Commercial-scale implementation of wet season spelling for Mitchell grass recovery

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Abstract

Mitchell grasses (*Astrebla* spp.) are the dominant component of the alluvial cracking clay grasslands of the Barkly Tablelands region in the Northern Territory, Australia. Mitchell grasses are native palatable, productive and perennial grasses that contribute significantly to cattle diet quality and quantity in the region. Several years of below-average rainfall resulted in a noticeable reduction in Mitchell grass tussocks in 2022. The Barkly Region component of the Rain Ready Rangelands (RRR) project trialled the commercial-scale application of wet season spelling to promote Mitchell grass recovery.

The pastoralist-led demonstration used four paddocks on a demonstration site 440km north east of Tennant Creek, Northern Territory. Three paddocks were used in a wet season spelling rotation, with one paddock continuously stocked as a control. Farmbot™ telemetry units were used to record daily rainfall data remotely. Using the Botanal field sampling methodology (Tothill et al. 1992) data were collected from each paddock before and after the 2023/24 wet season inside and outside of new 100m by 100m cattle exclosures in each trial paddock.

Changes in vegetation throughout the trial period were strongly influenced by successive high rainfall years, biomass increased in all paddocks both inside and outside of the exclosures regardless of management strategy. However, despite the high rainfall and moderate to low pasture utilisation, there was a tendency for a greater increase in total perennial grass basal area inside exclosures than in grazed areas. There was some early evidence from vegetation monitoring that recovery was enhanced inside exclosures and reduced in the poor (C) condition areas where there were very few pre-existing perennial grass plants. There was also a higher pasture growth response at the better land condition site with the same rainfall and grazing impact. This provides evidence of the benefits of promoting land condition recovery. We aim to continue to monitor the impacts of wet season spelling on Mitchell grass health in these paddocks through time.

Introduction

Wet season spelling is a grazing management strategy that can assist in the recovery of palatable perennial pastures by removing selective grazing during the growing phase and enabling palatable, perennial tussocks to establish and rebuild root reserves (Ash et al. 2011, O'Reagain and Scanlan 2013, O'Reagain et al. 2014, Scanlan et al. 2014). Without perennial pastures, annual grasses and forbs can become dominant leading to lower pasture

biomass, higher detachment and feed shortages during the dry season. This can have a cumulative impact in years with low rainfall.

Understanding the impacts of grazing management changes can be difficult to measure when combined with highly variable rainfall. Land condition change can be both slow (for most years) and then fast and sudden when rainfall, low grazing pressure and seedbank availability combine to provide the best conditions for establishment of new plants (Watson et al. 1996). Establishing sites that can be monitored long term, with and without grazing across variable years is needed to observe and measure changes.

This demonstration was designed to provide the information that may increase pastoralist confidence in implementing wet season spelling to promote Mitchell grass recovery. The objective of the project was to test the efficacy and practical implementation of wet season spelling to promote the recovery of Mitchell grass at the commercial scale.

Methods

The demonstration site included four paddocks ranging in size from 67 to 125 km^2 on Anthony Lagoon Station in the Barkly Tableland region of the Northern Territory. Three paddocks were part of a wet season spelling rotation (No. 5 East, No. 5 West, No. 6), with one paddock (No. 4) continuously grazed as a control. At the start of the project, the carrying capacity (AE/km^2) (AE = 450kg steer) of each paddock was calculated using regionally calibrated modelled pasture growth and safe utilisation rates for the land type (Pettit, 2011; Rickert et al. 2000; McLennan et al. 2020). Cibo Labs land condition spatial data (provided by the property owner) was used to adjust total modelled pasture growth for each paddock to better reflect potential pasture growth. To calculate the short-term stocking rates in the grazed paddocks carrying capacities were converted to AE/day. Decisions about cattle movements and which paddocks were grazed or spelled were determined by the property manager with advice from the project team. Thus, No. 5 East was wet season spelled with all cattle from No. 5 East and West going into No. 5 West on 18 December 2023.

In each paddock, a 100m by 100m exclosure was erected to exclude grazing for comparison to the surrounding continuously grazed and rotationally spelled paddocks. Site locations were selected between 1 and 2 km from a water point where Mitchell grass was present but in poorer condition. Four transect lines, 87m in length were established inside each exclosure. Four additional transect lines of the same dimensions were established parallel to the exclosure in an area most representative of species' composition and biomass (control treatment). An additional unfenced monitoring site with 4 transect lines was established in an area of good (A-B) land condition in Paddock 5 West where Mitchell grass was dominant. Fifteen 1m^2 quadrats were assessed for vegetation composition, pasture biomass, ground cover and perennial grass basal area along each transect line in October 2023 and May 2024.

Results

The rainfall in No. 4 and No. 6 Paddocks during the 2023-24 wet season was well above average (in the top 95% of all years) with 1132mm received. The October 2023 baseline pasture assessments highlighted a natural variation in pasture yield between paddocks (Fig. 1). Total standing dry matter (TSDM) inside and outside of the exclosures were similar in each paddock in October 2023. TSDM increased at all sites between October 2023 and May 2024. The average increase in TSDM was consistent in all exclosures (2010 kg/ha ± 112). Outside the exclosures, TSDM varied depending on the grazing treatment and pasture type. The good land condition site in No. 5 West paddock increased TSDM by 1653kg/ha between October 2023 and May 2024, compared to No. 5 West outside exclosure site which increased by 896kg/ha, despite both being in close proximity and the good land condition size having higher grazing scores.

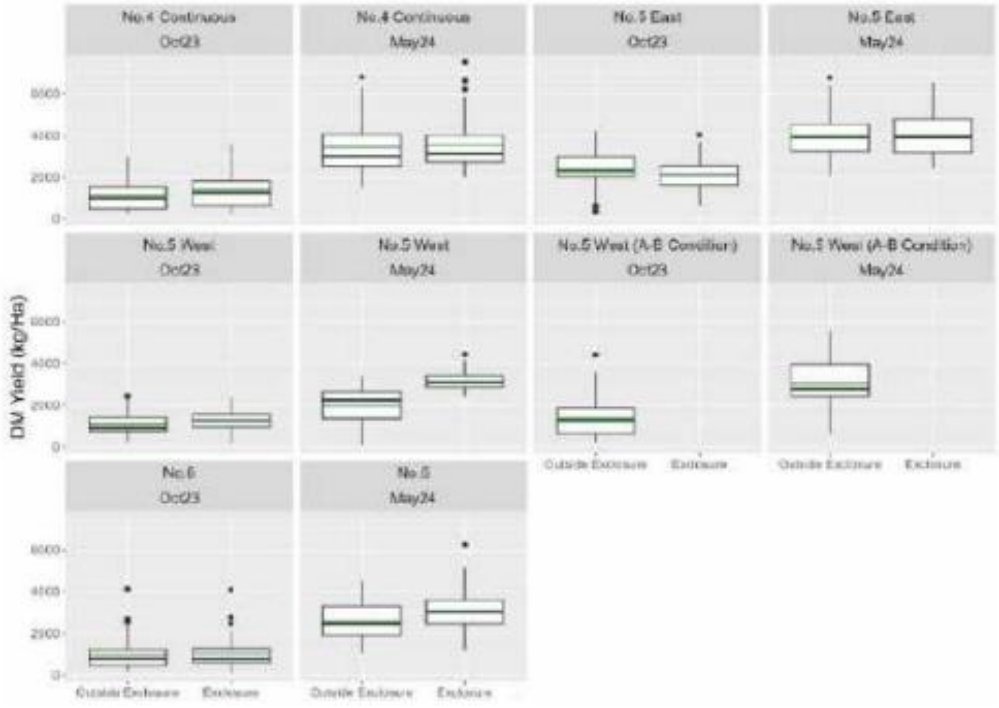

Figure 1: Total yield (kg dry matter/ha) inside and outside of exclosures, October 2023 and May 2024. Mean (green line), median (black line), middle 50% of data (box), min and max (whisker), outliers (dots)

The combined *Astrebla elymoides*, *Astrebla pectinata* and *Astrebla squarrosa* (Mitchell grasses) yield is shown in Fig 2. *Astrebla* species yield increased between October 2023 and May 2024 in all exclosures except No. 5 East. No. 5 West had the lowest yield of *Astrebla* species with no *Astrebla* spp. in the outside exclosure site in October 2023 and a small increase by May 2024 (4kg/ha). The No. 5 West good land condition site had the highest Mitchell grass yield of all sites in May 2024 (1848kg/ha, 61% of TSDM).

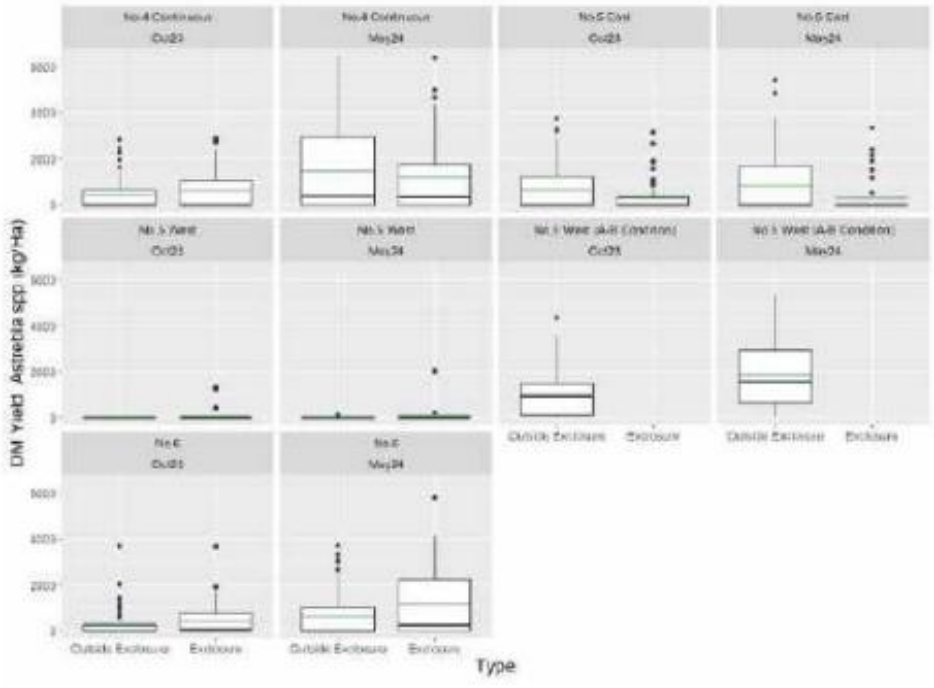

Figure 2: Total yield (kg/ha) contribution of grouped Astrebla spp. inside and outside of exclosures, October 2023 and May 2024. Mean (green line), median (black line), middle 50% of data (box), min and max (whisker), outliers (dots)

There was a high level of variation in grass basal area of *Astrebla* species across all paddocks and treatments (Fig. 3). Grass basal area of *Astrebla* species increased over the wet season at all sites in No. 4 paddock and in the exclosure of No. 6 Paddock.

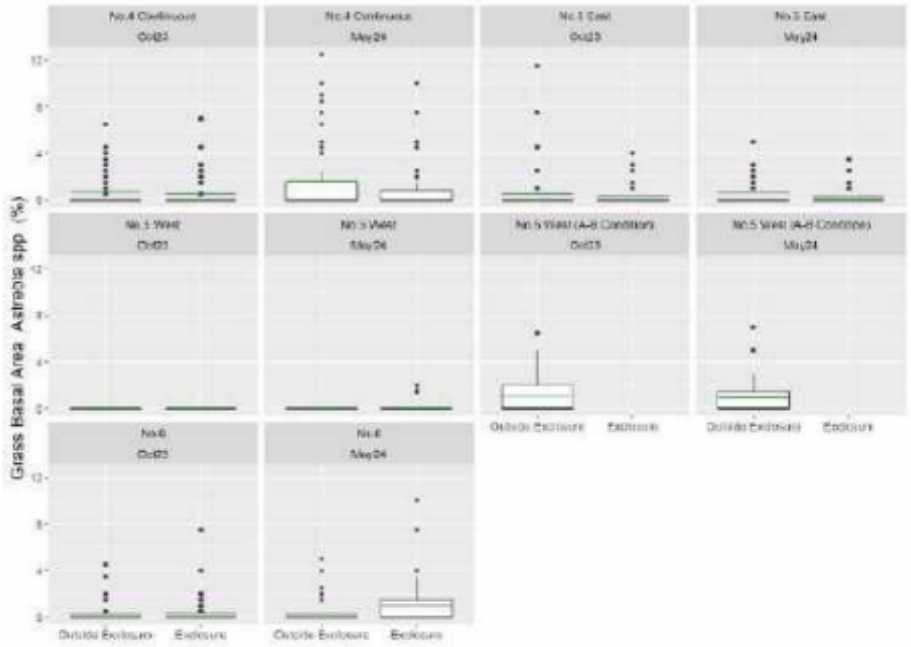

Figure 3: Grass basal area of *Astrebla* spp. in October 2023 and May 2024. Mean (green line), median (black line), middle 50% of data (box), min and max (whisker), outliers (dots)

Grazing scores (defoliation) outside exclosures were low to moderate across all paddocks in May 2024 but were higher in No. 5 West and the good condition site in No. 5 West. This was due to the additional cattle from the spelled No. 5 East paddock on the 18th of December 2023.

Discussion

The initial differences found inside and outside of exclosures and between paddocks in October 2023 (Fig. 1) were due to the underlying variability in soils, vegetation and grazing history, as the exclosures had only been recently established. Results highlighted the natural variance in pasture composition and yield.

Changes in vegetation throughout the trial period were strongly influenced by rainfall. Generally, in high rainfall years yield increased in all paddocks both inside and outside of the exclosures regardless of management strategy. However, yield increase was lower outside No. 5 West exclosure, presumably due to the higher stocking rates in the paddock (supported by the higher observed defoliation). The two outside exclosure sites in No. 5 West had the same grazing treatment and distance from water effects, however they had different pasture growth responses. The total yield increase in the good (A-B) land condition site was close to double the yield increase in the adjacent No.5 West outside exclosure site that began in C condition. While not unexpected, this provides "seeing is believing" evidence of the impact grass basal area has on biomass production and the importance of promoting perennial grass recovery for a climate resilient feedbase.

Astrebla spp (Mitchell grass) biomass increased over the wet season in all paddocks and sites except the No. 5 East exclosure. The low grass basal area of *Astrebla* spp. in No. 5 West C condition site may mean recovery will take longer to occur, with few plants present to provide a local seed source for establishment of new plants.

Changes in land condition and Mitchell grass recovery are unlikely to be observed after just one year in rangelands where land condition change is slow and episodic (Watson et al. 1996). However, after successive high rainfall years, there was some early evidence from vegetation monitoring that recovery was enhanced inside exclosures, and reduced in the C condition areas where there were very few pre-existing perennial grass plants to build upon. There was also a stronger pasture growth response at the better land condition site with the same rainfall and grazing impact, which provides evidence of the benefits of implementing grazing strategies that promote grass basal area recovery and better land condition. Longer term monitoring is required to see if the wet season spelling strategy has advantages over the continuously grazed paddock when both are grazed at recommended stocking rates. The project has established baseline data across the demonstration site to compare future seasonal conditions and impacts of wet season spelling.

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