Impacts of pasture spelling on the performance of a beef grazing property in northern Australia

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Abstract

Northern Australian beef businesses face productivity, profitability and environmental pressures, and improving land condition and animal performance is a key business priority for many beef producers. Pasture spelling can improve poor condition land by increasing the health and resilience of desirable 3P (perennial, palatable, productive) tussock grasses. However, implementing spelling strategies at the property scale can be complex. Bio-economic modelling was used to compare the performance of several rotational pasture spelling strategies on a case-study beef grazing property in central Queensland. The effectiveness of these strategies to improve land condition, animal productivity and enterprise profitability was assessed. Spelling strategies varied in how cattle from the spelled paddocks were distributed across the property, and in the stocking rates of the paddocks within the spell system. Spelling pastures with a reduced stocking rate improved pasture condition and live-weight gains. Both pasture condition and animal productivity declined in three of the five better condition paddocks when cattle from spelled paddocks were added for four consecutive growing seasons. The impact of spelling scenarios had a relatively small effect on the overall herd productivity and profitability (less than 5% on total gross margin). Even so, the spelling scenarios that distributed extra animals within the system achieved the highest $GM/AE. Pasture spelling can improve land condition, animal productivity and profit per beast but decisions regarding what to do with cattle from the spelled paddocks are critical to the success of strategies.

Introduction

The majority of the northern beef businesses have not been economically viable during the past decade (McLean et al. 2014), and hence, improving land condition and animal performance is a key business priority for many beef producers. Declining land condition reduces carrying capacity, livestock productivity and profitability. Pasture spelling can improve poor condition land by increasing the health and resilience of desirable 3P (perennial, palatable, productive) tussock grasses (Hunt et al. 2014). For regeneration of pastures, spelling is most effective over the wet season when the grasses are actively growing and setting seed (Scanlan et al. 2014). This can increase pasture yield and quality, leading to an increase in carrying capacity, animal production and business profitability. However, implementing spelling strategies at the property scale can be complex. Decisions are required on the most appropriate spelling regime (timing, duration, frequency), stocking rates, and distribution of livestock from the spelled paddock (sell, agist, add to other paddocks), all of which can impact the success of a spelling strategy. For example, when stock are distributed within a rotational system, the risk of over-grazing is usually greatest for the last paddock to receive a spell ("4th paddock issue"), as it is 'loaded up' for consecutive growing seasons before being rested (Scanlan et al. 2011). This paper assesses the performance of rotational pasture spelling strategies on a case-study beef grazing property.

Methods

A bio-economic modelling framework, consisting of the GRASP and ENTERPRISE models, was used to simulate rotational spelling strategies within a 10,150 ha breeding operation in central Queensland's eucalypt woodlands. The baseline model property varied in land type (5), vegetation structure (pulled regrowth, remnant and Graslan herbicide treatment), tree cover and pasture condition (good B and poor C). Management practices involving regular burning in combination with pulling or herbicide application were simulated to control regrowth. Each paddock was stocked at a fixed

maintenance rate (SR_m) appropriate for land type, pasture condition, tree cover and regrowth management. The SR_m was determined so that the initial pasture condition was maintained over the 20-year simulation period (1993-2012). Four poor (C) condition paddocks of identical area, land type, regrowth management and SR_m were sequentially spelled once every four years for six months over the growing season (Dec-May). Each of these paddocks was spelled five times over 20 years. Three spelling strategies were evaluated and compared to a non-spelled baseline. These were:

1. sp1; the spelled paddocks were set-stocked at SR_m with livestock from the spelled paddock evenly distributed across the other three paddocks in the spelling rotation.
2. sp2; the spelled paddocks were set-stocked at a rate 20% lower than SR_m with livestock from the spelled paddock evenly distributed across the other three paddocks in the spelling rotation.
3. sp3; cattle from spelled paddocks were distributed across five B condition paddocks outside the spelling rotation for the first cycle (4 years) of spelling (sp3). Cattle were sold in the first year to achieve the reduced stocking rate.

Results and Discussion

The effectiveness of spelling was influenced by the stocking rate, timing of spells, interaction with regrowth management practices, and the proportion of the herd affected. When paddocks were stocked at maintenance rate and spelled rotationally (sp1), there was no improvement in the condition of pastures in the 4th paddock, which was 'loaded up' with the extra animals for three consecutive growing seasons before receiving a spell (Fig. 1a).

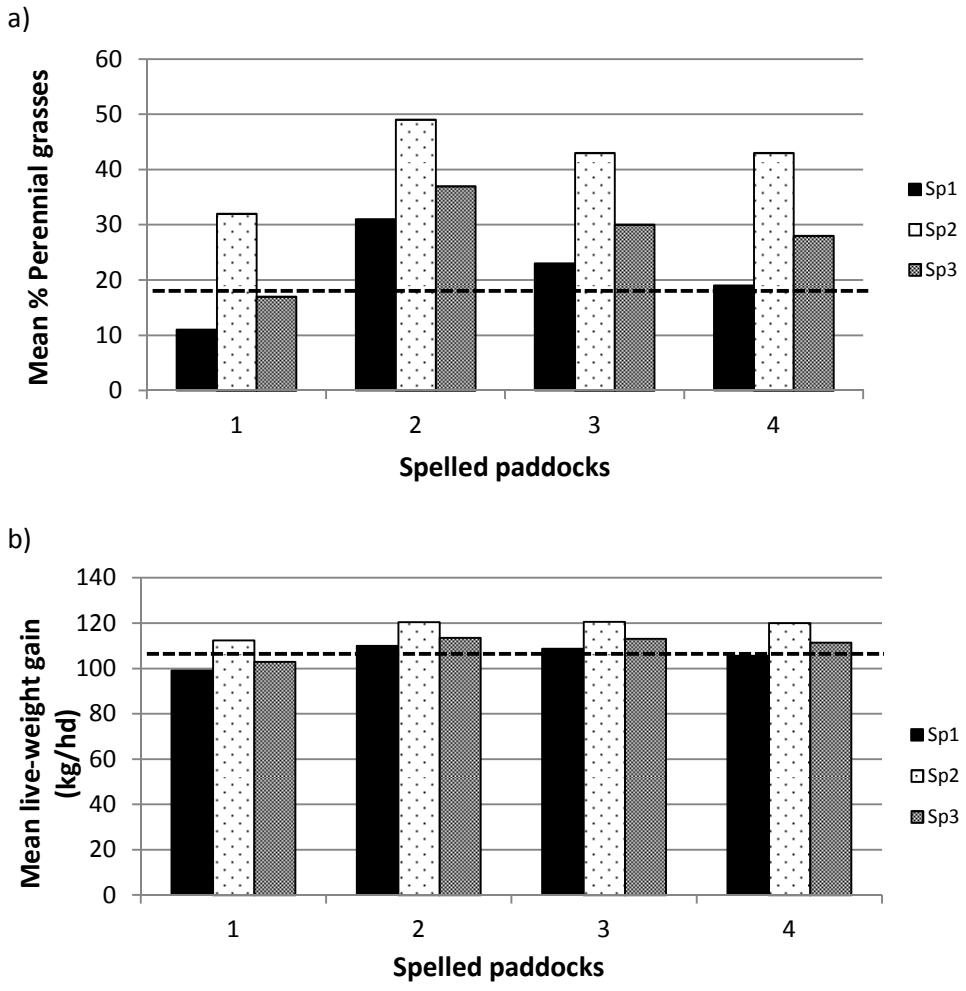


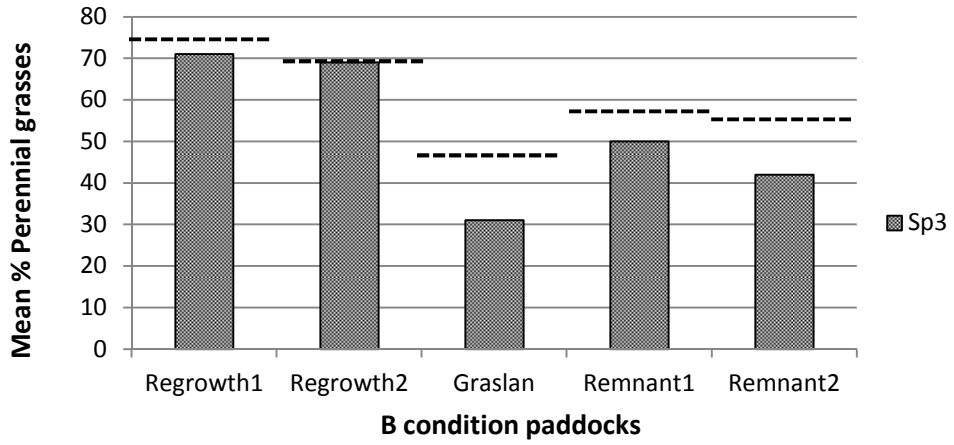
Fig.1. 20-year mean a) % perennial grasses and b) live-weight gain (kg/hd) for rotationally spelled paddocks (1-4) under spelling scenarios (sp1, sp2, sp3). Baseline values are shown as black dotted lines.

Spelling pastures with a reduced stocking rate (sp2) avoided the "4th paddock issue" and achieved the greatest improvements in pasture condition (i.e. % perennial grasses improving on average from 20% to 40%, Fig. 1a) and live-weight gains (average 10% above baseline Fig. 1b) in all four spelled paddocks. Distributing stock from spelled paddocks across the property for the first cycle of spelling (sp3) reduced the risk of over-grazing in the "4th paddock" allowing for some improvement in pasture condition (% perennial grasses improving from 19% to 29%, Fig. 1a).

Over-grazing akin to the "4th paddock issue" also occurred in the first paddock of the rotation as the commencement of spelling coincided with a year of below-average rainfall. The ineffective spell and subsequent loading up of this paddock during the first cycle when stocked at maintenance rate (sp1), or even when stock were distributed across property (sp3), degraded pastures to such an extent there was no recovery of condition after 20 years (Fig. 1a). Pasture condition in this paddock improved only when spelling was implemented with a lower stocking rate (sp2).

Distributing stock across the property for four (sp3) consecutive growing seasons improved pasture condition in three of the four spelled paddocks (Fig. 1a). Nonetheless, the increased grazing pressure caused a decline in both pasture condition (a decrease in % perennial grasses on average of 20%, Fig. 2a) and animal productivity (average 6% less than baseline, Fig. 2b) in the B condition paddocks, which received the extra stock. The added grazing pressure (~9% higher AE/ha) caused little change to the condition of pastures in the two most productive regrowth paddocks.

a)



b)

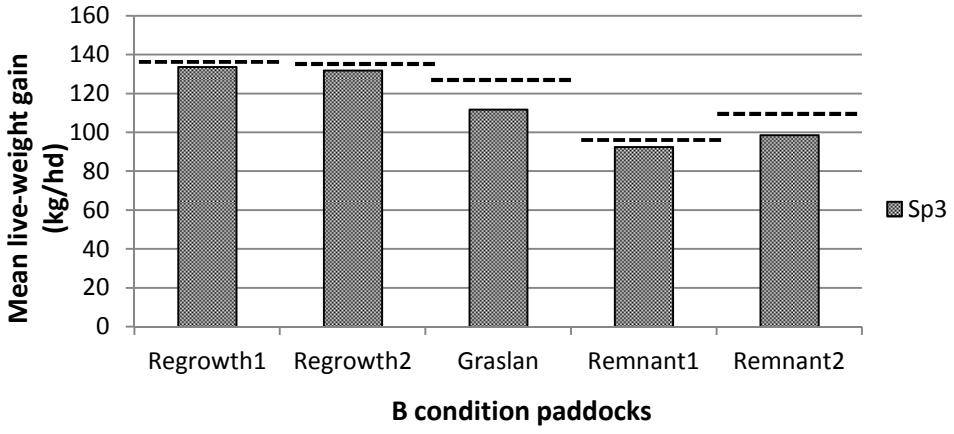


Fig.2. 20-year mean a) % perennial grasses and b) live-weight gain (kg/hd) for five B condition paddocks that received stock from spelled paddocks for four consecutive growing seasons (sp3). Baseline values are shown as black dotted lines.

The impact of extra animals in the herbicide-treated paddock was amplified through reduced fuel loads and burning regimes that were ineffective at controlling regrowth. In this paddock, over-grazing and an increased rate of regrowth resulted in degraded pastures. It was expected that these better condition paddocks would demonstrate resilience to slightly higher stocking rates over the initial four years of the spelling regime and, therefore, be an effective strategy for improving the poor condition paddocks. However, this did not occur.

The three rotational spelling scenarios had a relatively small effect on overall herd productivity and profitability. The marginal changes to financial outcomes (less than 5% $TGM) were due to the relatively small changes to the herd size, which did not vary greatly between spelling scenarios, the low proportion of the property area (20%) and herd (15%) impacted by spelling, and the use of fixed maintenance stocking rates in simulations. Even so, the spelling scenarios that distributed extra animals within the system (sp1, sp2) achieved the highest $GM/AE. The poor pasture and animal productivity outcomes when spelled stock were distributed across the property B condition paddocks were predominantly due to the initial loss of pasture condition in these paddocks.

Conclusion

Pasture spelling can improve land condition, animal productivity and profit per beast, but decisions regarding what to do with cattle from the spelled paddocks are critical to the success of the strategy. The greatest benefits from spelling occurred when a lower stocking rate was used, which minimises the risk of overgrazing when the other paddocks were 'loaded up' during the spelling period. Due to the constraints of modelling these benefits may be greater in reality. With more prudent timing of the spell, judicious selection of resilient pastures, and integration with other management practices, rotational spelling can be an important management option to assist beef businesses to achieve sustainable grazing and economic viability in the long term.

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