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# Spelling strategies for recovery of pasture condition

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## Abstract

This project seeks to improve the evidence base and modelling capacity underpinning recommendations for the use of wet season spelling to recover poor condition grazing land and design more reliable and cost-effective spelling options for producers across northern Australia. Our research now has four years of information from the Monteagle site near Clermont, and two years from the Wambiana site south of Charters Towers. Spelling has produced a small, yet significant improvement in perennial grass basal area at Monteagle when compared to grazing at a moderate stocking rate. This improvement is too small to alter a land condition rating, but does demonstrate the beneficial processes fostered by spelling. Lack of a sizeable germinable seed bank for the key perennial grass *Bothriochloa ewartiana* underpins a lack of its seedlings establishing and is therefore a major contributor to the lack of demonstrable land condition improvement. Both sites have a large amount of *Aristida* spp. in the pasture which may possibly be reduced by controlled burning to assist land condition improvement. Since spelling began, Monteagle has had two years of very good rainfall, followed by two very dry years while the Wambiana site has had one average, and one below average rainfall year. The Monteagle site was destocked over the 2012/13 summer following a wildfire in November 2012 and then very dry conditions. At Wambiana, the research is conducted under a moderate, or a high stocking rate. Data from the trials will be used to improve the capacity of GRASP to simulate the impacts of different spelling and stocking rate regimes on pasture conditions over a range of pasture community types and seasons. Spelling to improve land condition will often take more years than originally thought and must be in synergy with other best management practices.

## Background

Wet season spelling of grazing land is a key recommendation for maintaining or improving land condition. However, there is limited relevant information or experimental work on practical spelling strategies (McIvor 2011). Recent reviews by Scanlan *et al.* (2014) and O'Reagain *et al.* (2014) have highlighted principles for sustainable grazing land management and the role for spelling. This project, funded by Meat and Livestock Australia, and Queensland Department of Agriculture, Fisheries and Forestry seeks to improve the biological evidence base and modelling accuracy that underpins recommendations for use of wet season spelling to recover poor condition grazing land and to design more reliable and cost-effective spelling options for producers.

## Methods

The site at Monteagle, near Clermont studies a combination of timing, duration and frequency of spelling within 'C' condition land over a five year period. Two durations of spelling (early wet season or full wet season) are combined with two frequencies of spelling (annual or biennial), and each year there is an extra, once only full wet season spelling treatment, and all are compared against non-spelled areas in the same paddock.

The site at Wambiana is 'C' condition land within an existing grazing trial near Charters Towers (O'Reagain *et al.* 2014). Similar combinations of durations of spelling (early or full wet season) and

frequency (annual or biennial), are compared against non-spelled areas at both a moderate and high stocking rate.

At both sites, plots are 40 x 40m and replicated four times. Pasture yield, species composition and ground cover are recorded, along with soil surface characteristics to categorise land condition. Population dynamics of the key perennial grasses *B. ewartiana* and *Aristida* species are mapped in permanent quadrats. Soil cores are taken each spring to determine readily germinable seed reserves of pasture species.

## Results

### Monteagle

Rainfall at Monteagle was considerably wetter than average for the first two years (2010-11 and 2011-12), while the 2012-13 and 2013-14 years have been very dry. Pasture yield increased across all treatments through the first two wet years. A fire in November 2012, combined with the dry summer of 2012-13 and continuing dry conditions has significantly reduced pasture yield in 2014. Spelling strategies have not affected pasture yield.

Basal area has varied with seasonal conditions across all treatments. *B. ewartiana* and *Aristida spp.* contributed equally and made up the majority of the basal area during the first two wet years. The burn and dry summer in 2012/13 decreased basal area due to a decrease in the *Aristida spp.* while *B. ewartiana* basal area remained relatively stable. Full wet season annual spelling has significantly increased basal area above that of the grazed treatment, mainly due to an increase in the *B. ewartiana*. The small increase in basal area was not enough to increase pasture yield or land condition rating (Table 1).

**Table 1. The effect of spelling strategies on key pasture parameters at Monteagle\***

Stocking rate	Pasture parameter	Date	Treatment	
			Grazed	Full wet season annual spelling
Moderate	Pasture yield (kg ha <sup>-1</sup> )	Oct 2010	1697	2473
		May 2014	457	588
	Basal area (%)	Oct 2010	3.0	2.2
		May 2014	1.7a	2.8b

\*Means followed by different letters are significantly different ( $P < 0.05$ )

*B. ewartiana* density has been stable while *Aristida spp.* had a high turnover of plants. Recruiting plants (mainly *Aristida spp.*) have contributed about 10% to the basal area and this was maintained through the burn and dry summers. Mortalities were highest immediately after the fire for *B. ewartiana*, *Aristida spp.* and *P. effusum*, however *B. ewartiana* has a very high survival of the original plants (86%). The germinable seed bank is very low for all 3P grasses (palatable, perennial, productive) with *B. ewartiana* having 5 – 20 m<sup>-2</sup>.

### Wambiana

Rainfall at Wambiana during the 2012/13 year was average. The 2013-14 year had a dry winter, followed by below average and late summer rainfall. Pasture yields were relatively low but there has been an increase over time under moderate stocking. Significant treatment effects are not apparent under a moderate stocking, however full wet season annual spelling has significantly increased pasture yield under high stocking rates in May 2014. The increased yield was soon reduced by the high stocking rate through the 2013 dry season. Spelling treatments have not significantly affected basal area at either stocking rate so far (Table 2).

**Table 2. The effect of spelling strategies on key pasture parameters at Wambiana\*.**

Stocking rate	Pasture parameter	Date	Treatment	
			Grazed	Full wet season annual spelling
Moderate	Pasture yield (kg ha <sup>-1</sup> )	Oct 2012	567	487
		May 2014	812	1541
	Basal area (%)	Oct 2012	1.47	1.54
		May 2014	1.94	2.05
High	Pasture yield (kg ha <sup>-1</sup> )	Oct 2012	430	428
		May 2014	205a	938b
	Basal area (%)	Oct 2012	2.07	1.50
		May 2014	1.78	1.56

\*Means followed by different letters are significantly different ( $P < 0.05$ )

Under a moderate stocking rate the composition and basal area of *B. ewartiana* had a small increase with full wet season annual spelling. The germinable seed bank is very low for all 3P grasses with *B. ewartiana* having 0 – 4 seeds m<sup>-2</sup>.

### Discussion

Full wet season annual spelling has given slight improvements in some pasture parameters at Monteagle and Wambiana. This indicates land condition improvement by spelling is possible for poor condition land. This improvement is too small to have any impact on land condition in the short term, but it does demonstrate that beneficial processes are occurring with spelling. Significant land condition improvements were expected at both sites given the good initial seasonal conditions experienced.

We believe that the lack of a significant germinable seed bank for *B. ewartiana* and thus negligible seedling recruitment is the major contributor to the lack of demonstrable land condition improvement. The lack of increase in basal area of existing perennial grass crowns after regular spelling is also a concern because this is currently the main potential mode for improvement in land condition.

Wet season spelling will always be a key strategy for maintenance or improvement of land condition, despite very little supporting evidence to draw on. Stocking rate management is of primary importance and there are increasing recommendations that long term carrying capacity will only be marginally increased (~10%) for a paddock subject to a wet season spelling system.

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