



finalreport

Feedbase

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Demonstrate establishment and productivity of leucaena in selected areas of the Darling Downs

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Abstract

Real interest in growing Leucaena in southern Queensland for cattle grazing dates back to 2000 where an 8 ha patch was grown in Chinchilla. Others followed and by 2005, it was considered important to test the viability and suitability Leucaena as a pasture legume for the Darling Downs.

In this project, four sites representing a range of soil types, farming techniques and row spacings were established successfully and have grown on to become very productive paddocks of forage.

Leucaena has shown itself to be a viable option for this part of southern Queensland. It provided the reliable legume for pasture mixtures that has been missing. However, it may not be suitable for everyone, particularly those who are intent on breeding their own calves and selling weaners or yearlings.

The immediate effects are that farmers in the relevant parts of the Darling Downs can plan, with confidence, on returning marginal cropping land back to a very productive mixed pasture. Following the established guidelines is highly recommended and seeking expert advice will maximise the expected outcomes. It is recognised that further work would be beneficial and strengthen the position of Leucaena in the farming system in the areas of longer term viability and production, grazing methods, optimal row spacings and inter-row planting opportunities.

Leucaena is the best summer growing legume option available. The presence of a legume gives the pasture system that much needed boost to productivity and sustainability.

Executive Summary

It is well known that a legume, grass mixture is required for a sustainable pasture mixture to add nitrogen to the grazing animal's diet and to supply some nitrogen to the companion grass. The demand for a productive legume to add to grass pasture mixes arose from Darling Downs farmers wanting to put marginal cropping land back to permanent vegetation to alleviate the impact of current and predicted weather regime contributing to unreliable crop returns.

In 2000, at a field day at Taroom on the southern end of inland central Queensland, leucaena was discussed as a possible answer to their quest. By 2005, there were many small paddocks of leucaena all over the northern, central and western Darling Downs. It was an opportune time to showcase its real potential and sort out as many problems as possible before too many people got into difficulties with it.

This need resulted in the establishment of this project with four Producer Demonstration Sites to demonstrate known technology developed in central Queensland. It was also designed to "bend the rules" with respect to soil type, location on the property (cold flats versus higher up the slopes), row widths, row configurations, planting rates, cultural techniques, varieties and grazing management

The Project aimed to:

1. Establish and manage paddocks of leucaena of at least 20 ha, in each of 3 regions of the Darling Downs, using proven technology developed in central Queensland.
2. Record and report production of edible dry matter and any grazing undertaken (in cows days per ha). Weight gain information will also be recorded where possible.
3. Develop realistic guidelines for the suitability, establishment, and likely productivity of leucaena for different soil types and areas of the Darling Downs.
4. Involve local grazier groups at each site to ensure participation and shared understanding of soil and cultural requirements, plus likely productivity of leucaena in their local environments

Three 25 ha and one 10 ha site were established successfully and have grown on to become very productive paddocks of forage. The soil types varied from deep sandy loams to medium clays. Both zero till and conventional farming techniques were used and both methods achieved excellent plant stands. Phosphorus fertiliser was used at planting where soil testing found this necessary. Weed control became an issue even though the recommended herbicide was used. Zero till paddocks had more available moisture at depth because less water was lost through cultivations allowing the leucaena to out grow the weeds.

Leucaena has shown itself to be a viable option for this part of southern Queensland. It provided the reliable legume for pasture mixtures that has been missing. However, it may not be suitable for everyone, particularly those who are intent on breeding their own calves and selling weaners or yearlings. It has little or no productivity during winter. It is also a risk if put onto viable grain growing country if ownership changes and a change to crop production is required.

The project has shown that:

- Producers are interested in pursuing the Leucaena options on the Darling Downs.
- Leucaena is suited to the clay and clay loam soils of the Darling Downs. The forage has been stretched to the lighter soils with deeper profiles provided the required nutrients are present or added.
- Establishment of Leucaena is very reliable if the known technology for summer crop growing is followed.
- Varietal differences are minimal.
- Row width and row configurations are optional but single rows 7 to 8 m apart are favoured at this time.
- The best sowing time is late spring to early summer, the earlier the better.
- Good weed control through the fallow period and the first year of growth is critical. Seedlings are fragile and susceptible to competition for about 6 weeks.
- Leucaena is capable of providing quality forage for at least 7 months of the year and animals are capable of gaining in excess of 1 kg live weight a day while sufficient of the material is available.
- Observations indicate that stocking rates on leucaena will be substantially higher than on pure grass pastures.
- Grazing management favoured is a rotational system of short but intensive grazing pressure to keep the shrub to a manageable height and then spell for at least 6 weeks for recovery..
- Provided at least 50% ground cover is maintained, soil water runoff will be reduced along with reduced soil loss. Dryland salinity will be far less likely than compared with continued cropping because deep water drainage will be substantially reduced.
- Provided care is taken not to allow plants to escape to areas not accessed by any type of grazing animals, the possibility of it becoming an environmental weed in this area is limited.

The immediate effects are that farmers in the relevant parts of the Darling Downs can plan, with confidence, on returning marginal cropping land back to a very productive mixed pasture. Following the established guidelines is highly recommended and seeking expert advice will maximise the expected outcomes. It is recognised that further work would be beneficial and strengthen the position of Leucaena in the farming system in the areas of longer term viability and production, grazing methods, optimal row spacings and inter-row planting opportunists

Leucaena is the best summer growing legume option available. The presence of a legume gives the pasture system that much needed boost to productivity and sustainability.

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1 Background

The demand for a productive legume to add to grass pasture mixes arose from Darling Downs farmers wanting to put marginal cropping land back to permanent vegetation to alleviate the impact of current and predicted weather regimes contributing to unreliable crop returns.

It is well known that a legume, grass mixture is required for a sustainable pasture mixture to add nitrogen to the grazing animal's diet and to supply some nitrogen to the companion grass. Recent research also shows enormous increases in soil carbon levels achieved by adding a legume to a grass pasture, because of the substantial increase in legume and grass root mass produced.

Weather Conditions: The last twenty years have given drier than normal summer seasons; temperatures have been higher than normal in the summer; winter has resulted in a severe run of cold frosty weather now considered "normal"; and totally unreliable winter rainfall. Producers indicated they have had no return on investment from crops in that period and believe they can do better from cattle production.

Soil types: From investigation there are approximately 300,000 ha of cropped land on the Darling Downs on soil types with "marginal" water holding capacity, meaning that they will only produce viable crop yields with regular rainfall during the crop's growing season. The other major problem is that many of these soils are clay loam to clays which makes establishing small seeded species difficult. The hot summer days dry the soil surface too quickly for small seeds to germinate and put down primary roots into subsoil moisture. Most germinated seeds are doomed to die.

Need for a legume: For sustained productivity from pastures and to inhibit pasture rundown, a reliable, adapted legume is needed to add to grass mixtures. Fifty years of searching by pasture agronomists has not found that long lived, summer growing legume. Lucerne is good initially but quickly succumbs to being selectively grazed by cattle and also suffers badly from grass competition. Other legumes such as *Desmanthus*, burgundy bean and *Caatinga stylo*, although extensively trialled, have not given consistent results over the region. There are also winter growing annual legumes that can be added to mixtures. They will add nitrogen to the system if winter rains are received, but this item has been unreliable for many years.

The identification of Leucaena as a potential solution: In 2000, at a field day at Taroom on the southern end of inland central Queensland, leucaena was discussed as a possible answer to farmers' quest. A paddock of successfully established leucaena was being inspected by locals and the 40 farmers there were very keen to hear all about how to reliably establish and grow the shrub. There were many from further south of Taroom who wanted to know if this legume would survive in their regions. It was pointed out that leucaena was really a tropical plant and it was unknown how it would survive a series of moderate to heavy frosts known to occur on the Darling Downs.

By 2005, there were many small paddocks of leucaena all over the northern, central and western Darling Downs. It was an opportune time to showcase its real potential and sort out as many problems as possible before too many people got into difficulties with it.

This PDS project was approved and commenced in April 2007. It was developed to demonstrate known technology developed in central Queensland. It was also designed to "bend the rules" with respect to soil type, location on the property (cold flats versus higher up the slopes), row widths, row configurations, planting rates, cultural techniques, varieties and grazing management.

2 Project Objectives

1. Establish and manage paddocks of leucaena of at least 20 ha, in each of 3 regions of the Darling Downs, using proven technology developed in central Queensland.
2. Record and report production of edible dry matter and any grazing undertaken (in cows days per ha). Weight gain information will also be recorded where possible.
3. Develop realistic guidelines for the suitability, establishment, and likely productivity of leucaena for different soil types and areas of the Darling Downs.
4. Involve local grazier groups at each site to ensure participation and shared understanding of soil and cultural requirements, plus likely productivity of leucaena in their local environments.

3 Methodology

3.1 Site Selection

Sites were selected based on the following criteria:

- Regions on the Downs where frosts are less likely to be severe eg sloping landscapes with northerly aspects.
- The presence of active local producer groups and willing Landcare coordinators who were keen to participate in the PDS.
- Soil types and agricultural pursuits undertaken. Mixed grain growing and beef cattle enterprises were favoured.
- Previous landholder requests about leucaena and its possible adaptation to their individual enterprises.

Areas on the flood plains and in southern Darling Downs were rejected as possible sites because severe frosts, long periods of cool weather, flooding or water logging were more likely to occur.

Therefore, the northern Downs, Chinchilla and the Millmerran districts were chosen because all have undulating landscapes and are considered to be the warmer areas of the catchment. All are on Brigalow, mixed Brigalow belah, or vine scrub soils. These are lighter textured and well drained soils.

3.2 Selected Project Partners

Landcare coordinators were a key partner in this project due to their strong local network, access to producers and willingness to be engaged. Producer co-operators were diverse and based on the site selection criteria as well as willingness to contribute to the project both from a cash and in-kind perspective.

Producer Co-operators:

Area: Chinchilla The Wonka family from Charley's Creek area was nominated by the Chinchilla Landcare coordinator because of their involvement in Landcare activities and their desire to return cropped land back to permanent vegetation (pastures). They operated a mixed grazing and cropping enterprise and saw many advantages in having a simpler life style, namely, concentrating on cattle raising. They had also saw crop productivity dropping because of lowering fertility levels and did not want to risk extra expenditure on fertilisers. The producer set aside 30 ha of cropped land to look at Leucaena. Their land type is described as low sloping, light clay soils which originally supported Brigalow trees. Shallow melon holes ten to twenty cm deep dot the landscape.

Area: Yamsion Rana and Brett Haager are very keen land care members from the Yamsion group, near Kaimkillenbun. They are innovative cattle producers wishing to return old cultivation land back to permanent pastures. Their demonstration area of 30 ha was divided into two lots, one deep sandy loam which originally carried mixed scrub (Brigalow, eucalypts and cypress pine) and the second a sloping light Brigalow/softwood scrub block (slope to 4%) which was vulnerable to soil erosion.

Area: Millmerran John and Sue Moffatt are cattle producers in the Millmerran Landcare group area. Their country is sloping Brigalow country (up to 7% slope) in the Bringalilly district, 20 km south of Millmerran. Soil erosion and deteriorating crop yields convinced John to plant permanent pastures. He first inquired about leucaena five years ago and just needed encouragement to get started. John planted 28 ha for demonstration purposes in January 2008 and a further 40 ha of his own in 2009.

Area: Millmerran Craig Antonio was the back up site in Millmerran. His land type varies from mixed Brigalow, eucalypt and cypress pine country to heavy Brigalow on medium clay soil. He had previously planted 20 ha to leucaena and approached the land care group for technical help. The project supplied him with 10 kg seed and he planted a further 70 ha in February 2008 with his own seed. He has added another 70 ha to his area in 2009.

After each paddock was selected, a full profile soil analysis was undertaken to estimate plant available water holding capacity (PAWC) and fertility. From these analyses, fertiliser requirements for each paddock were determined and this was applied at sowing.

3.3 Planting the Paddocks

- A variety of row spacings, planting machines and row configurations were used with the individual co-operator choosing the methods used. Variable row spacings stretch the boundaries with respect to standard recommendations.
- Each paddock was sown to both varieties (Cunningham and Tarramba) to determine if there were any substantial differences between them.
- Grass was planted in the inter-row spacings in spring 2008 or summer 2009.
- Each site has had cattle introduced into them even though grass has not yet established well in most paddocks. This early grazing was done to control the height of the plants and to attempt to control their seeding.
- Prior to introduction, 10% of the cattle were inoculated with the rumen fluid specially prepared by DPI&F at Brian Pastures, Gayndah.
- The grass species planted into the inter-row spaces was chosen by consulting with the property owners.

3.4 Measuring Dry matter Yield

University of Queensland researcher, Dr Scott Dalzell, devised the formula below to estimate eatable forage from leucaena. He comments that he only uses it to compare yields from different varieties in the same paddock. However, it does give quick and useful information.

Yield kg dry matter per ha = basal diameter in cm² X height in cm (pers com.).

In another paddock, 12 m of row of each variety were cut and oven dried to calculate dry matter per ha.

4 Results and Discussion

Leucaena has shown itself to be a viable option for this part of southern Queensland. It provides the reliable legume for pasture mixtures that has been missing. However, it may not be suitable for everyone, particularly those who are intent on breeding their own calves and selling weaners or yearlings. It has little or no productivity during winter. It is also a risk if put onto viable grain growing country if ownership changes and a change to crop production is required.

4.1 Establishment Results

All the paddocks used in the demonstration were previously used for grain production, but considered unreliable for this purpose. Because of low PAWC, regular in-crop rain is required to produce a viable crop even if a full profile of soil moisture was present at sowing. Erosion was a problem in two paddocks because slopes were excessive.

All growers in the groups expressed reservations about planting pure grass pastures because of the unreliability of establishing grass on the clay and clay loam soil types. The seed has to be sown on the soil surface, rain is required to germinate seed and follow up rain shortly after is needed to give

the grass a chance to establish. This means having the soil surface moist for about 14 days, a rarity on the Downs.

At each site, both Tarramba and Cunningham (the two commercial grazing varieties) were sown. All the seed was germination tested before sowing and both germinated at over 90% in 4 days.

4.1.1 Individual Site results

- | | |
|--|---|
| <p>Area: Chinchilla</p> <p>Co-operator:
Wonka Family</p> <p>Area under Leucaena:
30ha</p> | <ul style="list-style-type: none">• Use of a combine planter (40 years old), in both twin (1 m between rows) and single row configurations. In one section, 3 m inter-row spacing was used. In the other, the spacing was 5 m.• Two adjoining paddocks were used: Tarramba in one and Cunningham next door.• The first sowing date was December 2007. Tarramba had no constraints and established perfectly. However, flooding killed all Cunningham seedlings in about 60% of the paddock and this was re-planted in March 2008. This latter section had severe weed problems and still is struggling to become a viable crop.• The remaining 40% has progressed well and has been heavily grazed three times to control its height and seeding. The cattle used for this were not inoculated and have not shown any ill effects. In early March 2009, an inoculated group of cattle were introduced into the leucaena to eliminate the risks of toxicity from now on.• No grass has established in the inter-row spacings as yet. |
| <hr/> <p>Area: Yamsion</p> <p>Co-operator:
Rana and Brett Haager</p> <p>Area under Leucaena:
30ha</p> | <ul style="list-style-type: none">• Use of a precision row planter, sowing single rows 6 m apart.• The light soil paddock (15 ha) was planted in December 2007. Both varieties were planted in this paddock. It established well initially but was set back by constant grazing by rabbits and wallabies. Eventually, good rainfall over the entire region gave the wallabies enough grass elsewhere to allow the leucaena to out grow them and in March 2009, it was over 2m tall and ready for its first grazing.• Couch and nut grass have covered the inter-row spacings and it was decided not to bother planting the preferred exotic grass species because they won't stand a chance. There is an additional 10 ha of established grass in this paddock.• The second paddock (15 ha) was planted in March 2008. It established well and has had no set backs. It survived severe frosts (as low as -6° C) in July 2008 and, in March 2009, the leucaena was 2.5 m high. The grass sown in January has not established well, but there is an additional area of 20 ha of green panic in this paddock.• Cattle were introduced into both paddocks in March 2009 after being inoculated with the rumen bug. |

- Area:** Milmerran
- Co-operator:**
John and Sue Moffatt
- Area under Leucaena:**
28ha + further 40 ha
- Use of zero till farming techniques. He planted his 28 ha paddock in January 08 using a precision planter in both single and twin rows configurations with inter row spacings varying from 7 to 8 m. This paddock, which has been cropped for about 20 years, is on slopes up to 7% and has been subjected to severe soil erosion. He planted grass between the rows in September 2008 and this has established satisfactorily. However, native Queensland bluegrass (*Dicanthium* spp.) has invaded from neighbouring paddocks and may become the dominant species. While there is no problem with that, it will be interesting to see how it handles the intensive grazing the leucaena will receive in years to come.
 - Cattle were introduced into the paddock in December 2008 after 10% of them were inoculated with the rumen bug. Because of the very lush growth, some animals showed toxicity symptoms (tail hair dropped out) but recovered after a few days.

-
- Area:** Milmerran
- Co-operator:**
Craig Antonio
- Area under Leucaena:**
70ha + further 70 ha
- This was initially considered a back up site and Craig got the left-over 10 kg of Tarramba seed. However, Craig has agreed to give animal production figures from all his paddocks.
 - He uses zero tillage practices in all his farming enterprises. He planted his paddock in February 2008 and achieved a 90% establishment. In March 2008, animals were introduced when the leucaena plants were 2.5 m high. The planted grass has not established well as yet.

4.2 Production Results

4.2.1 Dry Matter

Using Dr Scott Dalzell's (pers. com.) formula to calculate dry matter yield of leucaena edible material, there was no real differences between varieties in any paddock tested. By mid November 2008, most un-grazed paddocks had around 2000 kg DM/ha of leaf material available.

At Wonka's Chinchilla property, both paddocks were heavily grazed to mid November and then allowed to grow for 6 weeks. There was virtually no leaf left on the plants when the animals were taken out. Four (4) lots of three (3) m of row were randomly selected, of each variety and cut, oven dried and weighed.

Results:-

Tarramba = 925 kg DM/ha

Cunningham= 1184 kg DM/ha.

Although these figures would not stand up to statistical scrutiny, they do give an indication of expected growth rates under good conditions on the Downs. It also indicates there is very little difference between the varieties in terms of dry matter production.

4.2.2 Animal Production

Area: Milmerran	Grazed 28 ha leucaena paddock in conjunction with approximately 10 ha of grass (around the watering point) with 79 heavy steers and 49 yearling steers for 47 days from Late December 2008 to February 2009. Ten % of these animals were inoculated with rumen fluid before entry. There was good grass established between the rows of leucaena.
Co-operator: John and Sue Moffatt	
Area under Leucaena: 28ha + further 40 ha	
	Results were:- Heavy steers gained 1.2 kg per day giving 94.8 kg live weight gain/day and 4456 kg for the period. Light steers gained 1.3 kg per day giving 64 kg live wt gain/day and 2994 kg for the period. Total production from the paddock = 7450 kg live wt and = 196 kg/ha when the grass area is included (38 ha). Ten (10) head of the initial smaller steers were left in the paddock to ensure the correct rumen fauna were maintained. The area was rested for 60 days before a new lot of cattle were introduced. Results from the new lot have not been obtained as yet.

Area: Chinchilla	Grazed their leucaena for management purposes with large mobs of cows and heifers. Altogether, their well established 20 ha (15 ha of Tarramba and 5ha of Cunningham) was grazed with more than 2 adult beasts per ha for 90 days while the remaining later planted 10 ha was struggling through weeds to catch up. The applied spinnaker was not effective on button grass, annual Urochloa or red pigweed.
Co-operator: Wonka Family	
Area under Leucaena: 30ha	No live weight gain measurements undertaken

4.3 Discussion

4.3.1 Establishment

Provided good farming techniques are used to follow the ground, control weeds, deliver the required fertiliser and sow into good soil moisture, establishment is almost guaranteed. Seed treatment with fipronil to control soil insects and inoculation with the recommended strain of inoculum is also required. Treating the leucaena as another summer grain crop will deliver high establishment rates. Flooding, for example from a heavy down pour before emergence or severe wild life grazing pressure while the plants are young, will impact on establishment success.

All the proven “rules” were followed at all demonstration sites. Consequently, establishment of leucaena was excellent in each paddock. However, flooding caused the need for re-sowing at Wonka’s and wallabies and rabbits caused havoc at Haagar’s property. The latter crop responded very well when the uninvited grazing animals had elsewhere to graze.

4.3.2 Row Spacing and Configurations

The issue of single rows verses twin rows 1 m apart has not been resolved. The best solution is to let individual growers suit themselves. For practical reasons and to reduce planting rates, the single row system is favoured.

Row widths of at least 5 m wide appear to work. No real differences have appeared as yet but the best growth of leucaena appears to have been from Moffatt's 7 & 8 m wide rows and Antonio's 8 m row spacings. Establishment and persistence of inter-row planted grass is believed to have a better chance in these wider rows than closer row spacings. Moffatt's inter-row grass is the best of all the demonstrations. That was the result of the September planting of the grass, a firm recommendation of the author.

4.3.3 Weed Control

Following to control weeds is essential. The registered, pre-emergent chemical spinnaker® cannot be relied upon to control all weeds, especially legumes and big seeded species that come up from depth. Milk thistle, Datura, *Sida retusa*, red pig weed and noogoora burr are examples of these weeds. Other chemicals for annual grass control may need to be registered for use in leucaena to give more chemical options. The only real failure seen in 2008/9 (and outside the demonstrations) was where land preparation was rushed and weed control was poor.

4.3.4 Varieties

Both Tarramba and Cunningham have been sown side by side at all sites and to date, no differences in establishment, growth, flowering and seeding times, cold tolerance and productivity have been observed. Psyllids were present in one location and they appeared to be in equal numbers on both varieties. If definite statements need to be made about varieties, much more detailed work need to be undertaken and this is outside the scope of this type of project.

4.3.5 Grazing Management

Because of the size achieved by leucaena shrubs on the Downs, several people have commented that they will have to change their views on turnoff weights. Small cattle will not be able to manage shrubs over 2m tall and perhaps breeding cows do not need the high quality feed offered. The obvious answer is to use it for growing out sale cattle to larger sizes, targeting the Korean, European and Japanese markets instead of aiming for animals destined for feed lots (400 – 450 kg live wt.). As with other pasture systems, the method of grazing management is important. It seems appropriate to rotationally graze the material, allowing at least 6 weeks spell after each grazing during the growing season for recovery.

This will mean having several paddocks of leucaena and following, for example, a 2 weeks on and 6 to 8 weeks off programme during the growing season. John Moffatt prefers this system.

However his near neighbour, Craig Antonio, follows a set stocking system on his very much larger area with a beast to 1.2 ha since early November 2008. Craig usually sells his steers at 400+ kg live weight to feed lots but, because of the amount of leucaena he has this year, he intends to carry them on to Jap ox weight.

4.3.6 Productivity

As expected from the outset of the project, little animal production data were recorded because of time frame restrictions. However, the recorded weight gains from John Moffatt are in accordance with those experienced elsewhere in Queensland during the growing season, eg 1.2 to 1.3 kg live wt gain per head per day. Better gains are achieved from younger, growing animals.

Moffatt's production figures were obtained from 28 ha of leucaena and 10 ha of grass in the same paddock. They grazed the paddock for 47 days and:-

79 adult steers gained at the rate of 1.2 kg/head/day

+

49 yearling steers gained at the rate of 1.3 kg/head/day

Total weight gain = 7450 kg

= 159 kg per day

= 196 kg per ha including the 10 ha of grass.

Assuming a live wt price of \$1.70, the return per ha from the one grazing was \$333.20.

A rough calculation puts the cost of land preparation, weed control, planting the crop and planting the grass seed close to \$300.00 per ha.

Ten steers were left in the paddock to keep the rumen flora active.

After 8 weeks spell, a further group of steers were put into the paddock. They will be taken off in the May/June period 2009.

As a matter of interest, Moffatt's leucaena steers sold to a nearby feed lot achieved higher daily growth rates than any other group of steers put through the facility. The feed lot manager thought it may have been because they came off high quality forage (leucaena) and this prepared them to make the best use of the high quality feedlot material.

5 Success in Achieving Objectives

5.1 Objective 1: Establish and Manage Leucaena

Objective 1: Manage paddocks of leucaena of at least 20 ha, in each of 3 regions of the Darling Downs, using proven technology developed in central Queensland.

All objectives were met. Three main sites and one back up site were selected. The soil types and topography were varied to show producer groups what works, what happens when known technology is not rigidly followed and what should definitely be avoided. Poor paddock preparation and poor weed control and their effects on establishment were clearly demonstrated at field days outside the project sites.

The only set backs to establishment were floods at the Chinchilla site after planting requiring a replant and wildlife grazing at Yamsion which almost put paid to 15 ha of crop.

5.2 Objective 2: Record and Report Production

Objective 2: Record and report production of edible dry matter and any grazing undertaken (in cows days per ha). Weight gain information will also be recorded where possible.

This is one area where time has not allowed reliable information to be gleaned. At least 3 years of information is required for this. This report is only able to give one year's results from one producer.

5.3 Objective 3: Develop Realistic Guidelines

Objective 3: Develop realistic guidelines for the suitability, establishment, and likely productivity of leucaena for different soil types and areas of the Darling Downs.

From the outcomes of this project, a fact sheet has been developed for southern Queensland - *Leucaena recipe for Southern Queensland* (see appendix 9.1). It has been distributed on request to Darling Downs producers as well as people from as far away as St George and Roma. It gives all relevant up to date information on leucaena with simple guidelines on establishment and management.

Weed Potential: The Leucaena Network, based in Rockhampton, has detailed a standard for reducing the potential for leucaena to escape from its intended paddocks. If these are followed, there is little chance of it becoming an environmental menace. Because these rules have been followed in the PDS project areas, there have been no "escapes" from these farms.

However, at Goondiwindi leucaena plants were seen in several gardens and on the river banks in the town area. It appears that home gardeners have grown plants which have seeded and were then pruned. Pruning containing seed have been thrown onto the river bank in the town area where there are no grazing animals. Fortunately, established plants in this fairly confined area have been successfully destroyed by the town council who were alerted to the problem in March 09. It is precisely this situation that needs to be avoided at all costs, not only for leucaena but for other introduced pasture plants. Real care needs to be taken to avoid the potential prohibition of this valuable pasture plant.

5.4 Objective 4: Involve Local Grazier Groups

Objective 4: Involve local grazier groups at each site to ensure participation and shared understanding of soil and cultural requirements, plus likely productivity of leucaena in their local environments

All areas selected have strong producer involvement through linkages to Landcare groups. Without these, the field activities needed to instruct local producers are doomed to failure.

After establishment of each site, field days were held to show off results. All were well attended (refer table below). Follow up field days in 2009 were held at Yamsion and Chinchilla. Millmerran has missed out on an official field day but neighbours have met at Moffatt's for very local discussions. The district suffered from the loss of a land care coordinator for over 6 months.

Location	Date	Attendance
Chinchilla: Daryll and Kaylene Wonka	Initial field day after establishment 25 th February 2008	12 farmers attended
	Follow up day at projects end 27 th April 2009	12 farmers attended
Kaimkillenbun: Brett and Rana Haager,	Initial field-day after establishment 18 th April 2008	16 farmers attended
	Follow-up day - 27 th March 2009	10 farmers attended
Millmerran: John and Sue Moffatt	Initial day - 21st April 2008	22 farmers attended
In addition, there were 4 workshops conducted by University of Queensland and Leucaena Network @ Millmerran, Jandowae and Chinchilla		

Additional workshops and seminars have been held through the region:

- In September 2008, a Leucaena Network annual conference, including field inspections, was held at Chinchilla and **70 people attended**. Most were local producers.
- In November 2008, a field day showing off leucaena was organised by Tropical Grasslands Society. It was held at a Kaimkillenbun property which is close to the Yamsion site - **40 people attended**. This property has nearly 700 ha of leucaena and the manager willingly showed off all possible mistakes farmers can make if the rules are not followed.
- In March 2009, Tropical Grasslands Society held a conference at Goondiwindi where leucaena's role in southern Queensland was highlighted. A presentation showing the results of the Darling Downs PDS project was delivered and a follow-up field trip showed delegates what could be expected from this pasture system on Brigalow soils in that region. More than **80 people attended** the conference.

New paddocks of leucaena have been planted in each of the PDS project areas and all were sown by attendees of the field days. They all had specifically asked for the "leucaena Recipe" fact sheet developed for this area and all successfully followed the guidelines. Only one paddock was disappointing because weed control through the following period was poor. However, the owner used this first attempt to learn the technology and the paddock is good enough to keep.

6 Impact on Meat and Livestock Industry – now & in five years time

6.1 Impact on Meat and Livestock Industry – Now

The immediate effects are that farmers in the relevant parts of the Darling Downs can plan, with confidence, on returning marginal cropping land back to a very productive mixed pasture. They have been reluctant to take the step because of the unreliability of pasture establishment. Forage crops have been the safer option because sound land preparation will ensure some results where as pastures can take several years to become productive. Many people have had several attempts at establishing pastures over several years without any result.

Leucaena is the best summer growing legume option available. The presence of a legume gives the pasture system that much needed boost to productivity and sustainability.

6.2 Impact on Meat and Livestock Industry – in Five Years

It has the potential to substantially increase numbers of better quality cattle from a large area of southern Queensland from a sustainable, environmentally friendly pasture system. It is a definite substitute to the lot feeding industry with minimum environmental impacts. It would also release a lot of grain for other uses including human food.

There are at least 200,000 ha of land suited to leucaena that has been cultivated for crop growth on the Darling Downs. That is not counting the land suitable for sustained long term crop production. The area suited to leucaena in the other southern Queensland regions is not known.

Leucaena provides a pasture system that is reliable, productive and long lasting on the better classes of soil types in areas of southern Queensland receiving around 600mm of rainfall a year. Wonka's at Chinchilla have a 7.5ha paddock that has been very productive since 1994. It gives producers the opportunity to return non-viable and worn out cultivation paddocks back to a pasture that will also, with good management, reduce soil and water loss, reduce deep drainage of water through the profile, reduce the danger of inducing dryland salinity and increase soil carbon levels.

Because it is a legume, it gives grazing animals the protein required for growth for much longer, allowing animals here to achieve good weight gains for at least 7 months of the year. It has been shown through this demonstration that cattle steers will gain over 1 kg per day for sustained periods. This means that producers will be able to turn off animals at the required weight younger and perhaps allow producers to increase animal numbers safely.

Leucaena is also giving producers the opportunity to access a greater variety of markets. Instead of selling into the feedlot trade, some producers are suggesting that they can now safely and quickly grow out their animals to bigger weights and aim for other markets such as Jap Ox, Korean and European trade.

7 Conclusions and Recommendations

7.1 Conclusions

The project has shown that:

- Producers are interested in pursuing the Leucaena options on the Darling Downs
- Leucaena is suited to the clay and clay loam soils of the Darling Downs. The forage has been stretched to the lighter soils with deeper profiles provided the required nutrients are present or added.
- Leucaena is the best option for a summer growing legume for the area.
- Establishment of Leucaena is very reliable if the known technology for summer crop growing is followed. That is, fallowing for soil moisture and weed control, planting with a sound planting machine and following the known weed control guidelines.
- Varietal differences are minimal.
- Row width and row configurations are optional but single rows 7 to 8 m apart are favoured at this time.
- The best sowing time is late spring to early summer, the earlier the better. Planting then with adequate sub soil moisture and normal summer rainfall conditions, grazing may commence towards the end of the 1st growing season. All of the demonstration sites were grazed within 14 months of sowing, the earliest being after 11 months from sowing.
- Good weed control through the fallow period and the first year of growth is critical. Seedlings are fragile and susceptible to competition for about 6 weeks.
- Leucaena is capable of providing quality forage for at least 7 months of the year and animals are capable of gaining in excess of 1 kg live weight a day while sufficient of the material is available. Grazing cattle must also have access to the known rumen flora which eliminates toxicity and allows availability to the plants' protein content.
- Observations indicate that stocking rates on leucaena will be substantially higher than on pure grass pastures. These improved stocking rates will be maintained because the usual protein rundown in pasture will not occur as long as the required fertility (particularly phosphorus and sulphur) is maintained. No observations of fertility requirements has been possible in this project
- Grazing management favoured is a rotational system of short but intensive grazing pressure to keep the shrub to a manageable height and then spell for at least 6 weeks for recovery. The only managed grazing in this demonstration was at Millmerran where 5 beasts/ ha were used for 47 days and then the paddock was given 8 weeks spell. Seven steers remained on the paddock during the spell time to keep the introduced rumen flora active.

- Provided at least 50% ground cover is maintained, soil water runoff will be reduced along with reduced soil loss. Dryland salinity will be far less likely than compared with continued cropping because deep water drainage will be substantially reduced.
- Soil carbon levels and soil biota numbers will be enhanced because it is a permanent cover crop with a large root system. It will also enhance the development of better grass root systems because of the accumulation of soil nitrogen
- Provided care is taken not to allow plants to escape to areas not accessed by any type of grazing animals, the possibility of it becoming an environmental weed in this area is limited.

7.2 Recommendations

It is recommended that:

- Leucaena as a ***pasture legume be recommended*** as a viable option for the elevated, previously cropped lands of the northern and central Darling Downs, particularly on clay and clay loam soils. It is not recommended further south than Clifton.
- ***Guidelines*** developed for growing Leucaena on the Darling Downs ***are endorsed*** by the industry. Additionally producers should seek expert advice before planting anywhere in southern Queensland, so that a risk assessment can be made, particularly with respect to the landscape, climate, soils and possibility of escaping from the plantation. All potential growers must be made aware of the guide lines developed by the Leucaena Network to avoid the possibility of it escaping into the uncontrolled landscape.
- Additional work on the ***economics and return on investment*** is required, especially in relation to inputs required (fertilisers) on poorer soils.
- Farmers and graziers should be encouraged to actively destroy ***leucaena plants on public land***, or, alert the responsible authorities and make certain that they carry out the necessary destruction. Home gardeners should be made aware of the dangers of having this plant on their properties and if they must have it, not allow it to seed. It should never be allowed to be sold from plant nurseries.
- Further ***applied research*** is needed to:
 - (i) Measure the longer term viability and production from leucaena in this area. Susceptibility to the severe frosts known to have occurred in the past is still an unknown. Long time Downs residents have indicated that it is possible to have many (up to 10) severe frosts in a row. How would leucaena survive that?
 - (ii) Observe and document grazing methods (rotational and set stocking) to allow sensible recommendations to be made.
 - (iii) Determine the best row spacings, which are still a matter of discussion; however, rows 7 to 10m wide are favoured to give inter-row grass a better chance.

- (iv) Investigate using winter oats with zero till technology. There is some interest from graziers to plant forage crops in between leucaena rows. Incorporating other legumes in the inter-row pasture is a worthy option, particularly in rows wider than 6m. Suggestions include medics and woolly pod vetch as well as *Seca stylo*, *Caatinga stylo* and *Desmanthus* for summer growing species. Note that none of these legumes are direct substitutes for leucaena producing only a fraction of the dry matter and animal production of the latter.
- (v) Determine the best time to plant grass in-between the rows and decide which grass species are the best to use.

8 Appendices

8.1 Leucaena Fact Sheet

Leucaena for the Darling Downs

General facts

- Leucaena is a fast growing, tropical, legume shrub, with very high protein content in its leaves and small stems. It has a large tap root and wide ranging lateral root system
- It will last over 40 years with reasonable treatment.
- Establishment is very reliable as long as the “rules” for leucaena are followed (given below).
- Its soil, climatic and cultural requirements resemble grain sorghum, i.e. fallow for weed control and moisture accumulation, treat seed for soil insect control, plant when soil moisture conditions are right and soil temperatures are over 18°C.
- It thrives best in deep, alkaline clay soils with high moisture holding capacity and high fertility. Specifically, it requires high soil phosphorus, calcium, potassium, sulphur and zinc. It will grow on calcareous soils with pH above 5.5.
- It requires soil temperatures above 18°C to germinate seed and requires temperatures of 25 – 30 ° for optimum growth.
- Medium intensity frosts will knock back mature plants to ground level. They will regrow with the onset of warm weather.
- Light frosts will not affect mature plants over 2 metres tall. Plants may drop all of their leaves.
- The plant contains a toxic substance called mimosine. It is concentrated in the leaves and young growing points. This is broken down to a chemical called DHP by the normal rumen bacteria.
- DHP is also toxic and most symptoms of poisoning are caused by this substance. Hair falling out is the obvious visual symptom. The tail hair is first to go. If this happens, remove the animals from leucaena.
- DHP toxicity is avoided by orally drenching specific rumen bacteria into 10% of the leucaena cattle. This introduces the correct biota into their digestive system. It is readily available from DPI&F's Brian Pasture Research Station, Gayndah, QLD. Follow their instructions carefully.
- Expect live weight gains from animals on fresh leucaena of about 1 kg per day.

It is recommended that all leucaena growers join the “Leucaena Network” based in Rockhampton.

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Darling Downs Experiences

Leucaena has shown it will be very productive in areas receiving 600mm per year or more.

Given that rainfall, it has performed well in soils with a plant available water capacity (PAWC) of 120mm or better. This is marginal for grain cropping.

Most important - have potential leucaena paddocks soil tested to at least 120cm deep and professionally interpreted to measure PAWC and the elements phosphorus (P), potassium (K), sulphur (S), Calcium (Ca) and zinc (Zn).

Soil (P) levels on the bicarb test, must be at least 25 mg/kg. If the soil PAWC is adequate, it will pay to add P at planting at lower soil P levels.

Most of the other elements are commonly adequate in this region, but sulphur (S) and Zn could be low on basaltic clay soils which have been cropped for many years. **Seek professional help.**

It is suited to the sloping Brigalow and scrub soils of north eastern downs, central downs and western downs. Select paddocks in the warmer sections of the landscape. Avoid

(A) Low sloping land on the flood plains prone to severe frosts (below -6° C) and areas south of Clifton which may be too cold for too long for productive growth.

(B) Lower slopes and hollows in undulating landscapes. Severe frosts in July 2008 have rendered plants totally unproductive in 2009 even though they are still alive. Needs further investigation.

Control all weeds during the fallow period. Plan to have all “hard to control” weeds adequately suppressed before attempting to establish leucaena.

Plant only fresh, scarified seed.

Treat all seed with the chemical fipronil to control soil insects and with the correct inoculant. Use either leucaena or desmanthus inoculant. Treat only that amount of seed that will be used in half a day and keep treated seed cool before sowing.

Specifically, Use 90ml Regent ® with between 50 & 100ml water per 100kg seed. Adjust the rate of Cosmos ® according to its concentration of active ingredient. For example, mix 25 kg leucaena seed to a quarter of a packet of inoculant in about half a litre of water + 22.5 ml of Regent + 1 teaspoon of sugar (as a sticker) in a cement mixer. If the seed is too wet, allow it to dry so it will flow through the seeder. Store treated seed in the shade and **only inoculate enough seed to last a day’s planting.**

Sow only after soil temperature reach 18°C into good soil moisture conditions. Plant from October to February, the earlier the better.

Sow with a suitable row planter that will metre seed accurately – a seed every 2-3 cm – and is equipped with press wheels; Twin side pressing types are best. Sow into the same soil conditions and depth as applies to grain sorghum.

Both conventional and zero till (ZT) techniques are suitable for land preparation, sowing and establishing leucaena. ZT has the advantage of retaining moisture in the sowing zone for longer.

Row spacings and row configurations are personal choices. Configurations can be single rows with 5 to 10 m between rows, or 2 rows one metre apart and then 5 to 10 m between outside rows. The simplest and most practical configuration appears to be single rows 7 & 8 m apart.

Varieties: Several growers have expressed strong personal choices on varieties. There are no apparent observed differences between the varieties Tarramba and Cunningham in terms of establishment, growth rates, forage production, insect susceptibility and cool tolerance.

Weed control during the establishment phase is critical. Use **spinnaker®** as recommended on the label. Note: Use it as a pre-emergent in an area at least 1m either side of the planted row. Some farmers use it over the entire inter-row spacing.

If weeds are emerging at sowing, spray them out using glyphosate at the same time as the planting operation. Do not delay this more than 1 day as leucaena seed may have already started the germination process.

After Establishment

Plant suitable grass or pasture mixtures between the rows once the leucaena has reached about 1m high. This could be as early as February in the same summer season or October the next season. Some farmers have sown the inter-row two (2) months after planting the leucaena with excellent results. However, inter-row weed control is the first priority.

The choice of grass variety will depend on personal experience. The following have been used successfully; Green panic, Gatton panic, bambatsi, fine cut Rhodes, premier digit, purple pigeon and Bisset creeping blue grass.

Legumes can be included into the grass mixture if desired. Suggestions include winter growing medics and vetches as well as summer growing *Desmanthus* and *Caatinga stylo*.

Grazing management

Before introducing cattle into the leucaena paddock, drench the special leucaena rumen bug into 10% of the animals. Some researchers have suggested grazing the animals for 2 weeks on leucaena before drenching but practical considerations may not allow this.

In 2009, some successful graziers used "set stocking" on leucaena, putting 1 adult equivalent to 1.2 to 2 ha for the whole of the growing period.

Others have sub - divided paddocks to allow 6 to 8 weeks spell during the growing season. Both systems worked well and more observations are needed to establish the best option.

However, no matter what system is used, it is important to have some inoculated animals in leucaena throughout the year to perpetuate the introduced rumen biota. There is always some eatable material on leucaena even through the winter period.

Leucaena as a weed

The “Leucaena Network”, based in Rockhampton has put together a document (called the leucaena Code of Practice) indicating how to avoid letting leucaena become a weed. Please read this document before planting any leucaena.

Briefly, the code outlines management practices necessary to keep leucaena inside the paddocks in which it is planted.

- Try not to let it seed,
- Don't plant it close to water courses or drainage lines that lead to major water courses and
- Kill any plants that do happen to escape from your leucaena plantation. Hop out of your vehicle and kill any plants seen on roadsides or alert the appropriate authorities (council weed officers) of its presence and follow it up to see that it is destroyed.
- **Do not let people harvest your seed if they have the idea to plant it into home gardens.**

For more information and latest research data, contact the Leucaena Network.