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Beef cattle grazing rangeland pastures augmented with naturalised Stylo had higher liveweight gains in the Victoria River District of the Northern Territory

Williams, M[1]; Pettit, C[2]; Hearnden, M[2]

[1] Department of Agriculture and Fisheries, Katherine, Northern Territory; [2] Department of Agriculture and Fisheries, Berrimah, Northern Territory

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Abstract

The Victoria River District (VRD) in the Northern Territory supports extensive cattle grazing on native pastures. The pasture quality and quantity of this tropical savanna is subject to significant seasonal variability with most of the rain falling between December and March. During the dry months, pasture quality rapidly declines, and protein becomes the most limiting nutrient, which is commonly replaced with urea to supplement nitrogen (Silva et al. 2022).

To address the seasonal protein deficits, the benefits of augmenting exotic legumes into the native pastures is being demonstrated at Victoria River Research Station (VRRS) situated 400km south-west of Darwin. The high protein content in legumes make them an ideal cattle feed to fill the protein gap that occurs naturally in rangelands when pasture dries off in the late dry season (August-December).

The project includes a live weight gain trial for young heifers between 6 to 12 months old grazing an existing legume augmented pasture compared to a control paddock with <5% legume yield. Near Infra-Red Spectroscopy (NIRS) data was collected in October 2023, December 2023 and May 2024 to compare crude protein content and metabolisable energy in the legume paddock versus the control. Early results from the first year suggest the weight gain of weaner heifers was significantly higher with naturalised Stylosanthes legumes.

Introduction

In the Northern Territory (NT), almost all beef cattle production occurs in extensive rangelands where cattle graze native pastures. Native rangelands are a low input and low-cost method of growing cattle on large areas of land where it is not feasible to have intensive cattle production practises such as feedlots.

In the tropical savannas of the Northern NT, annual cattle weight gain coincides with wet season rainfall, falling between December and March (Burns et al. 2010). During the wet season, consistent rainfall enables the pastures to remain green and nutrient rich, providing adequate energy and protein to cattle. After the wet season, a prolonged dry season (April–October) leads to pastures drying out and maturing, causing a decline in nutritional quality. This is characterised by a reduction in protein and energy content and an increase in indigestible components such as

lignin and cellulose, making the forage less suitable for supporting consistent weight gain in cattle (Norman 1963). Often at this time cattle will be offered a urea supplement as a replacement protein source.

The 'protein gap' that occurs from the middle of the dry season until after rain when pasture growth occurs, presents an opportunity to investigate augmenting native pastures with high protein legumes in the Victoria River District (VRD) region of the Northern Territory.

If young cattle can continue to put weight on during this time of year, it would bring heifers to joining weight sooner and provide earlier turn-off of steers. Generally, in Northern Australia, cows calve around October-December (Bortolussi, 2005). A cows energy requirements is higher in their last months of gestation and when they start lactating (McCosker et al. 2023). Legumes may provide higher energy and protein during this time, which could be extremely valuable management tool for cattle producers.

Methods

Improved paddock (1.9km^2) at Victoria River Research Station (VRRS) is predominately loamy red earths with a tall, open woodland and has a substantial amount of Stylo spp. present (*S. hamata*, *S. scarbra* and *S. viscosa*). The Stylo spp. were planted as part of a previous research trial in the 1970's and has since become naturalised. Native grasses present in Improved paddock include *Heteropogon contortus* (Black spear grass), *Setaria surgens* (Pigeon grass), *Aristida holathera* (Kerosene grass), *Enneapogon purpurascens* (Limestone grass) and *Mnesithea formosa* (Silkytop grass). There are small areas of improved pastures including *Cenchrus setiger* (Birdwood grass) and *Urochloa mosambicensis* (Sabi grass). This paddock was referred to as (+ legume) or legume paddock.

Little Rosewood paddock (7km^2) at VRRS is a mix of alluvial cracking clays and shallow limestone country and has little to no introduced legumes (<5% total legume composition). Pastures are dominated by *Chrysopogon fallax* (ribbon grass), *Aristida latifolia* (feathertop wiregrass), *Ophiuros exaltatus* (cane grass) and *Panicum decompositum* (native millet). Native legumes include *Sesbania sp.* (pea bush), *Neptunia sp.* (Neptunia) and *Phyllanthus maderaspatensis* (spurge). This paddock was referred to as (- legume) or the control paddock.

Heifers between the age of 6-12 months were inducted into the paddocks in July 2023. 33 heifers in Improved paddock and 45 heifers in Little Rosewood paddock were measured over the trial period. Little Rosewood was stocked with a further 59 heifers and steers to ensure stocking rates matched long-term carrying capacity and paddocks had similar utilisation rates.

The animals were weighed in July 2023 when inducted to their allocated treatments and then again in September 2023, December 2023, and May 2024. Faecal NIRS samples were collected from both paddocks in October 2023, December 2023, and May 2024.

Each paddock has a series of permanent pasture photo monitoring sites that were used to record any changes throughout the trial.

Results

From July 2023 to May 2024, heifers grazing the legume augmented pasture were on average 31.3kg heavier ($p<0.001$) and grew faster (0.45kg/day v 0.35 kg/day, $p<0.001$) (Table 1).

Table 1: Average liveweight gain in the control and legume augmented paddocks from July 2023 to May 2024

Treatment	Proportion of total yield of introduced and native legumes (%)	Number of animals	Average weight gain (kg) (± 95% Confidence Interval)	Average daily weight gain (kg/day) (± 95% Confidence Intervals)
– Legume	7	45	109.9 (105-115)	0.35 (0.337 – 0.370)
+ Legume	31	31	141.2 (135-148)	0.45 (0.432 – 0.476)

Faecal NIRS was used to analyse protein and energy levels of the feed consumed by cattle in both paddocks. The improved paddock heifers' diet had a lower dry matter digestibility (DMD) to crude protein (CP) ratio and higher metabolisable energy compared to Little Rosewood paddock heifers.

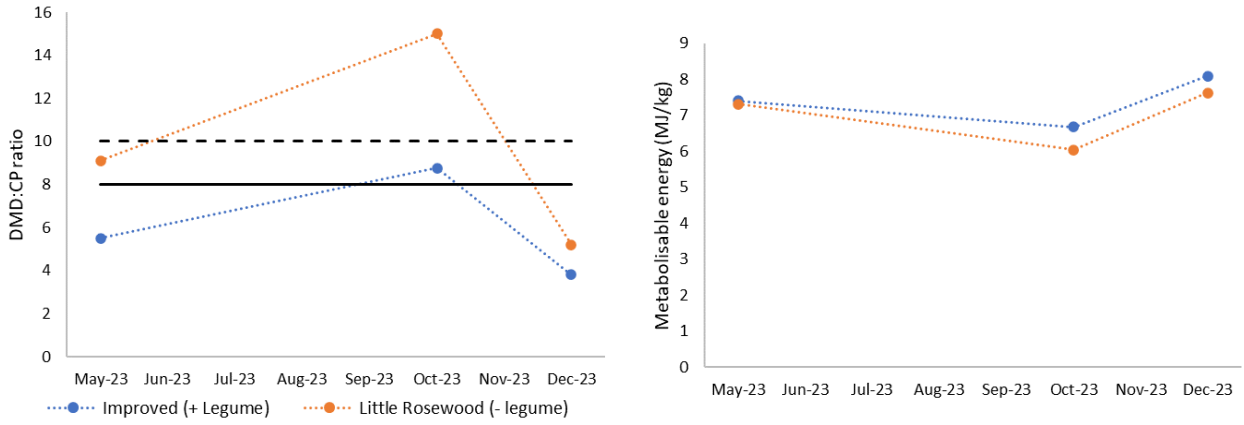

Figure 1: Faecal NIRS derived DMD%:CP% ratio and metabolizable energy in the legume and control paddocks, from October 2023 to May 2024. DMD:CP > 10 response to urea highly likely. DMD:CP>8 probable response to urea

Discussion

Heifers in the + legume paddock gained on average 100 grams more per day compared to heifers in the - legume paddock (Table 1). The increase in weight gain aligned with faecal NIRS data indicating a consistently higher crude protein (CP%) to dry matter digestibility (DMD%) ratio in the + legume paddock (Figure 1). In the late dry season, there was more metabolisable energy available in the pastures in the + legume paddock (Figure 2). This finding is consistent with previous research by Gardener (1980) which demonstrated that steers grazing a *Stylosanthes hamata*-native grass pasture exhibited improved diet selection and liveweight performance due to the higher quality forage provided by legumes. Notably, during the late dry season, metabolizable energy was also more available in the legume paddock (Figure 2), a critical period when protein and energy are often the primary constraints on cattle growth (Silva et al. 2022; Charmley et al. 2023).

The nutritional advantage of the legume paddock reduced after the wet season rains (December 2023–March 2024), as metabolizable energy levels equalized between the two paddocks. This suggests that the benefits of legumes are greatest during resource-limited periods, such as the late dry season. The late dry season nutritional benefits observed in the legume paddock are particularly significant for this environment, where limited protein and energy often constrain cattle growth. The continuation of this study through the 2024–25 wet season will

provide valuable additional data to assess the long-term impact of legume augmented native pastures on cattle weight gain and overall performance.

However, the study faced challenges in selecting a true control paddock with comparable soil fertility and pasture composition. The variations in soil quality and pasture composition may have influenced the results, highlighting the complexity of isolating treatment effects in extensive grazing environments.

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