

# Adoption of better agronomic practices for improving establishment of pasture legumes in the sub-tropics

Louise Newman<sup>1</sup>, Gavin Peck<sup>1</sup> and Stuart Buck<sup>2</sup>

<sup>1</sup> Queensland Department of Agriculture and Fisheries, 203 Tor St, Toowoomba, Qld 4350, Email: [louise.walker@daf.qld.gov.au](mailto:louise.walker@daf.qld.gov.au)

<sup>2</sup> Queensland Department of Agriculture and Fisheries, 25 Yeppoon Rd, Rockhampton, Qld 4700

## Abstract

Pasture legumes have been identified as the best long-term option to increase the productivity and returns from grass pastures in Queensland, however successful adoption rates remain low in the Brigalow Belt bioregion. Poor establishment is the most common reason for legumes failing. As part of a series of legume management workshops, 267 graziers and farm advisors were surveyed about their plans for sowing legumes and what agronomic practices they intended to use. Two-thirds of participants intended to change the practices they use to establish legumes through changing fallowing or seed-bed preparation, rhizobia application, sowing method or other practices. Despite the on-going drought the surveyed participants intend to establish 105,000 additional hectares of legumes using improved agronomic practices in the next 5 years. Adoption of better agronomic practices is likely to lead to more reliable legume establishment thereby increasing productivity for an important cattle production region of northern Australia.

## Keywords

Grazing, extension, Brigalow Belt, Queensland

## Introduction

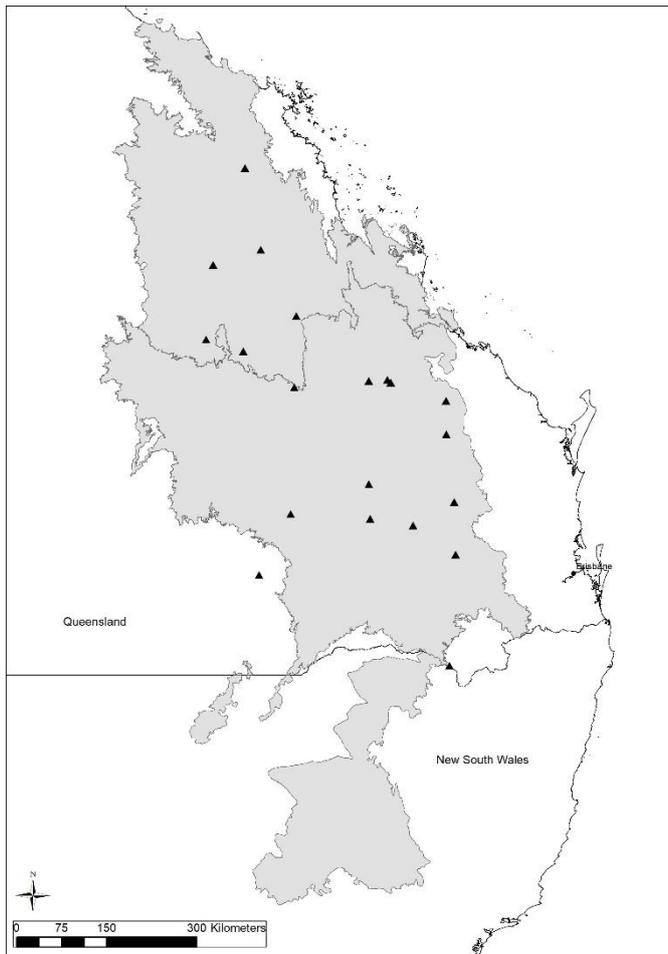
Nitrogen deficiency in pasture soils is common however there has been low rates of adoption of pasture legumes to increase nitrogen supply to pasture grasses and improve productivity in northern Australia. The majority of sown pastures in Queensland were sown with only grasses, and native pastures generally have low or no legume content. Grass-only pastures have a high requirement for nitrogen, but the nitrogen is progressively tied up in soil organic matter and not available in a form for plants to use with time after establishment (Myers and Robbins 1991; Graham et al 1985; Lawrence et al 2014). Nitrogen is a vital nutrient for plant growth, and legumes have the potential to provide some of that nitrogen requirement when used effectively (Myers and Robbins 1991; Peck et al 2011).

In research conducted with Queensland graziers in 2010, the two most commonly used strategies used to improve pasture productivity was mechanical renovation (often with the added benefit of killing woody weeds) and legumes (Peck et al 2011). Where legumes have been used, poor establishment commonly occurred and has resulted in many failures. This is especially true in the Brigalow Belt bioregion of Queensland, which is located in inland eastern Queensland, from Townsville in the north to the southern border and then extending into northern New South Wales (Figure 1). This bioregion is widely recognised for its high beef productivity, moderate rainfall climate, relatively fertile soils and a large area of sown grass pastures. Pasture legume adoption is low in this bioregion, however significant productivity gains and economic returns can be generated by graziers who successfully adopt legume forages (Peck et al 2011).

Using better agronomic practices to establish legumes into existing grass-only pastures has been the topic for a range of extension activities coordinated by Queensland Government Department of Agriculture and Fisheries staff for graziers in the Brigalow Belt bioregion of Queensland. One of the extension activities was a series of full-day, interactive action-planning workshops.

## Methods

During 2017 to 2019, a series of workshops were held across the Brigalow Belt bioregion of Queensland (Figure 1) focusing on reliable agronomic and management practices for pasture legumes. Twenty workshops were held with up to 25 graziers (average 17 per workshop) and advisors attending each one. The workshops were targeted to areas where legume adoption could provide most return on investment and participant numbers were capped to allow for optimal discussion and interaction. The workshops were held across seasons and climate conditions including the driest year on record for some locations, 2019.



**Figure 1. Brigalow Belt bioregion across Queensland and northern New South Wales in Australia. Locations of workshop events (▲) held in association with a project encouraging producers to incorporate legumes into grass-only pastures.**

A survey was completed at the end of the workshop where participants provided details about their business, change in knowledge and skills and intended practice change for sowing legumes and managing existing legume-based pastures.

## **Results**

### *Survey responses*

A total of 346 graziers and farm advisors attended the 20 workshops. The majority (267; 77.1 %) of workshop participants completed and submitted the end-of-workshop survey. Collectively the participants manage 1,400,000 ha of sown and native pastures and 269,000 head of cattle, which is approximately 2.6 % of Queensland's herd and 1.1 % of Queensland's grazed land area based on 2019-2020 Australian Bureau of Statistics data.

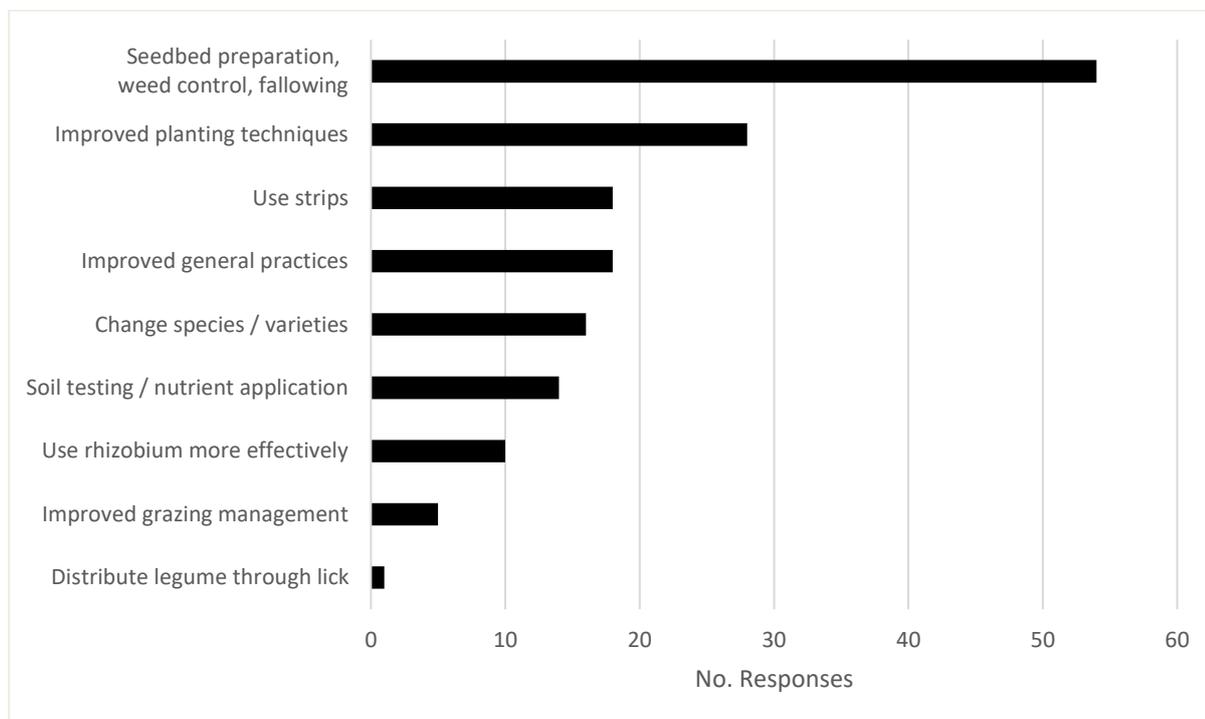
### *Changes to establishing new legume pastures*

Two-thirds (67.7 %, n = 181) of survey respondents indicated that they intend to change the practices they use to establish legumes. Despite the on-going drought, the surveyed graziers intend to establish 105,000 additional hectares of legumes using improved agronomic practices in the next five years after attending the workshop.

The most common management change identified by participants was improving preparation of the seedbed prior to sowing which included undertaking weed control and/or implementing a fallow (33 % of responses, n = 54), shown in Figure 2. Historically it has been common practice in the Brigalow Belt to use low-cost legume pasture establishment methods of broadcasting seed on to existing grass pastures or behind a single operation cultivation such as a deep ripper, chisel plough or offset discs (Peck et al 2011). These low-cost legume establishment methods are only successful when rainfall occurs regularly during the first growing

season to support seedling survival, however this occurs in a low percentage of years in the Brigalow Belt climate zone.

Another practice that participants identified as one they would adopt was to establish strips of legumes into existing grass-only pastures (11 %, n = 18, Figure 2) similar to how leucaena is commonly established in the Brigalow Belt bioregion. Recommendations for leucaena establishment include the option to cultivate strips in a paddock where the existing grass pasture is also retained in strips. Many graziers see using this as an efficient technique to reliably establish legumes into productive grass-only paddocks because it still allows grazing during the fallowing period and can reduce paddock preparation costs.



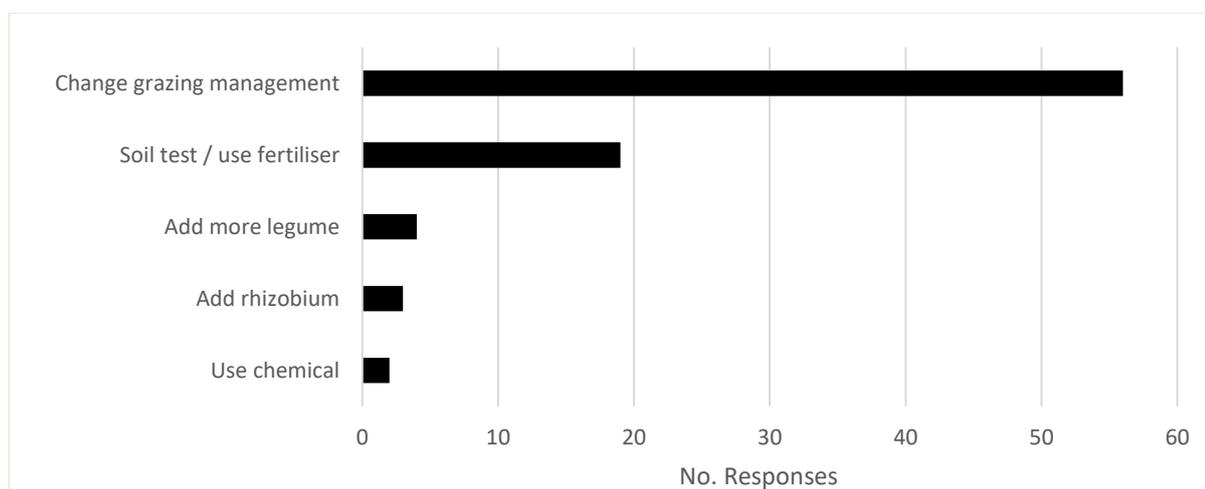
**Figure 2. Grazer intended practice change for establishing new legume-based pastures. Workshop participants indicated on the end-of-workshop survey how they intend to change establishment techniques.**

A brief economic analysis of the options to improve nitrogen availability to pastures was presented during the workshops. The analysis considered the costs of applying nitrogen fertiliser; renovating the soils to release nitrogen; and sowing legumes. It demonstrated that establishing legumes was the most cost-effective option to improve productivity in the Brigalow Belt bioregion. While participant feedback suggested more details surrounding the economics of legume establishment would be appreciated, their interest and in-principal acceptance of legumes as an option to improve productivity have resulted in changes to establishment practice intentions.

The number of hectares intended to be sown to legumes in the next 12 months (16,701 ha) represents about 1.2 % of the total area of pastures (sown and native) managed by the 267 respondents. It is likely that, despite good intentions, many participants delayed sowing due to the severe drought conditions across the focus area in the years since completing the survey. New legume paddocks intended to be sown over the next 5 years represent about 7.5 % (105,000 ha) of the total area managed by the survey respondents.

#### *Changes to managing existing legume-based pastures*

Following the workshop, 44.5 %, (n = 119) of the survey respondents indicated they would change their management of existing legume-based pastures into the future. These changes included change grazing management (n = 56), soil test and use fertiliser (n = 19), add more legume (n = 4), add rhizobium (n = 3), or use chemical to control weeds (n = 2) (Figure 3).



**Figure 3. Grazier intended practice change for managing existing grass-legume pastures. Workshop participants indicated on the end-of-workshop survey how they intend to change management techniques.**

### Conclusion

Adoption of better agronomic practices is likely to lead to more reliable legume establishment thereby increasing productivity for an important cattle production region of northern Australia.

The survey results indicate there is likely to be more legume-grass pastures in the short and long term however recent poor seasonal conditions have probably delayed the sowing of legumes. Additional surveys of graziers are required to provide further insights and understanding of on-going legume adoption in the Brigalow Belt.

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