminars, regional representative and information days, and leucaena conferences. Further, TLN website has been continually maintained with new information, six newsletters have been produced for members, and countless number of phone calls and emails has been managed. Many facets of the industry have been covered by these activities, including best practice

management, environmental and economic benefits, plant and animal nutrition, management of rundown pasture and leucaena, fertiliser requirements and of course the promotion of “the best management Code of Practice”.

TLN has been involved with the facilitation of the Northern QLD Leucaena PDS at Mt Garnet, through the support and technical assistance of Stuart Buck, DAFFQ (Minute Secretary of TLN) and the Executive Officer. The PDS will demonstrate the value of leucaena amongst standing trees in native pastures. The site will demonstrate seeding, including planting equipment, seed dressing, fertiliser management, planting techniques, row configuration and leucaena establishment and pest management control measures. Further open days will discuss the grazing management techniques and TLN’s code of conduct. The demonstration site will facilitate adoption of leucaena pastures to producers in North Qld.

TLN facilitated a PDS project with cattle producers in the Wandoan –Taroom district to revisit the old Leucaena fertiliser trial sites and determine impacts of fertiliser >5 years after initial trials ceased. Also, soil samples were taken in commercial leucaena paddocks to define a fertiliser regime and measure the impact of applying fertiliser. Clearly nutrition is an industry concern with regional soil tests indicating low levels of phosphorus, sulphur and in some cases potassium. Low nitrogen nitrate (50kg/ha or less) levels are impacting grass pasture dry matter production; further fertiliser evaluation testing would help assess leucaena’s contribution in arresting nitrogen tie-up in the north.

TLN had a stand at the 2015 “Beef Week” in Rockhampton. The site manned by TLN volunteers handled a constant flow of producer and industry enquires on leucaena. It has also provided the Network with the opportunity to espouse the best management “Code of Practice” and the importance it plays in minimising the leucaena weed threat in northern Australia. Also, TLN held a hugely successful seminar at Beef Week with MLA speakers. There were in excess of 100 people attending the seminar, the topics discussed the release of Redlands and its suitability for grazing on the eastern seaboard. The second topic covered the value of leucaena in the carbon market and how graziers could participate.

TLN attended one MLA Beef-Up forum over the period of the project at Mt Surprise, followed by attendance at the Northern Australia Beef Research Update Conference in Rockhampton. TLN gave presentations on days 2 and 3. The Network provided management information to a range of audiences, while highlighting environmental and economic issues relating to Leucaena.

The Leucaena Network commenced field trials to support environmental permit chemical registrations to manage out-of-place leucaena. Trials are located at Brian Pastures, Gayndah (site initiated December 2015) and Belmont Research Station, Rockhampton (site initiated January 2016). Two assessments have been undertaken, and a further assessment is required in late 2016 early 2017 to complete the chemical evaluation before submitting a report to DAFFQ and ultimately APVMA to seek additional chemical environmental permits.

The expansion of leucaena across northern Australia has in part been due to the availability of effective herbicides. In particular, Imazethapyr (trade names include Spinnaker, Impale, Amaze) is the only herbicide available for the control of grass and broadleaf weeds during establishment; however it is available to industry via a permit. The permit required a renewal in 2015. The Leucaena Network successfully prepared a permit submission to APVMA to renew the permit for a further 3 year extension. A further extension appears unlikely post 2018 unless there are more supplier trials or market evaluation on how much product is sold together with data on its use from the industry. An assessment needs to be supplied to APVMA before 2018. Further investment is

required to provide industry access to a range of herbicides to manage weeds in the critical phase of leucaena establishment. This issue is of extreme importance to ensure reliable expansion of leucaena-pastures in coastal environments based on the impending availability of a suitable variety (Redlands).

The Network has engaged with MLA on a number of occasions searching for methods for cattle producers to enter the carbon trading market. It is difficult for a smaller producer to engage in the C market as there is a need for large herd sizes to generate sufficient credits to overcome the costs associated by engaging an aggregator. This erodes the producer value proposition even though productivity gains can be significant through improved herd and nutritional management; linking the two major benefits for producers has proved elusive.

News articles have been supplied for 'The Muster' publication and two electronic newsletters have been provided to members and industry each year together with regular website updates.

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1. Background

The Leucaena Network (TLN) has been operating as not-for profit organisation for 16 years supporting and promoting Leucaena use as a highly palatable legume fodder within a grass pasture. The organisation has been instrumental in supporting leucaena's exponential growth across northern Australia (predominately in Queensland) by providing extension services in close association with MLA, UQ and DAFF Q.

Leucaena is one important legume for the cattle industry and can significantly increase beef production and economic returns per hectare. Leucaena will also assist the cattle industry meet the expanding free trade agreements and the demands for protein from our northern neighbours and other trade partners. Leucaena is one of the most cost effective forms of protein available to the northern Australian cattle industry.

It is estimated that there is about 5 million ha of land suitable for leucaena in northern Australia. With the new variety Redlands being psyllid resistant, another 1-2 million ha of coastal land would be suitable, providing a total of around 6-7million ha. Only a proportion of that would be sown, mainly due to landscape issues such as slope, existing vegetation and infrastructure and soil variability. The Network conservatively estimates that 2 million ha of grazing land could be sown to leucaena over time; therefore only about 10% of the potential area is currently sown. The psyllid resistant variety Redlands is highly suitable for coastal areas where psyllid infestation is prevalent, but could also be sown across western districts where psyllids are an intermittent problem. There is also opportunity for overseas sales of leucaena seed but the limited availability, especially in the short term, will limit these opportunities.

2. Project objectives

1. Review and upgrade the Leucaena Code of Practice into a Best Management Code of Conduct consulting with MLA, DAFFQ, Agforce, producers and other industry bodies so as to address all current issues concerning Leucaena use, particularly the leguminous weed potential. The presence of the BMP code and adherence to its guidelines is critical to the Industry.
2. Produce information materials on responsible and productive use and management of Leucaena and sponsor training opportunities to assist producers increase their skills and knowledge
3. Support and be engaged in the consultation process with MLA and UQ for the commercialisation of the psyllid resistant variety, Redlands.
4. Support the release of Redlands through the coordination of field and training activities.
5. Facilitate and conduct field trials to support environmental permit registrations for use of Tebuthiuron and other chemicals to control weedy leucaena.

3. Methodology

Operationally, project activities have been implemented by a part-time Executive Officer, (EO), guided and supported by the voluntary committee, regional representatives and DAFF Q staff.

The EO has coordinated field days and training activities along with the annual conferences, and therefore has led industry engagement and communication / extension processes. Collectively TLN have coordinated a large number of leucaena activities across Queensland, and managed all enquires by providing appropriate advice to industry both within Australia and overseas. During this project TLN has collaborated with beef producers, MLA, UQ, DAFF Q, AgForce, Dow AgroScience, USQ, CRT, councils, catchments and Landcare groups and other industry supporters.

4. Results and discussion

The four main activities in this process have been to:

1. Review the code of practice
2. Produce information materials and sponsor training opportunities
3. Support the release of the new leucaena variety Redlands through the coordination of field and training activities
4. Facilitate and conduct field trials to support registrations of other herbicides to control weedy leucaena.

4.1 Review the Code of Practice

The Best Management Code of Practice has been modified in consultation with industry, MLA, Agforce and DAFF Q. Additional modifications will be needed in future with constant revisions to the state government and council legislative and policy requirements surrounding the threat of becoming a weed of significance.

The underlying ethos of TLN is, if a grazier is not willing to follow the code of practice, then leucaena should not be planted. The critical aspirations of the code support management practices such as never planting in areas close to rivers, creeks or flood channels where seed dispersal, is highly likely. The code is well support by government agencies. There are still a number of groups and activists who will lobby to prevent the growing of leucaena in some bioregions so it is important to keep the code of practice at the front of industry communications, this has been a high priority for this project. Discussion has occurred with councils, council weed, railway and catchment staff with the support of Agforce or by direct engagement. One particular, positive outcome has been the endorsement of the code of practice by the Whitsunday Regional council. This council has declared Leucaena a weed within its shire boundaries, however has allowed the commercial grazing use of leucaena as long as graziers submit a management plan based on the code of practice. This provides the council improved opportunity to control weedy or feral leucaena, while concurrently allowing the sustainable use of leucaena for beef production.

4.2 Produce information materials on responsible and productive use and management of Leucaena and sponsor training opportunities to assist producers increase their skills and knowledge

During the project TLN has produced two information sheets for general industry release.

1. What is leucaena and its benefits?
2. Hints for Leucaena growers for assessing livestock that could be underperforming?

These information sheets are published on the website, and have been extended at field days, seminars and information days. Both have been useful extension products to outline the benefits of leucaena, and then be able to work through aspects of factors that could be hindering cattle performance.

TLN has held over 20 successful events to assist producers increase their skills and knowledge, with close to 1000 participants. Events included seminars, regional representative and information days, and leucaena conferences. Further, TLN website has been continually maintained with new information, six newsletters have been produced for members, and countless number of phone calls and emails has been managed. Many facets of the Industry have been covered by these activities, including best practice management, environmental and economic benefits, plant and animal nutrition, management of rundown pasture and leucaena, fertiliser requirements and of course the promotion of “the best management Code of Practice”.

The annual conferences, which have been held at Emerald in 2014, Rockhampton (during Beef Week) in 2015, and Atherton in 2016, highlights TLN’s endeavours to conduct conferences in different geographical regions so as many producers as possible can attend.

TLN has had a stand at the 2015 Beef Week in Rockhampton. The stand was very successful with large numbers of producers taking the opportunity to discuss latest industry updates and issues with TLN volunteers. In conjunction with DAFF Q and MLA speakers, TLN presented a successful seminar at Beef Week. Around 100 people attended highlighting the interest in leucaena, particularly Redlands as a great alternative to maximise beef production in Queensland and northern Australia. TLN had a stand at the Mt Surprise MLA Beef-Up forum and the Northern Beef Research Update Conference in Rockhampton.

TLN conducted a number of one or two day training courses in Kingaroy, Bowen and Walkamin on Leucaena establishment and management. There is a continued demand for the courses but attendance numbers are low since the removal of the Farm-Biz training subsidy.

Over the project life TLN has delivered 17 Leucaena Information days across central and southern Queensland. These on-farm days are designed primarily for the new leucaena grower and covered the basics of how to establish and manage leucaena. Being on-farm, practical information was presented in an accommodating environment by both technical experts from TLN members and the property owner. Established leucaena paddocks were also inspected, along with machinery, cattle and paddocks. In addition to the information days TLN supported three MLA PDS submissions, one, demonstrating the value of leucaena in grazing pastures in Nth Qld and two fertiliser leucaena amendment investigations in Chinchilla, Wandoan-Taroom.

4.3 Support the release of Redlands through the coordination of field and training activities

Through the extensive array of grazier engagement activities TLN has supported the release of Redlands. This support has been however, combined with the extension of other information, as collectively graziers are seeking a range of information from paddock selection, variety, sowing rate, planting methods, weed control, machinery requirements, insect control, rumen bug management, just to name a few. So no specific field or training events have occurred, but Redlands has been discussed at most if not all events where other information has been extended.

The network has been hampered in its ability to support the release of Redlands due to the extended process that occurred to get the priority breeding lines identified, named, and the lengthy process it took to award two licences to grow and market the new variety. The network has also been frustrated by the length of time taken for the licensees to be provided seed, and then for these licensees to prepare paddocks and sow the new variety due to the time of the year seed was provided. The industry has been waiting many years for the release of the new variety, and many graziers along coastal areas of Queensland have contacted the network to express their frustration on the time it's taken. Most of these graziers are looking to sow leucaena for the first time. Stocks of Redlands seed will be in short supply for a considerable period into the future with a small initial offering being marketed via possible tender. This will effectively reduce the seed distribution to regional areas.

4.4 Facilitate and conduct field trials to support environmental permit registrations for use of Tebuthiuron and other chemicals to control weedy Leucaena

TLN commenced chemical field trials to support new environmental permit registrations for the industry to manage out-of-place leucaena. The trials are being conducted at Brian Pastures, Gayndah and Belmont Research Station, Rockhampton and commenced in December 2015 and January 2016 at the two sites respectively. Two assessments have been undertaken, further assessment is required in late 2016 early 2017 to complete the chemical evaluation before submitting a report to DAFFQ and ultimately APVMA to seek additional chemical environmental permits from APVMA.

TLN has undertaken an active role to support the ongoing expansion and success of Leucaena pastures by ensuring the continued use of the herbicide Imazethapyr (trade names include Spinnaker, Impale, Amaze). This herbicide, used for both pre and post emergence control of grass and broadleaf weeds in Leucaena, has revolutionised the success of Leucaena establishment to the extent now where no Leucaena plantings fail from weed competition after this product has been correctly applied. TLN is the holder of the APVMA permit and this very important document provides the legal use of this herbicide for all Leucaena growers in Queensland, Northern Territory and now New South Wales.

A further PERMIT extension appears unlikely in the future unless there are more supplier trials or market evaluation on how much product is sold together with data on its use within the industry. An assessment needs to be supplied to APVMA before 2018. Further investment is required to provide industry access to a range of herbicide controls to manage weeds in the critical phase of leucaena establishment (see appendix for trial details).

5. Conclusions and recommendations

This project has demonstrated the benefit of having an industry body, co-ordinating and supplying information on the premier pasture legume to grow more beef per ha to meet the worlds ever increasing protein demand. Additional investment is required to continue the adoption of leucaena by the cattle industry.

The industry needs to;

- I. Support on-going training and information days for new entrants wishing to grow leucaena. The early adopters are up and running, it is the second tier adopters that need prompting and encouragement.
- II. Support the critical information needs of new leucaena growers, especially those in coastal areas where the new variety Redlands will be the only suitable variety. Graziers in these areas have generally no experience with leucaena, and there are limited support networks. This environment is one where the weed potential is the highest, placing an even greater need for adequate extension services to ensure the potential of this new variety while minimising the environmental impacts.
- III. Continue engagement with natural management resource groups at the local, catchment and government level, by espousing the Best Management Code of Conduct.
- IV. Continue to engage with producers and advisors through centralised demonstration sites to highlight the benefit of leucaena to their cattle production, and methods to maximise returns from their investment.
- V. Evaluate and support investigations into the nutritional needs of leucaena pastures demonstrating the benefits and returns from implementing a fertiliser amendment program.
- VI. A further PERMIT extension for the herbicide Imazethapyr (eg Spinnaker) appears unlikely in the future unless there are more supplier trials or market evaluation on how much product is sold together with data on its use within the industry. An assessment is required before 2018. Investment is required to maintain the permit and provide industry access to a range of herbicide controls to manage weeds. This will be critical for the new coastal production areas (suited to Redlands) due to the weed pressure in these environments.
- VII. Review the licensing of Leucaena seed production; clearly the easy leucaena sales have been made. To achieve anywhere near the projected leucaena production opportunities and encourage more producer adoption there needs to be more seed availability. This could be achieved through offering additional seed licenses and by making seed available through the reseller network at a reasonable price with variety of seed pack sizes to encourage trial plantings.
- VIII. Commence seeking financial and breeding partners to breed cold tolerant and seedless leucaena varieties.
- IX. Support leucaena's expansion into WA and Northern Territory by engaging and partnering with the state science groups and private farm and cattle groups by setting up demonstration sites.

6. Appendices

Appendix 1:

Dates and locations of Leucaena information days in 2013/14/15/16

Table 1

Date	Location	Venue	Participants
March 2013	Millmerran	'Borambil'	12
March 2013	Dalby	'Openbah'	12
April 3 2013	Rolleston	'Inderi'	10
April 4 2013	Kilcummin	'Yackadoo'	8
April 5 2013	Middlemount	'Lucky Creek'	20
April 8 2013	Thangool	'Pindari'	28

Table 2. Dates and locations of Leucaena information days in 2014-16

Date	Location	Event	Participants
March 28 th -29 th 2014	Emerald	Annual conference	50
May 20 th 2014	Dingo	Rubina	23
August 21 th 2014	Millmerran	(cancelled)	-
March 17-18 th 2015	Dalby	CRT regional conference	55
March 20 th 2015	Wallumbilla	Field-day	27
May 4 th - 9 th 2015	Rockhampton	Beef Week Display site and seminar	500+
May 26 th	Durong	RCS field day	42
December 11 th 2015	Chinchilla	Chinchilla Landcare	15
March 16 th 2016	Booubyjan- Tansy	Burnett Catchment	55
March 17 th 2016	Monto	Burnett Catchment	35
May 12 th -13 th 2016	Atherton	Conference / field day	32
June 1 st -2 nd 2016	Mt Surprise	Beef –Up forum	50
August 16-17-18 th 2016	Rockhampton	N. Aust Beef Research Update	150

Dry times significantly curtailed the field activities in 2014/15.

Table 3. Training days Bowen & Kingaroy & Atherton

Date	Location	Participants
July 9 th 2013	Kingaroy	8
October 10 th 2013	Bowen	11
May 11 th 2016	Walkamin (Nth Qld)	15

Appendix 2

Best Management Code of Practice for establishing and managing Leucaena Pastures

Endorsed by TLN committee, DAFF Q and AGFORCE

The Best Management Code of Practice development was financially supported by MLA.

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. The Queensland Government recognises that leucaena is 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.

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 pod-eating larvae 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.

[Leucaena must be grown to this Best Management Code of Practice Directive](#)

Purpose of the Best Management Code of Practice

The Best Management Code of Practice (BMCODE) targets those features of leucaena that predispose 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 BMCODE 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. This **BM CODE** is supported by Queensland Department of Agriculture Forestry and Fisheries (DAFFQ).

Aims of the Best Management Code of Practice

- Avoid planting leucaena near potential weed risk zones
- Minimise seed set in grazed stands
- Diminish the risk of live seed dispersal
- Control escaped plants from grazed stand

- **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:

- A. *Do not plant leucaena in areas where rivers, creeks and flood channels can disperse seed pods/seed.*
- B. *Keep leucaena at least 20 m away from external fence lines*
- C. *Maintain a buffer strip of strong grass pasture between leucaena plantings and creeks or boundary fences*
- D. *Fully fence leucaena paddocks to avoid the unlikely risk of stock spreading ripe seed*
- E. *Graze or cut leucaena to keep it within the reach of animals and minimise seed set*
- F. *Manage leucaena escapes. There are a range of chemical control options for example, Access® in pastures and rights of way, Vigilant II® (picloram + aminopyralid.) in non-crop areas and various herbicides in non-agricultural areas as listed on the Minor Use Permit 11463). For more information on control measures please seek the Biosecurity Qld Fact-Sheet on Leucaena (No PP85), Australian Pesticides and Veterinary Medicine Authority Minor Use Permit 11463 <https://portal.apvma.gov.au/permits> and herbicide product labels.*
- G. *Establish and manage vigorous grass in the inter-rows to:*
 - *provide competition to minimise establishment of volunteer leucaena seedlings*
 - *minimize the risk of seed being transported during heavy rain*
 - *productively utilize fixed nitrogen the system produces*
 - *maintain ground cover and prevent soil erosion*
- H. *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*
 - *on creek banks and other adjoining areas where cattle do not normally have access*
 - *on public roadsides (after first obtaining an Adopt a Spot permit or similar from Main Roads or Shire Council)*
- I. *Comply with Local Government local laws (weed declarations etc) and assist Government agencies to identify any escaped leucaena so that action can be taken to control plants where there is a safety or priority conservation issue.*
- J. *Promote the responsible management of leucaena in accordance with this Code*
- K. *Keep abreast of best practice developments in the management of leucaena.*

Appendix 3

Information sheet – What is leucaena and its benefit?

Leucaena in Queensland

Leucaena is perennial legume that produces high quality forage. Leucaena produces very palatable, nutritious, high protein leaf for cattle giving live-weight gains of 250-300 kg/hd/yr, or 125 – 150kg per hectare at a stocking rate of 1hd:2ha. This is twice that of grass only pastures.

History of Leucaena in Australia

In about 1890, Leucaena (*Leucaena leucocephala*) arrived in northern Australia. By the 1920's this Leucaena, now referred to as 'common' leucaena (*L. leucocephala* ssp. *leucocephala*) had colonised pockets of ungrazed, non-agricultural land along urban and coastal locations in northern Australia.

The first cultivars Peru and El Salvador were released for use in 1962. Others followed, including Cunningham in 1976, Tarramba in 1994 and Wondergraze in 2012. They all belonged to *L. leucocephala* subspecies *glabrata*. Hence the patches of 'common' or weedy Leucaena in urban and coastal locations did not originate from commercial stands of Leucaena that are used for grazing purposes.

Where is Leucaena suited?

Leucaena is highly productive in the central and southern parts of QLD where fertile and high water holding soils occur, together with adequate rainfall of > 600mm per annum. Even with these conditions, successful establishment of Leucaena is complex, and the Leucaena industry has delivered a significant number of extension activities to improve producer knowledge and reduce establishment failures.

Successful Leucaena establishment and production in western QLD districts with rainfall less than 500mm is nearly impossible, due to the high temperatures, long periods of low or no rainfall and competitiveness from existing grass pastures. Hence Leucaena will only be productive in this environment during wetter years and or irrigation.

What are the benefits of Leucaena?

The exceptional value of the Leucaena grazing system in adapted environments is due to a combination of factors:

- The edible material has very high nutritive value (digestibility, crude protein and essential nutrients) compared to other tropical forages. This imparts much faster cattle weight gains and turn-off rates that lead to greater profitability and flexibility in marketing beef cattle.
- It is a long-lived system. While it is costly to establish, it can remain productive for 30-40 years with minimal maintenance.
- A deep root system allows the tree to provide green forage longer into the dry season and drought than conventional grass grazing systems. Recent droughts have highlighted how leucaena can reduce the cost of supplements in dry conditions.

Leucaena also has some very important environment benefits

- It 'fixes' nitrogen that improves soil fertility and promotes better grass growth.
- Leucaena grown in association with a vigorous and adapted grass (e.g. buffel, Rhodes, green panic) will prevent soil erosion.
- The deep rooting habit of leucaena reduces the potential for deep drainage and the movement of saline soil water that causes dryland salinity.
- As a woody-stemmed tree, leucaena acts as a carbon sink by sequestering significant amounts of carbon from the atmosphere in its woody frame and in additional soil organic matter.
- Similarly, methane emissions from cattle grazing leucaena are substantially lower than for tropical grasses, probably due to the high digestibility and condensed tannin content of leucaena forage.

There is one important environment precaution to take

The Leucaena Network of growers (formed in 2000) is a proactive organisation and have adopted and released a **CODE OF PRACTICE** that is promoted widely among the industry. The **CODE OF PRACTICE** highlights the need to manage leucaena to minimize the risk of escape and to control any plants that move from the planted area. This CODE is consistent with the Queensland Government's *Policy to Reduce the Weed Threat of Leucaena*. The CODE OF PRACTICE is regularly updated and is supported by the QLD Government, AgForce and MLA.

Leucaena provides significant economic benefits to the QLD Beef industry

Compared to grass-only pastures, Leucaena-grass pastures significantly improve beef business profitability and contribute to the QLD economy.

In central Queensland, over a 30yr period the net present value for grass-only pastures is \$675/ha compared to Leucaena-grass pasture at \$2017/ha, a 3 fold increase in profitability (Bowen *et.al* 2010)

If all suitable land types are sown to Leucaena-grass pastures across the state, the net present value over 30yrs would approximately be \$2522/ha. This would provide approximately more than \$21 billion dollars of revenue for the QLD beef and broader state economy (Peck *et.al* 2011)

References

Bowen M, Buck S, Gowen R. (2010). High-output forages for meeting beef markets. Final Report B.NBP.0496. Meat and Livestock Australia Ltd. Sydney

Peck G, Buck S, Hoffman A, Holloway C, Johnson B, Lawrence D and Paton C. (2011). Review of productivity decline in sown grass pastures. Final Report B.NBP.0624. Meat and Livestock Australia Ltd. Sydney

Appendix 4

Information sheet- Hints for Leucaena growers for assessing livestock that could be underperforming.

Hints for Leucaena growers for assessing livestock that could be underperforming authored by Stuart Buck, DAF QLD and The Leucaena Network

Performance of animals grazing Leucaena-grass pastures will be influenced by a number of factors. In general there are three (3) main factors that impact animal performance:

- 1. Ability of the animal to utilise the feed available**
- 2. Quantity of feed available**
- 3. Quality of the feed available**

First, to provide an objective assessment of whether cattle are really 'underperforming', cattle weight gains need to be measured.

- 1. Measure daily weight gain of animals using scales;**
- 2. Weigh at same time of day to minimise daily variation, or weigh after a curfew overnight to empty the gut; and**
- 3. Calculate the daily gain over three weighing's, each 1-2 months apart.**

If poor weight gains are obtained during the growing season (less than 0.5kg/hd/day), assess potential problems limiting the ability of the animal to utilise the forage available, then the quantity and quality of feed available.

1. Ability of the animal to utilise good quality forage available in the paddock

In any grazing system there are many animal and external factors which may be the most important issue limiting animal growth. These might include:

- Animal health (eg Epherimal fever, 3 day sickness etc),
- Quality of water,
- Genetic traits
- Maturity and nutritional history of the animal
- Temperature or weather extremes

However if these factors are not issues, the main issue that could reduce animal weight gain is mimosine and DHP toxicity. The Leucaena leaf and stem contains a toxin called mimosine, that when converted to DHP in the rumen and can restrict weight gain if high amounts of Leucaena are ingested.

Symptoms of DHP toxicity include:

- Depressed appetite, poor weight gain or loss
- Hair loss typically from tail and pizzle
- Excess salivation, sores on skin

To overcome this issue, drench 10% of the herd with the rumen bacterium *Synergistes jonesii* (or better known as the 'leucaena bug') after the animals have been consuming Leucaena for about 14days.

To determine whether the herd is protected with the rumen bacterium, producers can undertake a urine test for DHP toxicity. A testing service is available at the University of Queensland. Contact: Michael Halliday | Research Assistant & PhD Student | School of Agriculture and Food Science | Faculty of Science, The University of Queensland. **Phone: 07 3365-1172 email: m.halliday@uq.edu.au**

2. Quantity of feed available

Generally, the amount of feed available is sufficient in a well-planned grazing system during average (or better) seasons, however low quantities of feed available can be due to a number of factors, including:

- Low soil moisture/rainfall over last 12mths;
- Low plant population or high past grazing pressure;
- Low nutrient availability;
- Insect attack;
- Extreme temperatures (cold or hot);
- Other grazing animals (kangaroos, wallabies, pigs etc)

Estimate the amount of forage available in the paddock stock are being moved into. Feed availability can be assessed by two methods

- a). Visual assessment**
- b) Measure forage availability**

This method entails cutting, drying and weighing a number of small samples (eg 1m² quadrats) across the paddock. An average of 10 grass and 10 leucaena cuts should be taken to gain an average 'biomass' assessment of the paddock. The forage will need to be dried and weighed.

It is also important to have a balance of grass and Leucaena in the paddock. Cattle performance over the year will be maximised when a mixed diet (Leucaena and grass) is available.

Assess which reason is most likely affecting feed availability:

- Soil moisture can be assessed by reviewing past rainfall charts, or measured via soil sampling.
- Nutrient availability can be assessed via soil sampling or leaf testing. Phosphorus, sulphur, zinc and potassium are the important nutrients to assess.
- Insects can be visually assessed. Especially look out for insects such as Brown soft scale and Psyllids.
- Other causes (e.g. temperature, kangaroos, grasshoppers) can also be visually assessed.

3. Quality of feed available

Leucaena produces high protein feed that is highly digestible. In a pasture with adequate supply of protein (ie Leucaena), weight gain will be related to the energy intake. There are two main ways of determining the quality of feed available:

1. Faecal NIRS

Collecting and analysing faeces will provide an assessment of the protein and phosphorus contents of the feed consumed, as well as the digestibility (measure of energy) and the proportion of grasses to Leucaena in the diet

Samples can be analysed at Symbio Alliance, Rockhampton (1300 703166) or Brisbane (07 33405700)

2. Collect plant material and test for nutrient concentration.

Assessment of the quality of feed available can be undertaken by cutting and collecting plant material, and having this material assessed in a commercial lab. Leucaena quality can be assessed via leaf tissue analysis. Measuring phosphorus and sulphur are the most important nutrients. Forage samples can be tested at any lab that undertakes leaf tissue analysis: **Symbio Alliance- Rockhampton (1300 703166) or Brisbane (07 33405700), SGS Food & Agricultural Service, Pinkenba, Qld (07 36224700), Queensland University (07-33652541)**

Further information and contacts:

The Leucaena Network. www.leucaena.net

DAF Business Information centre 13 25 23

Visit the MLA website at www.mla.com.au for a copy of:
'Leucaena: A guide to the establishment and management

Appendix 4

Chemical control permit



Australian Government
**Australian Pesticides and
Veterinary Medicines Authority**

**PERMIT TO ALLOW MINOR USE OF AN AGVET CHEMICAL PRODUCT
FOR THE CONTROL OF WEEDS IN LEUCAENA AND BUTTERFLY PEA**

PERMIT NUMBER – PER82166

This permit is issued to the Permit Holder in response to an application granted by the APVMA under section 112 of the Agvet Codes of the jurisdictions set out below. This permit allows a person, as stipulated below, to use the product in the manner specified in this permit in the designated jurisdictions. This permit also allows any person to claim that the product can be used in the manner specified in this permit.

THIS PERMIT IS IN FORCE FROM 06 JULY 2016 TO 31 MARCH 2018.

Permit Holder:
THE LEUCAENA NETWORK ASSOCIATION INC
Unit 701, Melrose on Fifth
51 Fifth Avenue Australia
Maroochydore QLD 4558

Persons who can use the product under this permit:
Persons generally.

CONDITIONS OF USE

Products to be used:

NUFARM SPINNAKER 700 WDG HERBICIDE
 AND OTHER REGISTERED PRODUCTS
 Containing: 700 g/kg IMAZETHAPYR as their only active constituent.

Directions for Use:

Crop	Pest	Rate
BUTTERFLY PEA (<i>Clitoria ternatea</i>)	CERTAIN BROADLEAVED AND GRASS WEEDS.	70 – 140 g/ha.
LEUCAENA (<i>Leucaena leucocephala</i>)		

Critical Use Comments:

- Apply either pre-plant at least 2 weeks prior to planting (no closer than 2 weeks prior to planting) or post emergent when the legume is at least 7 days old and weeds are very small.
- DO NOT add crop oil to any application.
- Use the higher rate for longer term weed control.
- Apply only ONE application per legume crop during the establishment phase.

Withholding Period:

DO NOT GRAZE, CUT FOR STOCK FEED OR HARVEST FOR AT LEAST 14 DAYS AFTER LAST APPLICATION.

Jurisdiction:

QLD, NT, NSW and WA ONLY.

Additional Conditions:

THIS PERMIT provides for the use of a product in a manner other than specified on the approved label of the product. Unless otherwise stated in this permit, the use of the product must be in accordance with instructions on its label.

PERSONS who wish to prepare for use and/or use the products for the purposes specified in this permit must read, or have read to them, the permit particularly the information included in DETAILS OF PERMIT and CONDITIONS OF PERMIT.

The PERMIT HOLDER should contact the product registrant and pursue registration of this use pattern. Effort in this regard must be demonstrated prior to any APVMA consideration of permit renewal.

Issued by Australian Pesticides and Veterinary Medicines Authority

Appendix 5

Chemical control and trial design to support environmental permit registrations for use of Tebuthiuron and other chemicals to control weedy leucaena

Trial detail:

A randomised complete block design with three replications. Methods trialled include cut stump, splatter gun, ground applied and herbicide gel. As a comparative standard, the trial will include the three registered methods of basal bark, cut stump and ThinLine using Access in diesel.

Treatment plots (experimental units) will range in size from 5 m² to 20 m² (large enough to contain 10 Leucaena plants).

TREATMENTS AND ASSESSMENT

Treatments

An array of methods (plus an untreated control).

1. Control (untreated)
Standard treatment (already registered for use)
2. Basal Bark - (Access [240 g triclopyr +120 g picloram /L] plus diesel) @ 1:60 (chemical:diesel); spray the bark around the stem from ground level up to 30cm high
3. Cut stump - (Access [240 g triclopyr + 120 g picloram /L] plus diesel) @ 1:60 (chemical:diesel); cut plants close to ground level and immediately apply spray mix to exposed cut surface
4. ThinLine - (Access [240 g triclopyr + 120 g picloram /L] plus diesel) @ 1:9 (chemical:diesel); spray the bark around the stem from ground level up to 5 cm high

Trial treatments (not registered for use)

5. Cut stump - (glyphosate ([360 g/L] plus water) @ 1 L per 1 L water; cut plants close to ground level and immediately apply spray mix to exposed cut surface
6. Cut stump - (metsulfuron ([600 g/kg] plus water and wetter) @ 2.5 g per 1 L water + Pulse; cut plants close to ground level and immediately apply spray mix to exposed cut surface
7. Cut stump - (metsulfuron ([600 g/kg] plus water and wetter) @ 5 g per 1 L water + Pulse; cut plants close to ground level and immediately apply spray mix to exposed cut surface
8. Cut stump - (Stinger ([300g metsulfuron + 375 g aminopyralid /kg] plus water and wetter) @ 10 g per 1 L water + Pulse; cut plants close to ground level and immediately apply spray mix to exposed cut surface
9. Cut stump - (Vigilant II Herbicide ([44.7 g picloram + 4.47 g aminopyralid/L]) @ apply neat; cut plants close to ground level and immediately apply 3 to 5 mm layer of gel to the exposed cut surface

10. Stem blaze or frill – (Vigilant II Herbicide [picloram 44.7 g/L + aminopyralid 4.47 g/L]) @ apply neat to cut 15-20 mm blazes around trunk, evenly spaced at 20-40 mm intervals.
11. Splatter gun - (Stinger ([300 g metsulfuron + 375 g aminopyralid /kg] plus water and wetter) @ 10 g + 5 mL Pulse per 1 L water; apply approximately 5 mL of a spray mix per half meter of plant height
12. Splatter gun – (metsulfuron ([600 g/kg] + glyphosate [360 g/L])@ 2.5 g metsulfuron + 111 mL Glyphosate + 5 mL Pulse per 1 L of water; apply approximately 5 mL of a spray mix per half meter of plant height
13. Splatter gun – (metsulfuron ([600 g/kg])@ 5 g metsulfuron + 5 mL Pulse per 1 L of water; apply approximately 5 mL of a spray mix per half meter of plant height
14. Ground applied – Tordon Granules [20 g picloram /kg] @ 45 g per m² of canopy; apply granules over the area extending from the main stem to 50 cm outside the dripline to cover the main part of the root system
15. Ground applied – Graslan [200 g tebuthiuron /kg] @ 1 g per m² of canopy; apply granules evenly over the area extending from the main stem to 50 cm outside the dripline to cover the main part of the root system
16. Ground applied – Graslan [200 g tebuthiuron /kg] @ 2 g per m² of canopy; apply granules evenly over the area extending from the main stem to 50 cm outside the dripline to cover the main part of the root system
17. Ground applied – Velpar [250 g hexazinone /L] @ 4 mL per spot, applied as a 1 spot for each metre in plant height
18. Ground applied – Velpar [250 g hexazinone /L] @ 4 mL per spot using a 1 x1 m grid pattern covering the dripline of the plant