

## Further reading

Two Special Issues of Tropical Grasslands-Forrajes Tropicales were published under an agreement with the Organizing Committee of the International Leucaena Conference (ILC2918) held at The University of Queensland, Brisbane, Australia, 1–3 November 2018.

### International Leucaena Conference

**Anon. 2019. SPECIAL ISSUE I.** International Leucaena Conference 1–3 November 2018, Brisbane, Queensland, Australia. *Tropical Grasslands – Forrajes Tropicales*, Volume 7, No. 2 February – May 2019.

SPECIAL ISSUE I contains the 24 papers presented during Sessions 1–4 of the Conference, pp 56–213.

Session 1: Germplasm resources of leucaena, pp 56–103

Session 2: Establishment and management of leucaena, pp 104–145.

Session 3: Feeding and management for animal production, pp 145–192.

Session 4: Alternative uses of leucaena, pp 193–213.

**Anon. 2019. SPECIAL ISSUE II.** International Leucaena Conference 1–3 November 2018, Brisbane, Queensland, Australia. *Tropical Grasslands – Forrajes Tropicales*, Volume 7, No. 4 July – September 2019.

SPECIAL ISSUE II contains the 36 papers presented during Sessions 5–8 of the Conference, pp 359–478.

Session 5: Leucaena and the environment, pp 259–302.

Session 6: Leucaena systems in Australia, pp 303–352.

Session 7: Leucaena systems in tropical America, pp 353–409.

Session 8: Leucaena systems across Asia, pp 410–468.

An overview of the papers presented at the Conference by researchers, extension consultants and graziers is given in:

**Shelton, H. Max. 2019.** International Leucaena Conference 2018: Highlights and priorities 469-478 H. Max Shelton. *Tropical Grasslands-Forrajes Tropicales* 2019, Vol. 7 (4):469–478.

## References to recent research

### 1. Why plant leucaena?

Bowen M; Chudleigh F; Buck S; and Hopkins K. (2018). Productivity and profitability of forage options for beef production in the sub-tropics of northern Australia. *Animal Production Science* 58:332–342.

Max Shelton and Scott Dalzell. (2007). Production, economic and environmental benefits of leucaena pastures. *Tropical Grasslands* 41: 174–190.

Gramshaw D. and Lloyd D. (1993). Grazing the north: creating wealth and sustaining the land. Information series QI92042. Queensland Department of Primary Industries, Brisbane.

Lifting Leucaena adoption in north Queensland (2019). MLA Final Report B.NBP.0791.

### 2. Establishment

#### Cultivars

Dalzell SA. 2019. Leucaena cultivars – current releases and future opportunities. *Tropical Grasslands-Forrajes Tropicales* 7:56–64.

Lemin C; Rolfe J; English B; Caird R; Black E; Dayes S; Cox K; Perry L; Brown G; Atkinson R; Atkinson N. 2019. Comparing the grazing productivity of ‘Redlands’ and ‘Wondergraze’ leucaena varieties. *Tropical Grasslands-Forrajes Tropicales* 7: 96–99.

McMillan HE; Liu G; Shelton HM; Dalzell SA; Godwin ID; Gamage H; Sharman C; Lambrides CJ. 2019. Sterile leucaena becomes a reality? *Tropical Grasslands-Forrajes Tropicales* 7: 74–79.

Oram RN. 1990. Register of Australian herbage plant cultivars. 3rd Edn. CSIRO Division of Plant Industry, Melbourne, Victoria, Australia

Real D; Han Y; Bailey CD; Vasan S; Li C; Castello M; Broughton S; Abair A; Crouch S; Revell C. 2019. Strategies to breed sterile leucaena for Western Australia. *Tropical Grasslands-Forrajés Tropicales* 7: 80–86.

### Rhizobium

Mullen BF; Frank VE; Date RA. 1998. Specificity of rhizobial strains for effective N<sub>2</sub> fixation in the genus *Leucaena*. *Tropical Grasslands* 32: 110–117.

### Row spacing

Pachas ANA; Shelton HM; Lambrides CJ; Dalzell SA; Murtagh GJ. 2018. Effect of tree density on competition between *Leucaena leucocephala* and *Chloris gayana* using a Nelder Wheel trial. I. Aboveground interactions. *Crop and Pasture Science*, 69: 419–429.

Pachas ANA; Shelton HM; Lambrides CJ; Dalzell SA; Murtagh GJ; Hardner CM. 2018. Effect of tree density on competition between *Leucaena leucocephala* and *Chloris gayana* using a Nelder Wheel trial. II. Belowground interactions. *Crop and Pasture Science*, 69: 733–744.

Pachas ANA; Shelton HM; Lambrides CJ; Dalzell SA; Macfarlane DC; Murtagh GJ. 2016. Water use, root activity and deep drainage within a perennial legume-grass pasture: A case study in southern inland Queensland, Australia. *Tropical Grasslands-Forrajés Tropicales*, 4: 129–138.

## 3 Managing the plant

### Plant nutrition

Burle STM; Shelton HM; Dalzell SA. 2003. Nitrogen cycling in degraded *Leucaena leucocephala*-*Brachiaria decumbens* pastures on an acid infertile soil at Mt Cotton, south-east Queensland, Australia. *Tropical Grasslands*, 37: 119–128.

Conrad KA. 2014. Soil organic carbon sequestration and turnover in leucaena-grass pastures of southern Queensland. PhD Thesis, The University of Queensland, Brisbane, Australia

Conrad KA; Dalal RC; Dalzell SA; Allen DE; Fujinuma R; Menzies NW. 2018. Soil nitrogen status and turnover in subtropical leucaena-grass pastures as quantified by  $\delta^{15}\text{N}$  natural abundance. *Geoderma*, 313: 126–134.

Conrad KA; Dalal RC; Dalzell SA; Allen DE; Menzies NW. 2017. The sequestration and turnover of soil organic carbon in subtropical leucaena-grass pastures. *Agriculture, Ecosystems and Environment*, 248: 38–47.

MLA Tips and Tools 2019. Managing plant nutrition of leucaena pastures.

MLA Tips and Tools 2019. Monitoring plant nutrition of leucaena pastures.

Pachas ANA. 2017. A study of water use in leucaena-grass systems. PhD Thesis, The University of Queensland, Brisbane, Australia.

Pachas ANA; Shelton HM; Lambrides CJ; Dalzell SA; Murtagh GJ; Hardner CM. 2018. Effect of tree density on competition between *Leucaena leucocephala* and *Chloris gayana* using a Nelder Wheel trial. II. Belowground interactions. *Crop and Pasture Science*, 69: 733–744.

Radrizzani A. 2009. Long-term productivity of *Leucaena* (*Leucaena leucocephala*)-grass pastures in Queensland. PhD Thesis, The University of Queensland, Brisbane, Australia.

Radrizzani A; Dalzell SA; Kravchuk O; Shelton HM. 2010. A grazer survey of the long-term productivity of leucaena (*Leucaena leucocephala*)-grass pastures in Queensland. *Animal Production Science*, 50: 105–113.

Radrizzani A; Dalzell SA; Shelton HM. 2011. Effect of environment and plant phenology on prediction of plant nutrient deficiency using leaf analysis in *Leucaena leucocephala*. *Crop and Pasture Science*, 62: 248–260.

Radrizzani A; Shelton HM; Dalzell SA. 2010. Response of *Leucaena leucocephala* pastures to phosphorus and sulfur application in Queensland. *Animal Production Science*, 50: 961–975.

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

Radrizzani A; Shelton HM; Kravchuk O; Dalzell SA. 2016. Survey of long-term productivity and nutritional status of *Leucaena leucocephala*-grass pastures in subtropical Queensland. *Animal Production Science*, 56: 2064–2073.

- Reuter DJ; Robinson JB. 1997. Plant analysis: an interpretation manual. 2nd edn. CSIRO Publishing, Melbourne.
- Ruaysoongnern S; Shelton HM; Edwards DG. 1989. The nutrition of *Leucaena leucocephala* de Wit cv. Cunningham seedlings. I. External requirements and critical concentrations in index leaves of nitrogen, phosphorus, potassium, calcium, sulphur and manganese. *Australian Journal of Agricultural Research* 40, 1241–1251.

### Psyllids

- Bray RA. 1994. The leucaena psyllid. In: Gutteridge RC; Shelton HM, eds. Forage tree legumes in tropical agriculture. CAB International, Wallingford, UK. p. 283–291.
- Elder RJ. 1992. Assessment of the pest status of leucaena psyllid in central Queensland. Final report for project DAQ.006 to the Meat Research Corporation. DPI Queensland, Brisbane. 35 p.
- Room P. 1993. Assessment of the Pest Status of Leucaena Psyllid in Northern and South Eastern Queensland. Final report for project CS.131 to the Meat Research Corporation. CSIRO. 33 p.
- The case for developing a sterile variety of leucaena (2013) MLA Final Report BNP.0705

### Irrigation

- Cicchelli FDF; Wehr JB; Dalzell SA; Cui L; Menzies NW; Kopittke PM. 2016. Overhead-irrigation with saline and alkaline water: Deleterious effects on foliage of Rhodes grass and leucaena. *Agricultural Water Management*, 169: 173–182.
- Petty SR; Poppi DP. 2008. Effect of muddy conditions in the field on the liveweight gain of cattle consuming *Leucaena leucocephala*-*Digitaria eriantha* pastures in north-west Australia. *Australian Journal of Experimental Agriculture*, 48: 818–820.
- Petty SR; Poppi DP; Triglone T. 1998. Effect of maize supplementation, seasonal temperature and humidity on the liveweight gain of steers grazing irrigated *Leucaena leucocephala*/*Digitaria eriantha* pastures in north-west Australia. *Journal of Agricultural Science*, Cambridge, 130: 95–105.

## 4. Grazing management

- Shelton HM; Kerven G; Dalzell SA. 2019. An update on leucaena toxicity: Is inoculation with *Synergistes jonesii* necessary? *Tropical Grasslands – Forrajes Tropicales* 7: 146–153.
- McSweeney CS; Padmanabha J; Halliday MJ; Hubbard B; Dierens L; Denman SE; Shelton HM. 2019. Detection of *Synergistes jonesii* and genetic variants in ruminants from different geographical locations. *Tropical Grasslands – Forrajes Tropicales* 7: 154–163.
- Honda MDH; Borthakur D. 2019. Mimosine concentration in *Leucaena leucocephala* under various environmental conditions. *Tropical Grasslands – Forrajes Tropicales* 7: 164–172.

## 5. Nutritive value of leucaena-grass systems

- Cowley FC; Roschinsky R. 2019. Incorporating leucaena into goat production systems. *Tropical Grasslands – Forrajes Tropicales* 7: 173–181.
- Dahlanuddin; Panjaitan T; Waldron S; Halliday MJ; Ash A; Morris ST; Shelton HM. 2019. Adoption of leucaena-based feeding systems in Sumbawa, eastern Indonesia and its impact on cattle productivity and farm profitability. *Tropical Grasslands – Forrajes Tropicales* 7: 428–436.
- Harper K; Quigley SP; Antari R; Dahlanuddin; Panjaitan TSS; Marsetyo; Popp DP. 2019. Energy supplements for leucaena. *Tropical Grasslands – Forrajes Tropicales* 7: 182–188
- Hopkins K; Bowen M; Dixon R; Reid D. 2019. Evaluating crude protein concentration of leucaena forage and the dietary legume content selected by cattle grazing leucaena and C4 grasses in northern Australia. *Tropical Grasslands – Forrajes Tropicales* 7: 189–192.
- Jones RJ; Megarrity RG. (1986). Successful transfer of DHP-degrading bacteria from Hawaiian goats to Australian ruminants to overcome the toxicity of leucaena. *Australian Veterinary Journal* 63, 259–262.
- Nulik J; Kana Hau D; Halliday MJ; Shelton HM. 2019. Tarramba leucaena: A success story for smallholder bull fattening in eastern Indonesia. *Tropical Grasslands – Forrajes Tropicales* 7: 410–414.

Quirk MF; Bushell JJ; Jones RJ; Megarrity RG. (1988) Live-weight gains on leucaena and native grass pastures after dosing cattle with rumen bacteria capable of degrading DHP, a ruminal metabolite from leucaena. *Journal of Agricultural Science, Cambridge*, 111: 165–170.

### Is there a different DHP detox pathway?

Dalzell SA; Burnett DJ; Dowsett JE; Forbes VE; Shelton HM. 2012. Prevalence of mimosine and DHP toxicity in cattle grazing *Leucaena leucocephala* pastures in Queensland, Australia. *Animal Production Science* 52:365–372.

Graham SR; Dalzell SA; Kerven GLF; Shelton HM. 2014. Detection of toxicity in ruminants consuming leucaena (*Leucaena leucocephala*) using a urine colorimetric test. *Tropical Grasslands – Forrajes Tropicales* 2:63–65.

Graham SR; Dalzell SA; Nguyen TN; Davis CK; Greenway D; McSweeney CS; Shelton HM. 2013. Efficacy, persistence and presence of *Synergistes jonesii* inoculum in cattle grazing leucaena in Queensland: On-farm observations pre- and post-inoculation. *Animal Production Science* 53:1065–1074.

Halliday MJ; Giles HE; Padmanabha J; McSweeney CS; Dalzell SA; Shelton HM. 2018. The efficacy of a cultured *Synergistes jonesii* inoculum to control dihydroxypyridine toxicity in *Bos indicus* steers fed leucaena/grass diets. *Animal Production Science* 59:696-708.

Halliday MJ; Giles HE; Shelton HM. 2014a. The incidence of high levels of urinary 2,3-DHP in ruminants consuming *Leucaena leucocephala* without clinical signs of toxicity. *Proceedings of the 30th Biennial Conference of the Australian Society of Animal Production* 30:180.

Halliday MJ; Padmanabha J; McSweeney CS; Kerven G; Shelton HM. 2013. Leucaena toxicity: a new perspective on the most widely used forage tree legume. *Tropical Grasslands – Forrajes Tropicales* 1:1–11.

Halliday MJ; Panjaitan T; Dahlanuddin; Padmanabha J; McSweeney CS; Depamede S; Kana Hau D; Kurniawan; Fauzan M; Sutartaha; Yuliana BT; Pakereng C; Ara P; Liubana D; Edison RG; Shelton HM. 2014b. Prevalence of DHP toxicity and detection of *Synergistes jonesii* in ruminants consuming *Leucaena leucocephala* in eastern Indonesia. *Tropical Grasslands – Forrajes Tropicales* 2:71–73.

McSweeney CS; Padmanabha J; Halliday MJ; Denman SE; Hubbard B; Davis CK; Shelton HM. 2019. Detection of the ‘leucaena bug’ *Synergistes jonesii* and genetic variants in ruminants from different geographical locations. *Tropical Grasslands – Forrajes Tropicales* 7:154-163.

O’Reagain JH; Graham SR; Dalzell SA; Shelton HM. 2014. Rates of urinary toxin excretion in unprotected steers fed *Leucaena leucocephala*. *Tropical Grasslands – Forrajes Tropicales* 2:103–105.

Padmanabha J; Halliday MJ; Denman SE; Davis CK; Shelton HM; McSweeney CS. 2014. Is there genetic diversity in the ‘leucaena bug’ *Synergistes jonesii* which may reflect ability to degrade leucaena toxins? *Tropical Grasslands – Forrajes Tropicales* 2:113–115.

Phaikaew C; Suksaran W; Ted-arsen J; Nakamanee G; Saichuer A; Seejundee S; Kotprom N; Shelton HM. 2012. Incidence of subclinical toxicity in goats and dairy cows consuming leucaena (*Leucaena leucocephala*) in Thailand. *Animal Production Science* 52:283–286.

Shelton HM. 2016. Improving smallholder cattle fattening systems based on forage tree legume diets in eastern Indonesia and northern Australia. Final report to Australian Centre for International Agricultural Research, December 2016. The University of Queensland.

Shelton HM, Kerven G, Dalzell SA. 2019. An update on leucaena toxicity: Is inoculation with *Synergistes jonesii* necessary? *Tropical Grasslands-Forrajes Tropicales* 7:146–153.

<https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/livestock/cattle/leucaena-inoculum-cattle>

## 6. Costs and returns

Bowen M; Buck S; Chudleigh F. 2015. Feeding forages in the Fitzroy – a guide to profitable beef production in the Fitzroy River catchment. Queensland Department of Agriculture and Fisheries, Brisbane. <https://futurebeef.com.au/wp-content/uploads/Feeding-forages-in-the-Fitzroy.pdf>

Bowen M; Chudleigh F; Buck S; Hopkins K. 2018a. Productivity and profitability of forage options for beef production in the subtropics of northern Australia. *Animal Production Science* 58: 332–342.

- Bowen M; Chudleigh F. 2018b. Grazing pressure, land condition, productivity and profitability of beef cattle grazing buffel grass pastures in the subtropics of Australia: A modelling approach. *Animal Production Science* 58: 1451–1458.
- Bowen M; Chudleigh F. 2019. Productivity and profitability of alternative steer growth paths resulting from accessing high-quality forage systems in the subtropics of northern Australia: A modelling approach. *Animal Production Science* 59: 1739–1751.
- ## 7. Leucaena and the environment
- Buck S; Rolfe J; Lemin C; English B. 2019. Adoption, profitability and future of leucaena feeding systems in Australia. *Tropical Grasslands – Forrajes Tropicales* 7: 303–214.
- Campbell S; Vogler W; Brazier D; Vitelli J; Brooks S. 2019. Weed leucaena and its significance, implications and control. *Tropical Grasslands-Forrajes Tropicales* 7: 280–289.
- Chará J; Rivera J; Barahona R; Murgueitio E; Calle Z; Giraldo C. 2019. Environmental services and climate change mitigation of silvopastoral systems with *Leucaena leucocephala* in Latin America. *Tropical Grasslands-Forrajes Tropicales* 7: 259–266.
- Christensen B. 2019. The Leucaena Network and The Leucaena Code of Practice. *Tropical Grasslands-Forrajes Tropicales* 7: 331–332.
- Conrad KA; Dalal RC; Dalzell SA; Allen DE; Fujinuma R; Menzies NW. 2018. Soil nitrogen status and turnover in subtropical leucaena-grass pastures as quantified by  $\delta^{15}\text{N}$  natural abundance. *Geoderma*, 313: 126–134.
- Conrad KA; Dalal RC; Dalzell SA; Allen DE; Menzies NW. 2017. The sequestration and turnover of soil organic carbon in subtropical leucaena-grass pastures. *Agriculture, Ecosystems and Environment*, 248: 38–47.
- 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.
- Harrison MT; Cullen BR; Tomkins NW; McSweeney C; Cohn P; Eckard RJ. 2016. The concordance between greenhouse gas emissions, livestock production and profitability of extensive beef farming systems. *Animal Production Science* 56: 370–384.
- Kennedy PM; Charmley E. 2012. Methane yields from Brahman cattle fed tropical grasses and legumes. *Animal Production Science* 52: 225–239.
- King K; Burgess R. 2019. Linking leucaena to carbon abatement opportunities. *Tropical Grasslands-Forrajes Tropicales* 7: 273–279.
- McMillan HE; Liu G; Shelton HM; Dalzell SA; Godwin ID; Gamage H; Sharman C; Lambrides CJ. 2019. Sterile leucaena becomes a reality? *Tropical Grasslands-Forrajes Tropicales* 7: 74–79.
- Pachas NA; Shelton HM; Lambrides CJ; Dalzell SA; Murtagh GJ; Hardner CM. 2018. Effect of tree density on competition between *Leucaena leucocephala* and *Chloris gayana* using a Nelder Wheel trial. II. Belowground interactions. *Crop and Pasture Science* 69: 733–744.
- Radrizzani A; Shelton HM; Dalzell SA; Kirchoff G. 2011. Soil organic carbon and total nitrogen under *Leucaena leucocephala* pastures in Queensland. *Crop and Pasture Science*, 62: 337–345.
- Real D; Han Y; Bailey CD; Vasan S; Li C; Castello M; Broughton S; Abair A; Crouch S; Revell C. 2019. Strategies to breed sterile leucaena for Western Australia. *Tropical Grasslands-Forrajes Tropicales* 7: 80–86.
- Shelton HM; Dalzell SA; McNeill FL. 2003. A survey of the weed status and management of *Leucaena leucocephala* (Lam.) de Wit in Queensland. *Plant Protection Quarterly*, 18: 42–47.
- Shelton M; Dalzell S. 2007. Production, economic and environmental benefits of leucaena pastures. *Tropical Grasslands*, 41: 174–190.
- Taylor CA; Harrison MT; Telfer M; Eckard R. 2016. Modelled greenhouse gas emissions from beef cattle grazing irrigated leucaena in northern Australia. *Animal Production Science* 56: 594–604.
- Tomkins N; Harrison MT; McSweeney C; Denman S; Charmley E; Lambrides C; Dalal R. 2019. Greenhouse gas implications of leucaena-based pastures. Can we develop an emissions reduction methodology for the beef industry? *Tropical Grasslands-Forrajes Tropicales* 7: 267–272.
- <https://www.industry.gov.au/regulations-and-standards/methods-for-the-emissions-reduction-fund>
- <http://www.greenhouse.unimelb.edu.au/Tools.htm>

## 8. Other countries

- Dahlanuddin; Panjaitan T; Waldron S; Halliday M; Ash A; Morris ST; Shelton HM. 2019. Adoption of leucaena-based feeding systems in Sumbawa, eastern Indonesia and its impact on cattle productivity and farm profitability. *Tropical Grasslands – Forrajes Tropicales 7*: 428–43.
- Nulik J, Kana Hau D; Halliday M; Shelton M. 2019. Tarramba leucaena: A success story for smallholder bull fattening in Eastern Indonesia. *Tropical Grasslands – Forrajes Tropicales 7*: 410–414.
- Nakamane G; Harrison S; Janthibordee K; Srisomporn W; Phaikaew C. 2019. Potential of *Leucaena* spp. as a feed resource for ruminant animals in Thailand. *Tropical Grasslands – Forrajes Tropicales 7*: 449–454.
- Khanna N K; Shukla O P; Gogate M. G; Narkhede S. 2019. *Leucaena* for paper industry in Gujarat, India: Case study. *Tropical Grasslands – Forrajes Tropicales 7*: 200–209.
- Pachas NA; Radrizzani A; Murgueitio E; Uribe F; Zapata Ccavid A; Chara J; E Ruiz T; Escalante E; Mauricio RM; Ramirez-Aviles L. 2019. Establishment and management of leucaena in Latin America. *Tropical Grasslands – Forrajes Tropicales 7*: 127–132.
- Zapata Cadavid A; Mejía C; Slarte I ; Suarez JF; Molina CH; Molina EJ; Uribe F; Murgueitio E; Navarro C; Chará J; Manzano L. 2019. *Leucaena* intensive silvopastoral system: the CIPAV experience in Colombia. *Tropical Grasslands – Forrajes Tropicales 7*: 353–358.

*Max Shelton and Scott Dalzell (co-authors of this publication) discuss leucaena production with Alex and Geoff Liddle in central Queensland.*

