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ILC2018 Poster and Producer paper*

Comparing the grazing productivity of 'Redlands' and 'Wondergraze' leucaena varieties

Comparando la productividad de las variedades de leucaena 'Redlands' y 'Wondergraze' bajo pastoreo

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Introduction

Leucaena is a rapid-growing, perennial, leguminous tree with the potential to sustainably intensify beef production in the northern rangelands of Australia (Harrison et al. 2015). Adoption of leucaena in the northern Australian beef industry has been slow, partly due to the prevalence of the sap-sucking leucaena psyllid (*Heteropsylla cubana)*. Recent efforts to develop new psyllid-resistant varieties have resulted in the release of cultivar Redlands, which has the potential to improve beef production in northern environments. A large-scale trial has been established to compare liveweight gains of cattle grazing Redlands, with that of the established cultivar Wondergraze in a psyllid-prone environment of north Queensland. This paper presents some preliminary results from the trial as the grazing phase commenced only in June 2018. Weight changes of successive groups of weaner steers (*Bos indicus* type) will be monitored over at least three 12 month grazing periods. Stocking rates in the first year are light to protect young leucaena plants, but will be increased in subsequent years when the leucaena is fully grown.

Materials and Methods

Preparation of trial site and psyllid monitoring

A 61 ha cleared trial site was selected at Pinnarendi Station (18.03849º S, 144.872453º E; 759 masl) on yellow to red-brown granite-derived soil with an average pH of 6.4 ± 0.07. Average annual rainfall is approx. 690 mm with the majority falling between November and April. Soil phosphorus and sulphur concentrations were low (5.1 ± 0.06 and 2.6 ± 0.15 mg/kg, respectively).

Prior to the 2016/2017 wet season, plant rows were set-out and prepared by strip cultivation. Superphosphate (9% P, 11% S) was applied at 300 kg/ha (27 kg P/ha; 33 kg S/ha) to a 1 m strip along plant rows before planting. Two leucaena treatments, cvv. Redlands and Wondergraze, were sown in an 8-paddock paired block design (Figure 1) in early 2017 during the wet season. After initial establishment, superphosphate was again applied at 280 kg/ha (25 kg P/ha; 31 kg S/ha) to a strip over the plant rows. Six months after planting, granulated sulphur (90% S) was applied over the leucaena rows at 160 kg/ha (144 kg S/ha) to provide sulphur for leucaena over the longer

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Figure 1. Trial layout with 4 replicates of Redlands (R'lnds) and Wondergraze (W'grz) in 8 paddocks.

8 R'lnds 8.4 ha Water	7 W'grz 8.4 ha Water	Station Access Road	Yards/ Scales	6 W'grz 7.3 ha Water	5 R'lnds 7.3 ha Water	4 R'lnds 7.3 ha Water	3 W'grz 7.3 ha Water	2 R'lnds 7.3 ha Water	1 W'grz 7.3 ha Water
Laneway				Laneway					

Table 1. Pinnarendi actual rainfall for 2017 and 2018 and the long-term median from the closest weather station.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Pinnarendi 2017	235	131	126	15	16	5	2	8.5	0	80	5	40	663
Pinnarendi 2018	175	122	298	12	4	12	8	1	1	37	19	262	952
Long-term median[1]	152	191	98	25	16	11	6	0	0	12	50	118	679

[1]Long-term median from Meadowbank weather station (1956–2017; Bureau of Meteorology) located in the district.

term; superphosphate was broadcast across the whole site at 240 kg/ha (22 kg P/ha; 26 kg S/ha) to promote growth of the inter-row pasture. In February 2018, a contingency application of custom-blend fertilizer (12% N, 11% P, 10.5% S) was applied at 250 kg/ha (30 kg N/ha, 27.5 kg P/ha; 26 kg S/ha) over a 3 m strip along plant rows to address apparent suboptimal growth of leucaena during the 2017-2018 wet season.

Existing inter-row pasture species were retained and included Indian couch (*Bothriochloa pertusa*), Wynn cassia (*Chamaecrista rotundifolia*), Sabi grass (*Urochloa mosambicensis*) and *Stylosanthes* spp. The leucaena and pasture grew well, helped by useful late rainfall in May 2017 and unseasonal rainfall in October of the same year (Table 1, Figure 2).

Figure 2. Redlands leucaena in Sabi grass pasture at Pinnarendi after 2017 wet season.

The Pinnarendi site was deliberately selected in an environment where psyllids were known to be prevalent so that any productivity difference between Redlands and Wondergraze caused by psyllid damage could be expressed. No attempt is being made to control psyllids. A monitoring program using 9 sentinel plants per paddock (9 × 8 = 72 plants total) was set-up to record the degree of leaf damage caused by psyllid infestations. A modified rating scale (Wheeler 1988) was used, where 0 is no psyllids present and 9 is blackened stems with total leaf loss. Assessments were made on 9 occasions in 2017 and 4 in 2018.

Grazing Trial

The Queensland Department of Agriculture and Fisheries (DAF) Animal Ethics Committee approved animal handling and experimental procedures (SA 2017/12/628). Consistent groups of cattle have been grazing on the trial site since late June 2018 comprising 16 Droughtmaster (stabilized *Bos indicus* × *Bos taurus*) steers and 12 Brahman cross (*Bos indicus* × *Bos taurus*) steers. There are 4 treatment groups with 7 animals/group blocked according to breed (4 × Droughtmaster and 3 × Brahman cross per group) and weight (to achieve relatively similar initial total group weights). The groups were assigned at random to either Redlands or Wondergraze treatments. Sampling of biomass to estimate dry matter yields was done in the inter-row pasture in late July 2018. Leucaena biomass was sampled in paddocks 1–4 on 16 August prior to cattle entry and again after cattle were removed on 28 September. Paddocks 5 and 6 were also sampled in mid-September before cattle entry. A weather station was installed to monitor rainfall, temperature, wind speed and solar radiation. Electronic monitoring systems track tank water levels, while cameras remotely monitor watering points and cattle, while they are in proximity of the watering points.

Results

Establishment and psyllid observations

Growth of leucaena during the 2017-2018 wet season was suboptimal, despite earlier fertilizer applications. Potentially, this was attributable to nitrogen deficiency, caused by

poor root colonization with non-viable rhizobium inoculum (CB 3126) applied to seed before sowing. Overall, establishment of Redlands was worse than that of Wondergraze owing to differences in germination rates (30–45 vs. 80–90%, respectively). However, Redlands mostly compensated with increased growth so that final biomass was relatively uniform across all paddocks with the exception of Paddock 8, which has produced poorly.

Psyllids were active across the trial site from May to September 2017. Monitoring of incidence and damage showed that Wondergraze suffered significantly more damage than Redlands (Figure 3), but Wondergraze recovered quickly once psyllid pressure declined after September. Psyllid populations and damage were comparatively low during 2018 and are not reported. Inter-row pasture biomass (dry matter basis, DM; ± s.e.) was 6,020 ± 1,527 kg/ha across replicate paddocks at the site early in the dry season (late July 2018), comprising about 45% legume and 55% grass. Edible biomass (leaf and stem <5 mm diameter) of leucaena was only 65 ± 33 kg DM/ha in early July 2018 but had increased to 158 ± 51 kg DM/ha by late September in paddocks which had been spelled since late June. This was due to warming weather as there was no significant rain at the site since March 2018. Average daily liveweight gains (ADGs) have been determined for Redlands and Wondergraze treatments for the period of grazing from weighing events conducted in August and September 2018 (Table 2). These data are preliminary only and have not been analyzed for statistical significance. During this period, trial animals were also sporadically fed molasses (equating to about 2.5 MJ ME/hd/d) to accustom them to routine handling.

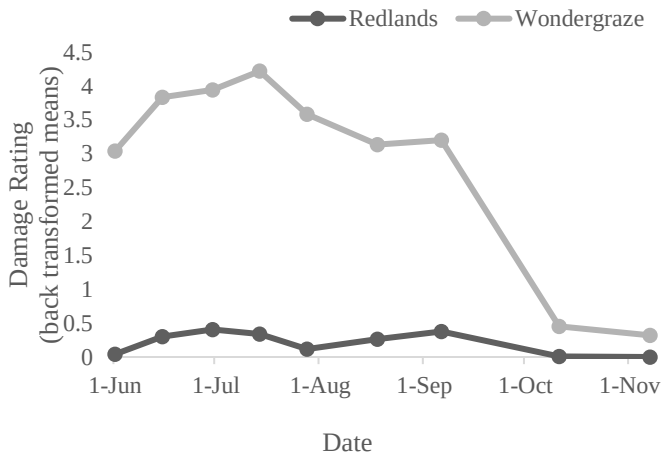

Figure 3. Psyllid incidence/damage in leucaena at Pinnarendi during 2017.

Table 2. Preliminary ADG data (± s.e.) for 28 steers grazing leucaena cvv. Redlands and Wondergraze at Pinnarendi Station, Mt Garnet district (28 June–20 September 2018).

	Average start weight (kg)	ADG (kg/hd/d)
28 Jun–7 Aug (40 days)		
Overall	231 ± 31	0.50 ± 0.21
Redlands	237 ± 35	0.47 ± 0.21
Wondergraze	225 ± 24	0.53 ± 0.20
7 Aug–20 Sep (44 days)		
Overall	248 ± 38	0.38 ± 0.18
Redlands	253 ± 43	0.32 ± 0.19
Wondergraze	244 ± 34	0.43 ± 0.15

Discussion and Conclusions

Preliminary results from the initial 3 months of grazing in the trial show cattle are gaining weight during the dry season with ADGs of about 0.4 kg. This is considerably higher than would be expected from native pastures at the same time of the year. While leucaena yield was low during the period and the grass-legume inter-row pasture will have contributed to this figure, leucaena was the only green feed available in the paddock and was high quality. Redlands was consumed readily by trial animals. To date, Wondergraze paddocks have produced slightly higher ADGs than those containing Redlands leucaena. However, the difference is not yet considered to be significant and the contribution of the inter-row pasture needs to be clarified. While psyllid resistance of Redlands was demonstrated during 2017, psyllid infestation during grazing in 2018 has been light and has not reduced growth of Wondergraze relative to Redlands. Performance of animals over the next 2–3 years is required to fully test the productivity of Redlands relative to Wondergraze grown within legume-grass pastures over a range of seasonal conditions.

Acknowledgments

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References

(Note of the editors: All hyperlinks were verified 2 May 2019.)

Harrison MT; McSweeney C; Tomkins NW; Eckard RJ. 2015. Improving greenhouse gas emissions intensities of subtropical and tropical beef farming systems using *Leucaena leucocephala*. Agricultural Systems 136:138–146. doi: 10.1016/j.agsy.2015.03.003.

Wheeler R. 1988. *Leucaena* psyllid trial at Waimanalo, Hawaii. Leucaena Research Reports 9:25–29. bit.ly/2Lk7miE

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‘Redlands for Regions’: Producer demonstration sites of psyllid-resistant leucaena across north Queensland

‘Redlands for Regions’: Un proyecto de sitios de demostración a nivel de productor de leucaena resistente a Heteropsylla cubana *en el norte de Queensland, Australia*

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Introduction

Leucaena, a tree legume with potential to greatly improve cattle performance, has not been readily adopted in northern Queensland primarily due to prevalence of the psyllid (*Heteropsylla cubana*) insect in higher rainfall zones. Psyllids reduce edible biomass in leaves by 40–52%, combined with a 46–83% reduction of stem yield (Bray and Woodroffe 1991). Losses to the Central Queensland beef industry due to psyllid impact on animal performance are estimated at $2 M per year (Mullen et al. 1998). Cultivar Redlands is a psyllid-resistant leucaena variety recently developed by Meat and Livestock Australia (MLA) and the University of Queensland. This new variety has the potential to lift productivity of cattle enterprises in the north. To accelerate early adoption and demonstrate benefits of the new variety to the grazing industry, the Redlands for Regions (R4R) project matched producer funds with PIFT-MDC (Producer Initiated Fast Track-MLA Donor Company) funding. The R4R project, led by The Leucaena Network (TLN), includes 7 trial sites in psyllid-prone areas with moderate to high rainfall from Mackay to the Atherton Tablelands in north Queensland. These sites will act as a platform for industry promotion and adoption of this promising new variety in accordance with TLN Code of Practice (CoP). The project supplied seed and technical assistance via Department of Agriculture and Fisheries (DAF) staff during the preparation and establishment phases to demonstrate best management practice for leucaena in these psyllid-vulnerable rainfall zones. This paper summarizes the extension processes employed during the project and highlights the challenges and successes at the project sites.

Planning and Site Selection

In May 2017, north Queensland-based DAF staff compiled a list of producers interested in establishing leucaena and the merits of each site based on location, soil types, expected psyllid pressure and the agronomic skills, confidence and capacity of the particular producers. In October 2017, producer agreements were finalized with 6 property owners (Table 1) with an additional property owner selected in December, independent of R4R funding.

The DAF team assisted MLA with engaging producer co-operators for the project. Once MLA had selected the sites, DAF provided technical and agronomic support including soil tests and interpretation, equipment requirements, fertilizer recommendations, seedbed preparation, planting and herbicide advice. Early development and

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Table 1. Names and location of 7 beef producers and their properties involved in the early pilot program for growing the Redlands leucaena variety in north Queensland.

Region	Property and Owner	Expected prevalence of psyllids
Mackay	Hazelwood, Mackay - Mark and Linda Degura	Moderate to high
	Mt. Spencer, Nebo - David Wright	Moderate to high
	Woonon, Sarina – Wayne and Scott Davis	Moderate to high
Townsville	Swans Lagoon, Millaroo - Peter Malpass	Moderate to high
	Four Mile, Woodstock - Gerard and Elizabeth Lyons	Moderate to high
Northern	Goshen, Mount Garnet - Brett Blennerhassett	Very high
	Quincan Springs, Peeramon - Peter and Colleen McLucas	Very high

establishment success were monitored at the respective sites where applicable, and local paddock walks conducted. Members of TLN and DAF coordinated 6 field days (total of 55 producers attended) on the northern sites to expose beef producers (R4R producers and the wider industry) to the latest leucaena establishment and production techniques. Field day topics included site selection, site preparation, planting, establishment and herbicide programs.

Materials, Methods and Results

Goshen (Brett and Theresa Blennerhassett)

The Goshen site consists of infertile red-earth soils. The Blennerhassetts purchased a heavy-duty Norseman twin-row leucaena planter with precision depth control (Figure 1) and leucaena was sown in February and March 2018 in twin rows (900 mm apart) with inter-row spacing of 10 m. Placing seed at 15–25 mm depth reduced time to emergence and improved overall establishment in comparison with planting at depths >30 mm under the same conditions. Approximately 56 ha of Redlands was successfully established at Goshen. Performance of this stand will be observed in comparison with a 40 ha stand of the psyllid-prone cultivar Cunningham, which pre-dates the Redlands planting.

Quincan Springs (Peter and Colleen McLucas)

This site on the Atherton Tablelands has deep, fertile red basalt soils. Redlands was sown into 32 ha (divided into 4 × 8 ha paddocks) in single rows with 15 m inter-row spacing in February 2018 using an adapted corn planter. Despite problematic seedbed preparation due to project delays and high residual organic matter levels, good establishment was achieved across the entire site. Weed control (tropical grasses and legumes plus broad-leaf weeds) was challenging at the site. Despite several frosts during June, leucaena was not affected. Stock were introduced to the site in August 2018 when leucaena plants were about 2 m tall (Figure 2).

Figure 1. The Norseman precision planter (left) and twin row Redlands leucaena seedlings (right) on Goshen.

Figure 2. Peter McLucas (Quincan Springs) and Bernie English (DAF) inspect leucaena seedlings (top) and cattle grazing the trial area in August 2018 (bottom).

Townsville sites

The soils at the Townsville site, Four Mile, are infertile, poorly structured yellow sandy-earths with low water-holding capacity and poor drainage. They were deemed unsuitable for leucaena establishment. Despite this, the Lyons family invested considerable effort in ground preparation and refining sowing techniques. Soils at the Swans Lagoon site were only marginally better and were also considered unsuitable for leucaena. About 30 ha of Redlands was sown at each site during February and March 2018 as conditions allowed but the unsuitable soils, plus hot, dry conditions and weed competition all contributed to poor establishment. When inspected in May 2018, leucaena was small and unthrifty at both sites and unlikely to survive.

Mackay sites

No attempt was made to establish leucaena at the Mackay sites in the 2017/18 growing season. Site preparation is underway currently at all sites and planting will take place over the 2018/19 spring-summer period.

- At Woonon, soil testing and interpretation have been completed across the 27 ha paddock selected for sowing with leucaena. Paddock clearing and initial cultivation have also been completed. A challenge with this site is high grass yields (>10,000 kg DM/ha).
- At Mount Spencer, the Wright family is being assisted by agricultural consultants Farmacist. In addition to soil sampling and analysis the 16 ha paddock was cleared of regrowth in 2017 and cultivated twice in late August 2018. Planting strips at 10 m spacing have been marked with a GPS and double-ripped. Paddock and soil variability will also be mapped using Electro-magnetic (EM) surveys prior to planting.
- At Hazlewood, an old sugarcane paddock was cultivated in March 2018 to incorporate trash from the previous cane crop. Soil samples have been collected and EM mapping data are available. Two additional cultivations were performed in May and the site was planted to pasture. Strips for planting leucaena rows were ripped at 10 m spacing using a GPS guidance system. Leucaena will be planted in the 2018/19 wet season in single rows with 10 m inter-rows.

Discussion and Conclusions

Under R4R, Redlands has been successfully established at both northern sites. At Goshen, planting of further areas with Redlands is planned for the 2018/19 growing season. The Townsville sites seem unsuitable for leucaena and would be more suited to development with improved pastures comprising a mix of grasses and legumes such as Rhodes (*Chloris gayana*), Keppel (*Bothriochloa pertusa*), Seca (*Stylosanthes scabra*) and Verano (*S. hamata*). Despite these recommendations, collaborators at both sites intend to plant more areas with Redlands in 2018/19. At Swans Lagoon, irrigated soils currently being trialled with Rhodes grass and *Desmanthus* sp. would be better suited to leucaena than the paddock previously used. DAF staff will continue to advise managers of Swans Lagoon to locate future leucaena plantings on these areas.

Learnings

Experiences from the project reinforce what is already known. Successful leucaena establishment is dependent on selection of appropriate soils/land types, good seedbed preparation, adequate soil moisture, good weed control, timely access to equipment and acquiring the necessary agronomic skills. Correct setting and control of planting depth were also of particular importance at the sites selected.

Future

While the R4R program is due to be finalized by March 2019, recommendations for future work include:

- Recording the performance of cattle grazing Redlands at the Mackay sites, assuming successful establishment during the 2018/19 wet season;
- Recording the performance of cattle grazing Redlands at Quincan Springs [to assess the cost: benefit of adding leucaena to highly productive grass-legume pastures on the Atherton Tablelands, which already achieve liveweight gains (LWGs) up to 250 kg/head/year]; and
- Comparing LWGs produced on Redlands with that on Cunningham at Goshen.

Such project activities would link closely with the Pinnarendi grazing trial (Mount Garnet), where productivity of Redlands is being compared with that of Wondergraze and initial grazing data indicate daily LWGs during the dry season of 0.4 kg/head. Continuing a series of trial and demonstration sites across north Queensland will expose beef producers to the practical challenges and production benefits of growing leucaena and sustainable management under the leucaena CoP.

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