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Meredith L. Mitchell

Department of Economic Development, Jobs, Transport & Resources, Australia

N. P. Linden

Department of Economic Development, Jobs, Transport & Resources, Australia

S. Norng

Department of Economic Development, Jobs, Transport & Resources, Australia

L. L. Slocombe

Department of Economic Development, Jobs, Transport & Resources, Australia

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Basal cover of perennial native grasses increases due to seasonal conditions

Meredith Mitchell^{1*}, N.P. Linden¹, S. Norng², L.L. Slocombe³

¹Department of Economic Development, Jobs, Transport & Resources, Rutherglen, Australia

²Department of Economic Development, Jobs, Transport & Resources, Parkville, Australia

³Department of Economic Development, Jobs, Transport & Resources, Hamilton, Victoria, Australia

Corresponding author e-mail: meredith.mitchell@ecodev.vic.gov.au

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Introduction

Australian native pastures in the high rainfall zone (> 600 mm AAR) in northern Victoria and southern NSW are usually dominated by annual species, and occupy a considerable proportion of the landscape (Pearson *et al.*, 1997; Hill *et al.*, 1999). Productivity of native pastures can potentially be increased by using fertiliser (Lodge 1979; Garden and Bolger, 2001) but this nearly always comes at the expense of the native perennial grasses (Garden *et al.*, 2000; Garden and Bolger, 2001). However, using a combination of fertiliser inputs and rotational grazing can provide increased productivity while maintaining the native perennial pasture base (Garden *et al.*, 2003). Maintaining and improving the current native perennial pasture base in this hilly landscape is essential for maintaining ground cover and meeting natural resource management targets (Virgona *et al.*, 2003).

This experiment was conducted as part of the Ever Graze project (Avery *et al.*, 2009), which had the aim of demonstrating that substantial increases in profitability can be achieved while improving environmental management by putting the Ever Graze Principle of 'Right Plant, Right Place, Right Purpose, Right Management' into action. The hypothesis for this research was that it is possible to maintain the persistence of native perennial grasses by appropriately combining fertiliser (superphosphate) application with appropriate grazing management.

Materials and Methods

The experiment ran from 2008 to 2012 at Chiltern (S36°12', E146°35', 256 m) in north-east Victoria. The median long term cumulative rainfall for this site is 682 mm (Jeffrey *et al.*, 2001), with most rain falling between April and October.

Three combinations of phosphorus fertiliser and grazing system were implemented (Table 1). The treatments were randomly allocated to the twelve plots with unequal representation to achieve optimal allocation for maximal precision in relation to the specific contrasts between the three treatments. The systems were run on 3 ha paddocks and were grazed using a breeding flock of Merino (Centre Plus) ewes joined to terminal (White Suffolk) sires.

Table 1: Treatments implemented at the Chiltern EverGraze site

Treatment	Fertiliser	Stocking rate	Grazing management
Low fertility set stock	11 kg P/ha applied every second year	Low (6.2 dse/ha)	Set stocked
High fertility set stock	21 kg P/ha annually	High (9.3 dse/ha)	Set stocked
High fertility simple rotation	21 kg P/ha annually	High (9.3 dse/ha)	Simple four paddock rotation (two weeks grazing followed by six weeks rest).

Basal area that is the percentage of ground occupied by the crowns of perennial native grass plants (*Microlaena stipoides*, *Rytidosperma* spp., *Austrostipa* spp.) was estimated using the method of McIvor (2001). Calibrated estimates were made in 32 quadrats (0.1 m²) at regular intervals along a permanent transect in each plot. This measurement was recorded at the end of summer each year. Data were analyzed using repeated measures analysis of variance (REPMEAS ANOVA) appropriate for a completely randomized design (CRD) using Genstat (Payne *et al.*, 2010).

Results and Discussion

The rainfall was variable over the experimental period. Rainfall for 2008, 2009 and the start of 2010 were below median (682 mm), whereas rainfall for 2011 was above average, with 276 mm received in February 2011.

There were significant ($P < 0.001$) differences between years for the number of both *Microlaena* and *Rytidosperma* spp plants but not for *Austrostipa* spp (Table 2). For *Microlaena*, 2010-2012 were significantly greater than 2008-2009. There were significantly greater levels of *Microlaena* in 2011 than any other year. Years 2010 and 2012 were not significantly different to each other but both were significantly less than 2011, but significantly greater than 2008 and 2009. Similarly, Years 2008 and 2009 were not significantly different from each other but both were significantly less than all three other years (2010-2012). For *Rytidosperma* spp., there was a significant ($P < 0.001$) difference between 2012 and the rest (2008-2011). There were no significant differences between Years 2008-2011.

There was no significant Treatments*Years interaction for *Microlaena*, *Rytidosperma* spp., nor *Austrostipa* spp. There were no significant differences between the treatments with respect to all three basal classes. However, it should be noted that, for *Microlaena*, T2 and T3 on average were higher than T1.

Table 2: Changes in the basal cover (%) of the main perennial native grasses for treatments from 2008 to 2012

	<i>Microlaena</i>	<i>Rytidosperma</i>	<i>Austrostipa</i>
Treatments			
T1	12.22	3.19	0.25
T2	21.79	3.48	0.08
T3	19.00	5.23	0.14
s.e.d.	6.67	1.18	0.41
Years			
2008	6.39	0.62	0.06
2009	9.35	2.16	0.18
2010	19.92	1.48	0.43
2011	28.40	1.30	0.34
2012	19.72	13.69	0.23
s.e.d.	2.25	1.44	0.13
F-test Probabilities			
Treatments (T)	0.452	0.315	0.735
Years (Y)	<0.001	<0.001	0.125

Conclusion

The basal cover of *Microlaena* and *Rytidosperma* significantly increased over the period of the experiment. This response is mostly likely a result of the high spring and summer rainfall, whilst managing the pastures to ensure the benchmarks of > 70% ground cover and > 800 kg DM/ha herbage mass benchmarks are maintained. Required management to maximise plant density increase in high rainfall years depends on the reproductive physiology of each species. *Microlaena* has very low seedling recruitment but is responsive to summer rainfall and can spread vegetatively through rhizomes and stolons (Mitchell *et al.*, 2013; Mitchell *et al.*, 2014). Therefore, removing grazing pressure after summer rainfall events may provide the best chance of recovery. *Rytidosperma* requires seed set and germination so grazing pressure should be removed towards the end of spring to allow seed set, but pastures need to be well utilized through summer to provide enough space for germination the following autumn (if seasonal conditions are favourable). In good seasons it is usually possible to remove grazing pressure from these areas in late spring when there is an abundance of feed.

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