FINAL REPORT

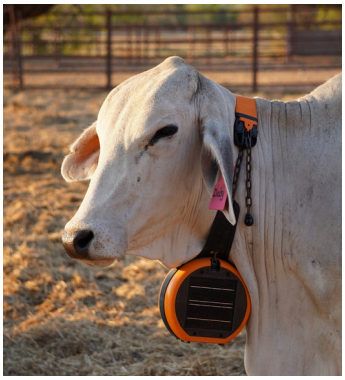
Crops for Cattle - Increasing the efficiency of north Australian cattle production systems to improve dry season weight gain

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Research for **sustainable** and **inclusive** development in **northern Australia**











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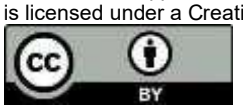
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Acronyms

AACo - Australian Agricultural Company
ADG - Average daily gain
BHF - Beatrice Hill Farm
CLD - Compact letter displays
CP – Crude protein
DAF - Department of Agriculture and Fisheries
DDRF - Douglas Daly Research Farm
DM – Dry matter
DOF – Days on feed
FTE – Full Time Equivalents (staff)
GM – Gross margin
KRS - Katherine Research Station
LW - Liveweight
LWG - Liveweight gain
MCP - Mono calcium phosphate
ME – Metabolisable energy
ML - Megalitre
MLA - Meat and Livestock Australia
NPV – Net present value
NT - Northern Territory
VF - Virtual fencing
VRD - Victoria River District
VRRS - Victoria River Research Station

Project Participants

[*listed or as logos with permission. Please differentiate Project Participants (those making co-contributions) and stakeholders (those who participated in research activities*].

The project participants were:
Northern Territory Department of Agriculture and Fisheries, AA Co. (LaBelle station), Avago Station Pty Ltd, National Feed Company Pty Ltd, Northern Livestock and Agriculture Pty Ltd (Ruby Downs), Northern Livestock Company Pty Ltd (Maryfield station), Ridley AgriProducts Pty Ltd, Surf & Turf Cattle Operations PTY LTD - Legune Station, T.J Oxley & P.J Thomson (Larakeyah station), The Trustee for JOHN ARMSTRONG FAMILY TRUST (Gilnockie station), Northern Ag and Civil Pty Ltd (Claravale Station).

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Executive Summary

The strongly seasonal rainfall pattern in much of northern Australia means that almost all cattle growth occurs during the wet season months and there is usually very little liveweight gain (LWG) during the dry season. Most northern cattle production systems target the live export market which typically has a recommended minimum target weight of 300 kg. If cattle do not reach this weight by June, it usually means that they are held over for another year so that they can gain weight over the next wet season. Properties then often have to wait until after the wet season for conditions to be dry enough for animals to be mustered and transported for sale. There are large gains in production efficiency to be made if the proportion of steers able to be turned off after one post-weaning wet season is increased.

Another potential area for improvement of production efficiency on many northern cattle properties is the heifer phase of their production systems. Maiden and first-lactation heifer pregnancy rates are strongly influenced by pre-mating weight/body condition (Schatz and Hearnden 2017) which is a result of their nutrition. Many heifers in northern Australia do not get the nutrition required to reach the critical weight for puberty (335 kg in Brahman heifers [Johnston *et al*. 2009]) and good pregnancy rates by early in their first mating season, which is usually at two years of age. This can result in low pregnancy rates and an increased proportion of maiden heifers conceiving late in the mating period, which leads to a more dispersed calving distribution, lower average weaning weights and lower first-lactation heifer re-conception rates. Such production systems are inefficient as they carry a higher proportion of unproductive young females and have lower weaning rates and average weaning weights.

This project aimed to investigate the feasibility and profitability of feeding strategies aimed at increasing dry season LWG to achieve a higher proportion of steers being turned off after one post weaning wet season and more efficient heifer performance through heavier pre-mating weights. This should improve whole-of-herd productivity, as heifers and first lactation heifers make up a significant proportion (> 40%) of the breeding herd.

The first stage of the project involved recording reliable data on growth rates that are realistic for properties to achieve in northern Australia during the dry season from different feeding strategies. Data was collected from feeding programs on Northern Territory (NT) Department of Agriculture and Fisheries (DAF) research stations, and from collaborating commercial properties that had existing dry season feeding programs. The data collected from the different feeding programs at the different sites is presented in the results section of this report. Producers will be able to use this data to get a realistic estimate of the sort of results they might get if they implemented a similar feeding strategy.

The data was then used to evaluate the profitability of different feeding strategies and in economic modelling and sensitivity analyses to determine the break-even cattle prices required at different feed prices for the strategies to be profitable. The first step in this process was to use historical cattle growth and performance data recorded at Victoria River Research Station (VRRS) over several years to determine the classes of cattle that were considered likely to be the most profitable to feed. These were:

- Steers in the weight range 255 – 299 kg at a mid dry season muster. These steers are lighter than the recommended minimum target weight for live export (i.e.. 300 kg), and so a feeding program that enabled these steers to gain an extra 45 kg in the dry season would mean that they could be exported after several months of feeding, rather than holding them for another whole year until after they reached the target weight.

- Maiden heifers with a pre-mating weight (PM Wt) of <250kg. The equations of Schatz and Hearnden (2017) predict that increasing the average PM Wt of these heifers from 230 to 270 kg should increase the pregnancy rate of this group by 17%, from 69% to 86%.
- First calf heifers with a pre-calving weight (PC Wt) of <430kg. If these first calf heifers are fed over the dry season before calving to increase their PC weight by 40 kg, then this will likely increase their re-conception rate by around 16% (Schatz and Hearnden 2017).
- Culled cows weighing between 350 kg and 400 kg. These are usually cows that are culled for age and that have had a calf weaned in the mid dry season and so are in low body condition. They usually show good compensatory gain after their calves are weaned and respond rapidly to improved nutrition. If they were fed to gain 50 kg over the dry season their value would likely increase from $690 to $996 per cow.

A simple gross margin (GM) calculator from the Breedcow Dynama software suite of programs (Holmes et al. 2017) was used to calculate the dollar margin per head fed for each of the feeding strategies, to determine which ones were likely to provide a positive return. This analysis valued cattle using a current market value of $4.00/kg and included the apportioned variable costs of the equipment and machinery used in the feeding strategy and also considered the opportunity cost of capital including livestock capital. This gives a more complete picture of the short-term profit of a feeding strategy compared to only considering direct feed, freight and labour costs. The feeding strategies that returned a positive GM (in order of decreasing GM) were:

- Floodplain grazing cull cows in the 350 – 400 kg weight range, for 97 days with an ADG of 0.52 kg/day. GM = $162 and the break-even cattle sale price = $2.09.
- Feeding a silage-based feedlot ration to cull cows in the 350 – 400 kg weight range for 34 days with an ADG of 1.5 kg/day and a ration cost of $276/t. GM = $150 and the break-even cattle sale price = $2.12. Note that this ADG was not achieved in this study but has been suggested as achievable by a nutritionist with extensive feedlot experience.
- Grazing steers in the weight range 255 – 299 kg on dryland forage sorghum for 115 days with an ADG of 0.39 kg/day. GM = $90 and the break-even cattle sale price = $3.72. Note that this ADG was not achieved in this study but has been documented in grazing trials in Queensland (Bowen et al. 2015).
- Floodplain grazing steers in the weight range 255 – 299 kg for 83 days with an ADG of 0.60 kg/day, without pre-floodplain feeding of supplements. GM = $72 and the break-even cattle sale price = $3.77. Note that this ADG was not achieved in this study but has been suggested as achievable by Top End pastoralists.
- Centre-pivot irrigated improved pasture grazing by steers in the weight range 255 – 299 kg on for 115 days with an ADG of 0.39 kg/day. GM = $64 and the break-even cattle sale price = $3.80.
- Floodplain grazing steers in the weight range 255 – 299 kg for 107 days with an ADG of 0.42 kg/day, without pre-floodplain feeding of supplements. GM = $55 and the break-even cattle sale price = $3.83.
- Feeding a silage-based feedlot ration to steers in the weight range 255 – 299 kg for 36 days with an ADG of 1.25 kg/day and a ration cost of $276/t. GM = $14 and the break-even cattle sale price = $3.96. Note that this was not the average ADG recorded at all sites, but was achieved by some of the pens fed.

The feeding strategies that returned a negative GM (in order of decreasing GM) were:

- Floodplain grazing steers in the weight range 255 – 299 kg for 80 days after 43 days of being fed weaner pellets and weaner mix. The overall ADG was 0.37 kg/day. GM = -$19 and the break-even cattle sale price = $4.06.

- Feeding a silage-based feedlot ration to steers in the weight range 255 – 299 kg for 48 days with an ADG of 0.95 kg/day and a ration cost of $276/t. GM = -$27 and the break-even cattle sale price = $4.09. Note that this was the average ADG recorded at all sites in this study.
- Feeding a commercial corn-based ration to steers in the weight range 255 – 299 kg while grazing native pasture for 57 days with an ADG of 0.79 kg/day. GM = -$175 and the break-even cattle sale price = $4.55. (Note that this ADG was not achieved in this study but was sourced from other feeding trials).
- Feeding “Weaner pellets” to steers in the weight range 255 – 299 kg for 80 days while grazing native pasture with an ADG of 0.57 kg/day. GM = -$127 and the break-even cattle sale price = $4.40. (Note that these pellets were not designed for long term feeding).
- Feeding “Shipper” pellets to steers in the weight range 255 – 299 kg for 69 days while grazing native pasture with an ADG of 0.66 kg/day. GM = -$322 and the break-even cattle sale price = $5.01. (Note that these pellets were not designed for long term feeding).

Sensitivity analyses were conducted to calculate the break-even cattle prices required at different feed costs for the various strategies. Break-even prices should be considered an indicative threshold for profitability rather than a minimum acceptable price for profit. The profit margin required above the break-even price will vary between businesses according to their appetite for risk, confidence in achieving the assumed ADG, exposure to feed and cattle price changes, ability to secure feed and forward pricing, access to working capital, and the consequences of an adverse outcome. Producers should therefore apply an appropriate margin of safety above the calculated break-even price when assessing whether a feeding opportunity is sufficiently attractive to proceed with adoption. This approach recognises that individual producers have different risk appetites, financial circumstances, opportunities to secure forward pricing and expectations of return on investment. Producers must consider the additional margin required to compensate for production and market risks, the opportunity cost of capital and alternative uses of available resources. Presenting break-even prices therefore provides a consistent basis for comparing feeding strategies while allowing individual producers to determine the level of profitability required to justify investment within their own business circumstances.

GM per head and break-even price are simplistic indications of whether a strategy is profitable under a defined set of conditions (cattle price, ADG, intake, feed cost etc.), and they do not capture any flow on benefits or costs to the business. Therefore, more detailed full property economic analyses were undertaken using a herd modelling approach (Breedcow Dynama) to assess the strategies more fully. These evaluations found that annualised NPV was negative for most of the feeding strategies evaluated. A contributing factor to steer feeding strategies with positive GMs having negative annualised NPV is that in the economic modelling, the feeding and early sale of steers frees up pasture which is used by an expanded breeding herd with an assumed 55% weaning rate. The modelled breeder herd has a lower GM per adult equivalent (AE) after interest than steer production in this modelling, and so the effect of expanding the breeder herd is to reduce the profitability of the whole property compared to the property without the feeding strategy. Therefore, the break-even GM analysis for feeding steers can produce a positive result and, at the same time, reduce the overall profitability of the beef business.

This highlights how important it is for producers in the region to consider all of the economic impacts of feeding strategies before taking steps to implement them. There is also a need for northern producers to gain skills in more intensive cattle feeding systems and to share knowledge on how best to increase profit and decrease risk when implementing feeding strategies.

It should be noted that some feeding strategies may create value that is not easily captured. Strategic benefits may include improved drought preparedness, greater marketing flexibility, improved utilisation of seasonal feed resources, reduced mustering frequency or labour costs, increased carrying capacity, improved breeder performance or access to higher-value markets. Strategies can also have a positive effect on property valuation. The analyses undertaken for this study have focussed on operating profit and not allowed for any returns from capital gains or some of these other potential benefits. Where property managers feel that potential for such value creation arises from feeding exercises, such factors should be included in the investment analysis undertaken at their property or business enterprise level.

An original aim of the project was to explore how the feeding strategies might be used to obtain carbon credits through reducing the lifetime emissions of the cattle fed (since they are turned off at a younger age) and increasing production efficiency. If this could be done, then it had the potential to further improve the profitability of the feeding strategies, as income could be gained from carbon credits as well as production gains. However, during the project the “Beef Herd Management Method” for obtaining carbon credits was discontinued. Meat and Livestock Australia (MLA) has the remit to develop a new system, but the process will involve extensive industry consultation and is not likely to be completed for at least two years.

As there is currently no method to obtain carbon credits through cattle management, the decision was made to show how this could have been done under the previous system, and how this information could be used under a new system once it is introduced. An example of how lifetime emissions can be reduced through a feeding strategy was demonstrated using an emissions calculator (Primary Industries Climate Challenges Centre 2026). The example used a hypothetical average steer using growth path data collected at VRRS over many years. The CO_2 emissions produced by the steer were calculated for three different growth paths (1. No dry season feeding. 2. Feeding in the first post-weaning dry season. 3. Feeding in the second post-weaning dry season). The different scenarios were then compared to assess the benefits from reduced emissions using the value of carbon credits under the previous Beef Herd Management method, in which a carbon credit (representing 1 tonne of carbon dioxide equivalent) traded for around $34 - $42. The modelling found that, compared to a steer that just grazes native pasture, the same steer that gets fed weaner pellets to gain 45 kg in the first post weaning dry season and gets turned off a year earlier would have 1.6 t less CO_2 emissions. A steer fed in the second post weaning dry season would have 0.91 t less CO_2 emissions. At a carbon credit price of $40/t, this calculator estimates that a property that sells 1,000 steers per year could potentially get $64,000 worth of carbon credits per year from feeding supplements in the first post weaning year. While the extra income from carbon credits could improve the profitability of feeding strategies, it was not included in the economic evaluation of the feeding strategies in this study.

Overall, the project was successful in documenting the rates of LWG currently being achieved under a range of feeding strategies in the north Australian environment, and in evaluating their cost effectiveness, and determining the feed cost/cattle price combinations under which they would be profitable. This information will be useful for northern cattle producers when considering whether to implement such a feeding strategy.

A variation to the project in 2024 added two research activities to the project that investigated how the productivity of north Australian cattle stations might be improved through the use of virtual fencing (VF) and the use of supplements containing products to repel buffalo flies from cattle.

Research was conducted to investigate the potential of VF to increase productivity through facilitating more even grazing, allowing better utilisation of forage, excluding animals from areas that are in poor condition, grazing animals in areas for better weight gain and spelling pastures for re-growth and better productivity. Three demonstration sites were established to evaluate the application of VF in different commercial grazing settings. Each site addressed a distinct

management objective aimed to assess whether VF could modify grazing behaviour in ways that improved animal performance, land condition, and overall productivity.

One VF trial demonstrated the capacity of VF to establish animals at an unfamiliar water point within a paddock where animals had previously shown a strong preference for an existing water source. This has important implications for extensive grazing systems in northern Australia where the installation of additional watering infrastructure is commonly used to improve grazing distribution. Virtual fencing provides a practical mechanism to encourage animals to use newly developed water points, allowing previously underutilised areas of the landscape to be grazed while reducing land condition decline around established watering locations (from over-grazing). Improved grazing distribution has the potential to overall productivity.

A second VF trial highlighted the potential for VF to exclude animals from an overgrazed “scald” area while maintaining productive use of the rest of the paddock. Throughout the trial, no VF collared animals entered the exclusion zone, demonstrating the effectiveness of VF in protecting highly preferred areas without the need for conventional fencing. These findings have broad applications for grazing management, including excluding animals from erosion prone areas, degraded landscapes, riverbanks, weed infested areas, and undesirable terrain such as gullies or swamps. From a production perspective, VF also allowed the paddock to remain in use while protecting the degraded area, demonstrating that VF can simultaneously achieve landscape exclusion objectives and maintain livestock productivity.

A third VF trial demonstrated the application of VF within an intensive rotational grazing system, where precise and frequent adjustments to virtual boundaries were used to implement strip grazing under a centre pivot irrigation system. Animals remained highly compliant with the virtual boundaries despite the small grazing areas and the presence of high value forage outside the virtual boundaries. Controlled strip grazing reduces selective grazing and minimises forage losses through trampling by limiting the area available for grazing at any one time. This promotes more uniform pasture utilisation and provides a more consistent forage supply throughout the grazing period. The successful implementation of VF under these conditions demonstrates that the technology is suitable not only for extensive rangeland systems but also for intensive production where more precise grazing control is required.

Results from the VF trials demonstrated the practical viability of the technology across a range of production systems. After the training period, the average number of pulses received from the VF collars per day was close to zero per animal across all sites during the trial periods. This result indicates that the animals rarely challenged the virtual fence once training had been completed, suggesting that they had developed an understanding of the virtual boundary and effective learning of the audio-pulse association. The high levels of compliance indicate that VF can effectively contain animals under diverse environmental and management conditions. These findings highlight the versatility of VF as a management tool capable of supporting multiple production and grazing management objectives.

These findings demonstrate that virtual fencing has considerable potential to improve grazing management and productivity in extensive beef production systems. One of the greatest constraints to production in northern Australia is the highly variable utilisation of pasture resources, with animals often concentrating around preferred water points and overgrazing these areas while large areas of available forage remain underutilised. By enabling precise control of animal distribution without the need for additional physical fencing, virtual fencing provides producers with a practical tool to better match grazing pressure with forage availability across the landscape. Improved grazing distribution has the potential to increase pasture utilisation, maintain higher diet quality for longer periods, and reduce the distance animals travel to access feed and water. Collectively, these outcomes may contribute to improved liveweight gain, particularly during the dry

season when declining pasture quantity and quality often limit animal performance. Furthermore, the ability to protect sensitive areas while continuing to utilise productive parts of paddocks offers opportunities to simultaneously improve environmental outcomes and enterprise productivity. As the technology continues to develop and become cheaper, virtual fencing has the potential to become an important component of precision livestock management in northern Australian grazing systems, supporting both sustainable land management and improved production efficiency. While the project found that virtual fencing provides some potential opportunities to improve grazing management and productivity on northern cattle stations, the cost effectiveness of these strategies was not evaluated as the technology is developing quickly and prices are changing rapidly.

Trials were also conducted at two sites to investigate whether mineral supplement blocks containing Allicin (garlic) and Sulphur were effective in repelling buffalo flies from cattle and improving LWG. At both sites there was no consistent treatment effect of the Allicin + Sulphur blocks on LWG, fly burden or skin lesion scores. This may have been because the intake of the supplement blocks was below the level recommended level by the manufacturer, but it is not known whether there would have been an effect if intake was higher. There are anecdotal reports from producers that the Allicin + Sulphur blocks repel buffalo flies, but this trial did not find such an effect.

1. Introduction

Most of northern Australia has a strongly seasonal rainfall pattern, with almost all rain usually falling between November and April. This results in almost all cattle growth occurring during these "wet season months" and typically there is very little liveweight (LW) gain and sometimes LW loss from June until December (Bortolussi 2005). Also, it is difficult to muster and transport cattle during the wet season months, so if cattle do not reach a target sale weight by June it usually means that they have to be held for another year so that they can put on weight over the wet season and then be mustered and transported for sale once conditions are dry enough for that to occur.

The extended dry season (typically from May to November) and poor pasture quality during this period results in low cattle annual liveweight gain (LWG) in much of the Northern Territory (typically 80 to 110 kg/year). Therefore, in a typical year, the majority of steers do not put on enough weight after the first post-weaning wet season to grow from an average weaning weight of around 180 kg to the recommended target minimum weight for live export of 300 kg. Those that do not reach the target sale weight have to be kept for another year to gain the required weight, and so most steers destined for the live export market are turned off after two post-weaning wet seasons at around 30 months of age. Increasing the proportion of steers that are turned off after one post-weaning wet season would greatly increase the production efficiency of many northern cattle stations and free up more land for other cattle. Similarly, many heifers do not reach the critical mating weight of 335 kg for Brahman heifers required for puberty and good pregnancy rates by early in the second wet season after weaning (at two years of age) (Johnston *et al.* 2009). This can result in low pregnancy rates and an increased proportion of maiden heifers conceiving late in the mating period, which leads to a more dispersed calving distribution, lower weaning weights and lower first lactation heifer re-conception rates. Such production systems are inefficient as they carry a higher proportion of unproductive young females and have lower weaning rates and average weaning weights.

Overcoming the problem of low LWG during the dry season would reduce the average age at turnoff of steers and improve heifer performance and breeder herd efficiency. There have been numerous attempts over the years to feed cattle to increase weight gain during the dry season in northern Australia. However, in most cases these ventures were not profitable and were abandoned. With the emergence of new cropping industries in northern Australia, higher cattle prices and the possibility of carbon credits for approved methodologies, the economics of more intensive feeding strategies may have changed. This project aimed to identify on-property dry season feeding ventures that are profitable and practical for northern producers. It also aimed to foster intensification of the northern cattle industry by integrating northern cropping and cattle production systems to increase weight gains of cattle during the dry season and provide markets for locally produced crops.

The project aimed to investigate the feasibility and profitability of feeding strategies aimed at increasing weight gain over the dry season to achieve a higher proportion of steers being turned off after one post weaning wet season and more efficient heifer performance from a greater proportion reaching the critical mating weight early in their first mating period. This improves the overall whole-of-herd productivity, as heifers and first lactation heifers make up a significant proportion (> 40%) of the breeding herd. The project collaborated with commercial properties in the Northern Territory (NT) that had existing dry season feeding programs. Data was recorded and sourced from their production systems and used in modelling to identify the conditions under which the strategies would be profitable.

This report provides a practical framework to assist northern beef producers in evaluating a range of feeding strategies under commercial conditions. Rather than identifying a single 'best' feeding option, the report demonstrates that profitability depends on the interaction between feed costs, cattle prices, animal performance, capital requirements and the objectives of the individual business. Economic modelling undertaken as part of the project demonstrates that every feeding strategy has circumstances where it may be profitable, and others where it may not. Sensitivity analysis highlights that relatively small changes in feed cost, average daily gain or cattle prices can substantially alter the economic outcome. Consequently, producers are encouraged to evaluate a range of scenarios rather than relying on average values.

This report combines technical research, commercial producer experience and whole-business economic analysis to evaluate feeding strategies and help producers understand the conditions under which they are likely to increase the profitability of a business. Feeding cattle in northern Australia is rarely a simple question of comparing the cost of feed with the resulting additional liveweight gain. Feeding decisions influence reproductive performance, market timing, stocking pressure, drought resilience, labour requirements, infrastructure utilisation and whole-business cashflow. Therefore, the report provides producers with a framework for evaluating feeding strategies using biological, economic and financial information together, while recognising the practical realities of commercial beef production.

Good evaluation of investment decisions requires three complementary forms of analysis:

1. Analysis of animal performance measures such as average daily gain, feed conversion efficiency, health etc.
2. Economic analysis of whether these biological responses create profit through measures such as cost of gain, gross margin, net present value (NPV), internal rate of return (IRR) and discounted cashflow.
3. Financial analysis considering whether the investment is practical for the business by assessing capital requirements, cashflow, etc.

No single metric should be used in isolation. High animal performance does not necessarily translate into good financial returns, while strategies with a modest cost of gain may provide substantial strategic value elsewhere in the business. It is important to test a proposed strategy with sensitivity to feed costs and cattle prices. Therefore, the evaluation of the feeding strategies studied in this report was thorough and took all these things into account.

An original aim of the project was to explore how the feeding strategies might be used to obtain carbon credits through reducing the lifetime emissions of the cattle fed (since they are turned off at a younger age) and increasing production efficiency. If this could be done, then it had the potential to further improve the profitability of the feeding strategies, as income could be gained from carbon credits as well as production gains. However, during the project the “Beef Herd Management Method” for obtaining carbon credits was discontinued. Therefore, modelling using the previous system was used to show how lifetime emissions could be reduced through use of dry season feeding strategies and give an indication of the potential for obtaining extra income through carbon credits once a new method for obtaining carbon credits has been developed.

The project also aimed to investigate how virtual fencing and the use of supplement additives to repel buffalo flies might be used to improve the LWG and the production efficiency of northern cattle properties. Improving the efficiency, profitability and sustainability of northern cattle enterprises is consistent with the CRCNA objectives of creating a prosperous, sustainable, vibrant and healthy northern Australia as the cattle industry is the NT’s largest agricultural sector by economic value and land area, and it has a large impact on regional communities.

2. Methodology

There were a number of different activities in the project and the methodologies are given here separately for each. More details on the specifics of the different feeding activities each year at each of the sites are provided in the results section for each site and activity (in section 3.3). The research was conducted under permit A23003 from the Charles Darwin University Animal Ethics Committee.

The first stage of the project involved recording reliable data on growth rates from the different feeding strategies. It was important to have actual data recorded in the local environment, rather than using estimates or data recorded in other environments. This ensured that the growth rates used when evaluating the profitability of the different feeding strategies are realistic for properties to achieve in northern Australia. Data was collected from feeding trials on Northern Territory (NT) Department of Agriculture and Fisheries (DAF) research stations, and from collaborating commercial properties that had existing dry season feeding programs. The data was then used to evaluate the profitability of the different feeding strategies.

An average ADG was calculated for the feeding strategy at each site from the data collected over all of the years. This average ADG was then used to assess the profitability of the strategies using a simple cost of feed calculator to calculate the dollar margin per animal fed. This analysis included the amortised costs of the equipment and machinery employed in the feeding strategy and also took into account the cost of capital. This gives a more complete picture of the short-term profitability of a feeding strategy, rather than only accounting for the direct feed and labour costs. However, these assessments are only indicative for the purposes of this report as a fixed price for both purchase and sale of the cattle was used across all strategies. In reality, producers use feeding strategies to meet market specifications at specific times of the year and thus increase the price per kilogram received in addition to the weight of the animals they sell. The actual margins may therefore be higher than the indicative margins generated by the analyses.

The outputs from the calculator are detailed in the results section for each individual property. Data that was not considered to be not representative of the feeding strategy for some reason was omitted. The details used in the calculator are shown in Table 49 in Appendix 1. The data was intended to be representative of a typical property in the Victoria River District (VRD) and used data that had been collected on Victoria River Research Station (VRRS) over many years.

The outputs of “margin per head fed” give a simplistic indication of whether a strategy is profitable, and do not capture any flow on benefits to the business. A more detailed full property economic analysis has been undertaken using a modelling approach in order to assess the strategies more fully without compromising the privacy of any individual producers. The methodology of this economic analysis is presented in section 2.3.

2.1. Feeding trials on NT DAF research stations

Trials were conducted at Victoria River Research Station (VRRS) and Katherine Research Station (KRS) to document the improvement in liveweight gain (LWG) from feeding commercially available pellets to young cattle grazing in paddocks during the dry season. The methodologies used at the two sites are given separately here.

2.1.1 Victoria River Research Station (VRRS) – Weaner pellet feeding trials.

Feeding trials were conducted during the late dry seasons (September to December) of 2023,

2024 and 2025 to assess the performance of young animals fed Ridley Rumevite® Northern Weaner pellets (details in Table 1) in troughs in the paddock while grazing native pasture. Each year the group that was fed pellets was compared to a control group that grazed in a similar paddock but did not receive pellets. Both groups were provided with a urea based dry season mineral supplement that did not contain any true protein. The groups grazed in paddocks that contained similar pasture but that were different in size, therefore the number of animals in each treatment was set to ensure that the grazing pressure in both paddocks was similar using carrying capacity assessment data. As a result there were 20 animals in the Pellet group and 105 in the Control group. The animals used had been weaned at VRRS in May and then grazed together as a mob until branding in July when they were separated into treatment groups and taken to their respective paddocks. Most of the animals were heifers, although some steers were also used as there were not enough heifers to stock the paddocks at the required numbers. Only data from the heifers were used in the analyses as there were not enough steers in the groups to give reliable data (the steers were just there to make the stocking rates similar in the paddocks).

Each year the average weight of the animals at weaning was around 175 kg (range = 100-240 kg). They were weighed again just before branding in early July and this weight was used to allocate them to treatments groups. Allocation was done on weight using stratified randomisation to give each group a very similar average starting weight. The animals grazed in their respective paddocks until they were weighed again in early September when feeding of the Pellet group commenced. Feeding continued until the first rains (usually in November) when pellet feeding ceased and a final weight was recorded for the feeding period. After pellet feeding finished the groups were combined into one mob and grazed together over the wet season and were weighed again in the following May to assess whether any compensatory gain had occurred.

In 2024 and 2025 Ridley Rumevite® Northern Weaner Pellets were fed and in 2023 a custom pellet was fed that was similar to the “Northern Weaner Pellet” except that soybean meal was substituted for canola meal which increased the crude protein levels. This pellet is not commercially available, and so the economic evaluations of the feeding strategy only used data from the 2024 and 2025 feeding trials. The pellets came in 20 kg bags that were tipped into troughs in the paddock at a rate calculated to provide the animals with the desired intake. The number of bags fed each week was recorded and used to calculate pellet intake. More details of the methodologies each year are provided in the results section.

2.1.2 Katherine Research Station (KRS) – Shipper pellet feeding trials.

Feeding trials were conducted during the late dry seasons (September to December) of 2023, 2024 and 2025 to assess the performance of young heifers fed National Feed Company (NFC) shipper pellets (details in Table 5) in troughs in the paddock while grazing native pasture. Each year the group that was fed pellets was compared to a control group that grazed in a similar paddock but did not receive pellets. Both groups were provided with a urea based dry season mineral supplement that did not contain any protein. The groups grazed in paddocks that contained similar pasture but that were different in size, therefore the number of animals in each treatment was set to ensure that the grazing pressure in both paddocks was similar using carrying capacity assessment data. The animals used were heifers that had been weaned in May and then grazed together as a mob until branding in July when they were separated into treatment groups and taken to their respective paddocks.

Each year the average weight of the heifers at weaning was around 175 kg (range = 100-240 kg). They were weighed again just before branding in early July and this weight was used to allocate them to treatments groups. Allocation was done on weight using stratified randomisation to give each group a very similar average starting weight. The animals grazed in their respective paddocks

until they were weighed again in early September when feeding of the Pellet group commenced. Feeding continued until the first rains (usually in November) when pellet feeding ceased and a final weight was recorded for the feeding period.

The pellets came in 20 kg bags and the number of bags fed each week was recorded and used to calculate pellet intake. The amount of pellets fed each year varied and more details of the methodologies each year are provided in the results section.

2.2. Feeding trials on commercial properties

Eight NT properties collaborated with the project to document the LWG performance of animals in feeding programs that they were conducting prior to collaborating in the project. The methodologies used in their feeding programs were not influenced by their involvement in the project. The project just documented the results from feeding programs that they were already conducting. General methodologies used at the eight sites are given separately here and more details are provided in the results section. Note that some properties and feed companies have asked to be de-identified in this report.

2.2.1 Short term feeding followed by floodplain grazing – Top End

Weaners from AACo properties in the Victoria River District (VRD) were trucked to LaBelle Downs station shortly after weaning where they were fed Milne Early Weaner pellets and loose mix supplement containing protein meal (details provided in the results section) in a paddock for a short period (e.g. 1-2 months) in the dry season before being transferred to a floodplain paddock where they grazed until the wet season started. The weaners were weighed on arrival, when they were transferred to the floodplain and when they came off the floodplain. This data was used to calculate average daily gain (ADG) while being fed, and while grazing on the floodplain.

2.2.2 Dryland forage sorghum grazing – Sturt Plateau

A Sturt Plateau cattle property has established a 382 ha cultivation area that is sown to forage sorghum and each year weaners are allowed to move freely between the cultivation area and a neighbouring 33 km^2 native pasture paddock for several months during the dry season. The cultivation requires re-sowing approximately every second year.

Weaning musters are conducted in paddocks on the property from July to September each year and the weaners are taken to the main station yards where they are held and educated (tailing etc.) until about 400-800 animals have been gathered. They are then weighed and branded before being released into the native pasture paddock that opens into the cultivation. This is repeated until all the paddocks have been mustered and calves weaned. Typically, this results in about 4,400 weaners (males and females) in the two paddocks by the end of September. The gate between the two paddocks remained open and the weaners could come and go as they pleased. It should be noted that there was no way of knowing which animals accessed the cultivation or how long they spent grazing it.

The weaners are removed from the paddocks in November each year, so that the cultivation area can be prepared and sown again for the following year, as necessary, or allowed to re-grow over the wet season. Weaners are removed from the paddocks by mustering mobs of several hundred

animals at a time, and they are weighed and drafted into groups (males and females etc.) and then taken to other paddocks.

A group of heifers in another paddock was used as a “Control”. They were weighed at similar times but did not have access to the cultivation area. The average daily gain of animals that had access to the cultivation was compared to the control group. All animals were provided with a dry season weaner loose mix supplement containing: Salt - 20%, Urea - 10%, Gran Am - 20%, MDCP, - 20%, Soy Meal/Copra/CSM 20%, Lime - 6%, Dolomite - 2%, Rumensin – 0.5%, and Pre-Mix trace minerals 1.5%.

2.2.3 Corn-based ration fed in self-feeders to cattle grazing native pasture - Victoria River District

A VRD cattle property feeds a purchased grain ration to steers from self-feeders in a native pasture paddock to try to increase the number that meet the target minimum weight for live export. Details of the ration are provided in the results section, and the cattle were also provided with ad lib access to loose mix supplement that contained 10% cottonseed meal, 20% urea, 26% MCP, 20% Gran Am, 16% salt. LWG performance of the fed steers was compared to others in a similar paddock that were not fed but received the same supplement.

The group fed the grain ration were kept in a 2,400 ha paddock of native pasture and the grain ration was fed from three Advantage Self Feeders in the paddock for approximately 90 days. More details on the specific methodologies each year are provided in the results section.

2.2.4 Pivot irrigated improved pasture in the Douglas Daly district

A cattle property in the Douglas Daly district has two areas of improved pasture (Rhodes grass) that they irrigate with pivots (25-30mm/week) for about 13 weeks during the dry season. One pivot is 100ha and one is 50ha in area. Each year they graze young animals on the pivots during the dry season to try to increase the proportion that reach the minimum live export target weight within a year after weaning (as animals normally would not gain any weight over the dry season while grazing pasture that is not irrigated). The pivot areas are also used for hay production and are usually cut twice prior to grazing.

The animals were weighed at the start and end of the periods grazing under the pivot and this data was used to calculate average daily gain (ADG). This data was then used to evaluate the profitability of the strategy compared to cattle that just graze pasture and do not put on any weight over the dry season.

2.2.5 Silage-based total mixed feedlot ration fed - VRD

Legune station (near the northern NT/WA border) has a large feedlot in which cattle are fed a silage-based ration that they grow on station, with some additional purchased grain added. The details of the ration contents fed each year are provided in the results section.

The station mostly feeds young animals during the dry season that have not reached the minimum live export target weight. Feeding these animals in the feedlot until they reach the target weight means that they don't have to be held for another year grazing pasture before they reach the target weight. Some other classes of cattle (e.g. small weaners) are also fed, but data from these animals was not included in this study as it is not relevant to the strategies being proposed.

Cattle are weighed at the start and end of their time in the feedlot and this data was used to calculate ADG. This data was then used to evaluate the profitability of the strategy compared to cattle that just graze pasture and do not put on any weight over the dry season.

2.2.6 Silage-based total mixed feedlot ration fed – Sturt Plateau

Maryfield Station is located near Larrimah, NT and has a large feedlot (with capacity to feed up to 10,000 head). They grow forage sorghum which they make silage from and then mix with other purchased ingredients (details in the results section) to produce a total mixed ration which they feed to cattle in the feedlot.

Their feeding system is similar to that at Legune Station in that they mostly feed young animals during the dry season that have not reached the minimum live export target weight. Feeding these animals in the feedlot until they reach the target weight means that they do not have to be held for another year grazing pasture before they reach the target weight. Some other classes of cattle (e.g. small weaners) are also fed, but data from these animals was not included in this study as it is not relevant to the strategies being proposed.

Cattle are weighed at the start and end of their time in the feedlot and this data was used to calculate ADG. This data was then used to evaluate the profitability of the strategy compared to cattle that just graze pasture and do not put on any weight over the dry season.

2.2.7 Silage-based total mixed feedlot ration fed – Top End

Claravale station (south-west of Pine Creek) has a feedlot in which they feed young cattle until they reach the target weight for live export, so that they don't have hold these cattle for another year until they reach the target export weight. Some other classes of cattle (e.g. small weaners) are also fed, but data from these animals was not included in this study.

The station feeds a feedlot ration of silage (56%), cottonseed (24%), cavalcade (13%), molasses (4%), concentrate (2%), and silk sorghum hay (1%). Most of the ration ingredients are grown on the property and the silage is produced there by contractors.

Cattle are weighed at the start and end of their time in the feedlot and this data was used to calculate ADG. This data was then used to evaluate the profitability of the strategy compared to cattle that just graze pasture and do not put on any weight over the dry season. More details of the feeding activities in each year are provided in the results section.

2.2.8 Weaner pellets fed to cattle grazing native pasture – Roper region

Hodgson Downs is an indigenous owned (Alawa 1 Land Trust) cattle station located approximately 260 km south-west of Katherine NT. The Waynorth Cattle Co. hold the grazing license on Hodgson Downs and run their own herd within the grazing area. They also manage cattle owned by the Alawa 1 Land Trust alongside their cattle.

Over three years (from 2023 to 2025) at Hodgson Downs, cattle were fed Ridley Rumevite® Northern Weaner pellets in troughs while grazing native pasture in a very similar way to the feeding trials conducted at VRRS, except that the animals fed were 18 month old heifers prior to their first mating rather than weaners. Pellet feeding commenced in mid-September and continued until the wet season started (50 mm of rain received) which was usually about 90 days later. The heifers were weighed at the start end of the feeding period to calculate how much weight they gained during this period. It is well known that the pregnancy rates of heifers increase as the average pre-mating weight increases (Entwistle 1983; Schatz and Hearnden 2017) and the equations described by Schatz and Hearnden (2017) that predict the pregnancy rates likely from different pre-mating weights were used to calculate the benefits of the feeding strategy in terms of extra calves produced compared to heifers which would not have gained any weight during this time.

2.2.9 Pivot irrigated improved pasture - Katherine region.

Over three years (from 2023 to 2025), a cattle property in the Katherine region measured the LWG of young cattle grazing a 50 hectare centre-pivot of established Rhodes grass. The area under the pivot is valued at $15,000/ha. The pasture is used for hay production in the wet season and then during the dry season it is used primarily for grazing by small weaners that would otherwise require feeding after weaning, and by other animals that would require an extra wet season to reach the target minimum weight for live export if they just grazed native pasture. Other classes of animals are sometimes also grazed on the pivot area depending on market opportunities. No extra fertiliser is applied for the grazing period.

The animals were weighed before and after grazing the pivot area and these weights were used to calculate average daily gain (ADG).

2.3. Economic evaluation of feeding strategies

The feeding strategies documented in the project were evaluated to assess their profitability using the actual data recorded during the project (ADG, feed intake and costs etc.) using the Breedcow Dynama software suite of programs (Holmes et al. 2017), and the methodology of Bowen and Chudleigh (2021).

Initially historical data recorded at VRRS over a number of years was evaluated to determine the classes of cattle most likely to be profitable to feed. This involved calculating the typical growth rates of different classes of cattle on native pasture in the Katherine/VRD region of the NT, and then working out which weight ranges of steers, heifers and cull cows would increase most in value if their weight was increased by 40-50 kg using a feeding strategy i.e.. which classes and weight ranges of cattle would give best “bang for buck” from feeding. This process identified that the most likely classes of animals to be profitable to feed were:

Class 1: Steers that were lighter than the recommended minimum target weight for live export (i.e.. 300 kg) by an amount of weight that would be realistic to put on during the late dry season (i.e.. 45 kg) when receiving one of the feeding strategies. This would be steers that weighed between 255-299 kg in the mid dry season after their first post-weaning wet season and are approximately 18 months old. Using VRRS data, this weight range was calculated to be typically about 38% of a year group of steers. A feeding program that enabled these steers (or cull heifers) to gain an extra 45 kg in the dry season would mean that they could be exported after several months of feeding, rather than holding them for another whole year until after they reached the target weight. According to historical VRRS data, the typical annual LWG of these animals is 110 kg. A dry season feeding strategy that increases annual LWG of the fed group by 45 kg, from 110 kg to 155 kg would result in the average weight of the whole year group of steers at a mid-dry season muster increasing from 292 kg to 309 kg, and the percentage of the mob that reaches the recommended target for live export of 300 kg increasing from 45% to 84%. Having a greater proportion of steers turned off after one post weaning wet season frees up country to be grazed by other animals and may increase production efficiency.

Class 2: Maiden heifers with a pre-mating weight (PM Wt) of <250kg. These are heifers that are approximately 18 months-old in the mid-dry season after their first post weaning wet season. Data collected at VRRS has been used to create equations that predict the pregnancy rates of maiden and first calf heifers with different average PM Wts (Schatz and Hearnden 2017). These equations show that maiden heifers with these low PM Wts have low pregnancy rates, and that increasing their average PM Wt from 230 to 270 kg should increase the pregnancy rate of this group by 17%, from 69% to 86% (Schatz and Hearnden 2017). However, this is only likely to increase the overall pregnancy rate of the year group of heifers by 4%, since only 19% of a year group are likely to be <250kg prior to mating as two year-olds.

Class 3: First calf heifers with a pre-calving weight (PC Wt) of <430kg, which from VRRS data is usually around 82% of a year group of heifers. If these first calf heifers are fed over the dry season before calving for the first time to increase their PC weight by 40 kg, then this will likely increase the average PC Wt of the whole year group from 396 kg to 429 kg and increase their re-conception rate by around 16% (Schatz and Hearnden 2017).

Class 4: Culled cows weighing between 350 kg and 400 kg. These are usually cows that are culled for age and that have had a calf weaned in the mid dry season and so are in low body condition. They usually show compensatory gain after their calves are weaned and respond rapidly to improved nutrition. However, usually they would not gain much weight until pasture

quality improves in the wet season. If they were fed to gain 50 kg over the dry season using one of the feeding strategies, in addition to the increase in LW, this could have the effect of increasing their sale price received by $0.52/kg LW. For example, using the Rum Jungle abattoir grid for cull cows (quoted on 29/9/26), if they were sold at 350 kg LW then they would receive a price of $1.97/kg LW and return a value of $690 per cow. However, if LW was to be increased by 50 kg then the sale price received would be $2.49/kg LW and such a cow would be worth $996 (i.e. its value would be increased by $306).

Some properties also currently feed weaners, however, compensatory gain over the subsequent wet season should be considered when assessing the profitability of a feeding strategy for weaners. This project (and other studies e.g. Silva et al. 2022) found that it is realistic to expect the feeding strategies documented in this study to increase LWG over the dry season by 45 kg, but that 10 kg of this LWG advantage is likely to be lost over the following wet season in comparison to animals that did not get fed. This inefficiency due to compensatory gain impacts on the profitability of feeding strategies for weaners and so the profitability of the feeding strategies was not assessed for feeding weaners in this study.

However, if a property does wish to feed weaners then the group most to be profitable to feed would be those weighing between 155 and 190 kg at weaning. This is because steers that are heavier than 200 kg at weaning and have an annual LWG of 110 kg are likely to make the recommended minimum target weight for live export (300 kg) in the following year without feeding. Whereas steers that are lighter than 190 kg at weaning and that have an annual LWG of 110 kg are unlikely to make the minimum target weight for live export in the following year without feeding. A weaner feeding program that increases annual LWG by 45 kg would only result in weaner LW being increased by 35 kg after the subsequent wet season. Feeding weaners in the 155 – 190 kg weight range would increase their annual LWG from 110 kg to 145 kg, enabling them to achieve the recommended minimum target weight for live export of 300 kg after the wet season. Although steers lighter than 155 kg will not reach the target minimum weight for live export even with feeding. While these calculations identify the weight range of weaners most likely to be profitable to feed, the strategy of feeding weaners was not used in the modelling to evaluate the profitability of the feeding strategies due to the inefficiency associated with compensatory gain when feeding weaners and not selling them until after the next wet season.

Once the most suitable classes of cattle to feed were identified, a simple gross margin (GM) calculator from the Breedcow Dynama software suite of programs (Holmes et al. 2017) was used to calculate the gross margin after interest per head or adult equivalent fed to determine if the different feeding strategies were likely to provide a positive return. This analysis included the apportioned variable costs of the equipment and machinery used in the feeding strategy and also took into account the opportunity cost of capital including livestock capital. This gives a more complete picture of the short-term profit of a feeding strategy than only taking into account direct feed, freight and labour costs. However, it is still only indicative of the actual profitability of a feeding strategy.

In this form of economic analysis animals are valued at the start and end of the feeding period to estimate the value added. For the purposes of this report a fixed price of $4.00/kg was usually used for both the “buy price” and “sell price” of the steers when assessing the feeding strategies. However, producers can use feeding strategies to provide opportunity to increase cattle sale price received ($/kg) in addition to increasing LW. An example of a feeding strategy in which the cattle sale price increased following the feeding period weight is when cull cows are fed to increase their weight and also their sale price ($/kg received). Two such feeding strategies were evaluated in this study using prices from the Rum Jungle abattoir grid for cull cows (quoted on 29/9/26).

The necessary data required for the economic evaluation calculations was collected by interview during property visits at which the feeding programs were being conducted. The details required for the GM calculator are shown in Table 49 in Appendix 1. The actual ADG and feed cost data recorded in this study were used in the evaluations, and where possible the average of the data recorded over three years was used. However, where there were years with data that was not suitable, or the property was unable to produce the necessary information, then data from those years was not used (e.g. if a different feeding strategy was used in different years).

The outputs from the GM calculator are detailed in the Results and Discussion section (Table 31) for each individual property. In addition to the feeding performance data (ADG, intake, purchase price of feed etc.), the outputs include the Total Feed Costs ($/hd/day), Cost of Gain ($/kg), Margin per animal fed ($/head) and the Break-even sale price.

Margin per animal fed is a simplistic indication of whether a strategy is likely to be profitable and is worth pursuing further, but it does not capture impacts on such things as herd structure or any flow on benefits to the business. For this purpose, a more detailed full property economic analysis was undertaken using a herd modelling approach with the Breedcow Dynama software suite of programs, Holmes et al. (2017)). This economic analysis involved examining the effects on whole farm profitability of the different feeding strategies when fed to the groups identified as being most likely to be profitable to feed (classes 1-4 above). Some feeding strategies were not evaluated in this way if their “Cost of Gain” and “Margin per head” figures showed that they were unlikely to ever be profitable. The feeding strategies that were evaluated (see Table 39 in the results section) and their key data (expected average ADG during the feeding period, and the length of feeding period required to increase LW by the desired amount) were:

1) "Weaner pellets" fed to steers in the weight range 255-299 kg and that were fed for 80 days to gain 45 kg. ADG = 0.57 kg/day, no increase in sale price per kg after feeding.

2) "Weaner pellets" fed to steers in the weight range 255-299 kg and that were fed for 80 days to gain 45 kg. day. ADG = 0.57 kg/day, with an increase in sale price of $0.40/kg after feeding.

3) "Weaner pellets" fed to maiden heifers with a PM Wt of <250 for 80 days to gain 45 kg. ADG = 0.57 kg/day, with no increase in sale price after feeding.

4) "Weaner pellets" fed to first calf heifers with a PC Wt of <430 kg that were fed for 80 days to gain 45 kg. ADG = 0.57 kg/day, with no increase in sale price after feeding.

5) Floodplain grazing 255-299 kg steers for 75 days to gain 45 kg. ADG = 0.6 kg/day. no increase in $/kg.

Desk-top analyses were undertaken for these feeding strategies to model the whole-of-herd impacts on the herd structure, productivity and profitability of a typical cattle property in the Katherine region using the Breedcow Dynama software suite of programs (Holmes et al. 2017) and using the methodology of Bowen and Chudleigh (2021). This enabled Annualised Net Present Value (NPV) to be calculated, which gives a guide on whether implementing a feeding strategy is likely to be profitable when the whole-of-herd impacts are considered. Net Present Value (NPV) provides important additional measures of economic performance by accounting for the timing of costs and benefits over the investment period. Unlike gross margins, NPV considers the value of future cashflows in today's dollars, allowing feeding and intensification strategies to be assessed against the capital invested and the opportunity cost of alternative investments.

Sensitivity analyses were conducted using the GM Calculator from the Breedcow Dynama software suite of programs (Holmes et al. 2017) to examine the effects of changing feed costs and cattle prices on the profitability of the strategies. The results of the sensitivity analyses shown in Tables 32-38 identify the cattle price at which each feeding strategy breaks even for different feed

purchase prices using the measured ADGs and intakes from this study. Importantly, these tables also provide producers with a simple quick-reference tool to identify the range of conditions under which a feeding strategy may be economically viable, without requiring them to undertake detailed calculations themselves. This is particularly valuable where feed and cattle prices change rapidly, allowing producers to quickly assess whether current conditions warrant further investigation of a feeding opportunity. They are intended as a first-pass screening tool rather than a substitute for enterprise-specific analysis, helping producers identify which opportunities warrant more detailed assessment. The sensitivity analyses are critical for interpreting the economic results and ensure that they stay relevant as costs and prices change. The results, presented in Tables 32–38, demonstrate how the economic viability of individual feeding treatments change under different market conditions.

2.4. Potential for carbon credits

An original aim of the project was to explore how the feeding strategies might be used to obtain carbon credits through reducing the lifetime emissions of the cattle fed and increasing production efficiency, which was hoped to have the potential to further improve the profitability of the feeding strategies. However, during the project the "Beef Herd Management Method" for obtaining carbon credits was discontinued (on 30/9/25 see Beef cattle herd management method (closed) | Clean Energy Regulator viewed 27/03/2026), due to integrity issues being identified in it. After industry lobbying, the federal government has prioritised the development of a new method and recently gave Meat and Livestock Australia (MLA) the remit to do this (see https://www.beefcentral.com/carbon/mla-approached-to-develop-new-beef-herd-carbonhttps://www.beefcentral.com/carbon/mla-approached-to-develop-new-beef-herd-carbon-methodology/methodology/ viewed 27/03/2026). MLA have advised that development of a new method will involve extensive industry consultation and is likely to take at least two years.

As there is currently no method to obtain carbon credits through cattle management, the decision was made to show how this could have been done under the previous system. This strategy could be adapted and used under a new system when it is introduced.

Under the previous Beef Herd Management method for obtaining carbon credits a carbon credit (representing 1t of carbon dioxide equivalent) traded for around $34 - $42. Therefore, there is potential for beef producers to obtain carbon credits in the future through management practices, such as the feeding strategies used in this project that can reduce the time taken for an animal to reach sale weight, reducing lifetime emissions, or improve pregnancy rates in heifers and cows, increasing lifetime productivity.

An example of how lifetime emissions can be reduced through a feeding strategy is shown in the results section (section 3.4). This was done using an online emissions calculator (Primary Industries Climate Challenges Centre 2026). The example shows a representation of a steer from birth to the recommended minimum target weight for live export (300kg) under three different scenarios in which the feeding strategy used at VRRS (Ridley Northern Weaner pellets) was implemented in either Year 1, Year 2, or not at all. Data collected at VRRS over many years was used for the growth path figures (weights at different ages). The calculated CO_2 emissions produced by the steer were then compared to assess the benefits from reduced emissions.

2.5. Virtual Fencing trials and demonstrations

In 2025, two additional activities were incorporated into the project through a contract variation. One of these activities investigated the application of virtual fencing (VF) technology as a tool for managing grazing behaviour and improving livestock productivity on northern Australian cattle properties.

Virtual fencing systems may offer ways to manage cattle across the landscape on a large scale in extensive environments, thus making the animals more productive by remotely moving them to and keeping them in desirable areas. This activity explored the potential of VF systems to increase production and facilitate more even grazing, allowing better utilisation of forage available, excluding animals from areas that are in poor condition, grazing animals in areas for better weight gain and spelling pastures for re-growth and better productivity.

Three demonstration sites were established to evaluate the application of VF under different commercial grazing scenarios. Each site addressed a distinct management objective aimed at assessing whether VF could modify grazing behaviour in ways that improved animal performance, land condition, or overall productivity. Brief descriptions of the methodology at each demonstration site are provided below, with more details provided in the results section.

At each site, animals were trained to interact with the virtual fencing system according to the manufacturer's recommended training protocol. Animals were initially confined to small training paddocks to increase opportunities for repeated interactions with the virtual boundary and accelerate the learning process.

When approaching the virtual boundary, animals first received a five-second audio cue. If they continued moving towards the boundary after the audio warning, a brief electrical pulse was delivered. Animals rapidly learned to associate the audio cue with the boundary and modified their behaviour accordingly. Training was considered complete once the mob achieved an audio ratio of at least 80%, indicating that, in 80% of boundary interactions, animals responded appropriately to the audio cue without progressing to receive an electrical stimulus. Training duration varied among sites depending on the rate at which individual animals achieved the required learning threshold.

The VF system utilised Gallagher eShepherd neckbands that communicated with solar-powered, Starlink-enabled base stations strategically positioned across each trial site. Base station number and locations were selected in consultation with Gallagher Pty Ltd to maximise communication coverage and line-of-sight connectivity. Communication between neckbands and base stations occurred via LoRa (Long Range) wireless technology. Once a virtual paddock or boundary was activated through the web-based management platform, updated boundary information was transmitted to neckbands between10 minutes to several hours, depending on animal location, base station connectivity, and network coverage.

Site 1 – Manbulloo Station

The objective of the Manbulloo Station demonstration was to determine whether VF could encourage animals to utilise a newly established watering point while excluding access to an existing water source that had become habitually overgrazed. Redirecting grazing pressure towards previously underutilised areas was expected to promote more uniform pasture utilisation, allow vegetation recovery around the original water point, improve land condition, and enhance the animals' performance through access to higher quality forage.

One hundred non-lactating cows grazing a 2,200-hectare paddock at Manbulloo Station near Katherine, Northern Territory, were fitted with Gallagher eShepherd neckbands. Animals were trained for six days within a temporary 5 ha paddock comprising three sides of conventional fencing and one electric fence boundary. Following successful training, animals were walked

approximately 3.3 km to the newly constructed water point using horses and a buggy. After holding animals for 30 minutes at the new water, animals were released within a virtual paddock extending between 1.5 and 4.6 km from the new water source. The virtual boundary remained active for four weeks.

Following completion of the exclusion period, VF neckbands were removed and replaced with Smart Paddock GPS tracking collars to monitor subsequent movement patterns and determine whether animals continued to preferentially utilise the new water point after the virtual fence had been deactivated. Visits to each watering point were quantified using a 200 m buffer, with distances calculated in R using the distHaversine function from the geosphere package (Hijmans, 2024). This post trial monitoring provided insight into the persistence of learned watering behaviour and assessed the potential for temporary VF deployment as a practical management strategy for establishing new watering points in commercial grazing systems.

Site 2 – Kidman Springs Research Station

The objective at this site was to evaluate the effectiveness of VF for excluding animals from a severely degraded scald area while allowing continued grazing of the surrounding paddock.

The study was conducted within the 9.2 km² 'Gutta Percha' paddock at Kidman Springs Research Station in the Victoria River District, approximately 220 km southwest of Katherine. The paddock had previously been destocked due to the presence of an extensive scald area. Previous research demonstrated that animals consistently spent time on the scald, preventing vegetation recovery and contributing to ongoing decline in land condition.

Virtual fencing was implemented to protect the scalded area while maintaining grazing access to the remainder of the paddock. This approach aimed to increase the effective grazing area available for livestock while minimising the impact to the scalded area. The findings also have broader implications for excluding livestock from fragile landscapes, and other locations requiring targeted exclusion without the need for constructing physical fences.

Forty-five Brahman cows were fitted with Gallagher eShepherd neckbands during the first-round muster in May 2025. Animals underwent a 7–10 day training period within a 16 hectare airstrip paddock until the mob achieved an audio ratio of at least 80%. Following training, animals were released into the trial paddock where a virtual exclusion boundary had been established around the scald. Data collected by the neckbands were analysed to quantify exclusion effectiveness, animal interactions with the virtual boundary, and the frequency of individual breakthrough events.

Site 3 – Larrakeyah Station

The Larrakeyah Station demonstration investigated the feasibility of using VF to implement strip grazing within a centre-pivot irrigated pasture without the need for temporary electric fencing.

Strip grazing was expected to improve pasture utilisation by restricting animals access to smaller grazing areas, reducing selective grazing, minimising trampling losses, and allowing previously grazed areas sufficient time to recover before re-grazing. Concentrating animals within defined grazing strips was also anticipated to improve forage utilisation, live weight gain and pasture productivity.

One hundred Brahman heifers were fitted with Gallagher eShepherd neckbands between August and December 2025 and trained within a 27 hectare paddock until the majority of animals achieved an audio ratio of at least 80%. Following training, animals were transferred to a larger holding paddock using VF while preparations for the strip grazing demonstration were completed.

The strip grazing trial commenced on 24 April 2026 and concluded on 15 May 2026. The centre pivot was divided into a series of approximately 100 m wide virtual grazing strips arranged perpendicular to the pivot, with each strip incorporating a virtual laneway providing continuous access to the watering point. Animals remained within each strip until available forage had been utilised, with progression to the next strip determined through consultation with the property manager. Previously grazed strips were subsequently back fenced using VF to prevent re-entry, allowing pasture recovery while directing animals onto fresh forage. New grazing strips were generally activated every two days, although timing varied according to pasture availability.

2.6. Evaluation of supplementation with Allicin (garlic) and Sulphur lick blocks to reduce the impact of buffalo flies and incidence of skin lesions.

Experiments were conducted from September 2025 to April 2026 (i.e. the 2025-2026 wet season) at two locations.

1. Douglas Daly Research Farm (DDRF) in 4 similar Buffel pasture paddocks using DAF Selected Brahman and Composite heifers.

2. The other location was Beatrice Hill Research Farm (BHF) on the Adelaide River floodplain using DAF Commercial Brahman steers.

The rainfall during the trial periods is shown in Table 50 for DDRF and Table 51 for BHF in Appendix 2. Each location had two control and two treatment groups of young cattle that grazed in separate but similar paddocks. All the paddocks were provided with the same mineral supplement blocks that were appropriate for the time of year (i.e.. Olssons NT Uraphos + 40% urea blocks in the dry season and Olssons Superphos12 blocks in the wet season). The dry season blocks were fed at DDRF from 25/09/2025 to 17/11/2025 and at BHF from 25/09/2025 to 13/10/2025. The wet season blocks were fed at DDRF from 25/09/2025 to 22/04/2026, and at BHF from 13/10/2025 to 22/04/2026. In addition, the + Fly treatment paddocks were given Olsson's Allicin + Sulphur lick blocks for the duration of the trial. Details of the supplement block compositions are shown in Appendix 2. The blocks were weighed regularly throughout the trial to calculate intake.

Cattle were randomly allocated to groups, stratified by liveweight and a baseline lesion score (see below). These groups grazed in similar neighbouring paddocks of improved buffel grass pasture at the same stocking rates. There were 53 heifers in each group at DDRF and 25 in each group at BHF. At the beginning and end of the experiment, animals were weighed and scored for lesions using a lesion scoring system which was developed for this trial (see Table 55 in Appendix 2) which involved visually assessing the near side of animals in the race. The number of lesions (if any) and their size was estimated and then multiplied to create a total lesion area on the animal. The number of lesions in different regions of on one side of the body was also assessed.

Visual fly counts were conducted monthly. Each month the number of flies was estimated on the same 15 animals in each treatment group (identified with large brightly coloured ear tags. The number of flies were estimated on one side of an animal and multiplied by two to give a total fly count for each animal. The assessments were conducted in the paddock that the animals were grazing in and were conducted at approximately the same time of day each time. The assessors were experienced in the fly counting process.

At the beginning, a mid-point and at the end of the experiment, all animals were weighed, and body condition score and skin lesion score were recorded. All the weights were recorded after a 12-hour curfew, and treatment groups were processed through the yards in the same order each time.

Statistical Analysis

All data recorded were analysed for the treatment (treated (+fly control) and control (-fly control)) effects and their interaction over time.

Average daily gain (ADG) was analysed using a generalized linear model with treatment and initial liveweight fitted as fixed effects. Pairwise comparisons were performed using estimated marginal means (emmeans), with compact letter displays (CLD) used to identify significant differences among groups.

Liveweight and total lesion area were analysed using linear mixed-effects models with treatment, time, and their interaction included as fixed effects, and individual animal included as a random effect to account for repeated measurements. Model effects were assessed using Type III ANOVA, followed by estimated marginal means and CLD comparisons. For DDRF total lesion area, a log transformation was applied in the model to account for positive skewness in the data.

The number of body regions affected was analysed using a Poisson generalized linear model. Individual animal was initially included as a random effect; however, because the estimated variance was effectively zero, it was removed from the final model.

Fly counts were analysed using a negative binomial generalized linear mixed model (glmmTMB) to account for overdispersion. Treatment, time, and their interaction were fitted as fixed effects, with individual animal included as a random effect to account for repeated measurements.

3. Results and Discussion

Results from each of the sites are presented here separately. They were then summarised and these summaries were used in the economic evaluations of the feeding strategies. Photos from different sites are shown in Appendix 3.

3.1 Results from feeding trials on research stations

3.1.1 Victoria River Research Station (VRRS) pellet feeding trials.

In 2024 and 2025 Ridley Rumevite® Northern Weaner Pellets (details in Table 1 below) were fed and in 2023 a custom pellet was fed. The company does not want to divulge the contents of the pellets used in 2023 but stated that they were similar to the northern weaner pellets except that soybean meal was substituted for canola meal which increased the crude protein levels. As the pellets used in 2023 are not commercially available and the exact contents are unknown, the data from the 2023 feeding trial was not used in the summary of data used in the economic evaluation and production of the grids (only data from the 2024 and 2025 feeding trials were used for these purposes).

Table 1. Analysis (as fed) of the Weaner Pellets used in trials in 2024 and 2025.

Total Crude Protein and Equivalent Crude Protein (minimum)	32%
Crude Protein (minimum)	30.5%
Equivalent Crude Protein (minimum)	1.5%
Urea (max)	0.5%
Salt (maximum)	1%
Calcium (minimum)	1%
Phosphorus (minimum)	1%
Fluorine (maximum)	0.1%
Crude Fat (minimum)	3%
Crude Fibre (maximum)	10.0%
Sulphur (minimum)	0.2%
Copper (added)	50mg/kg
Cobalt (added)	4.5mg/kg
Iodine (added)	0.45mg/kg
Zinc (added)	100mg/kg
Selenium (added)	0.5mg/kg
Monensin (as Rumensin)	60mg/kg

The paddocks used in this study were the same each year, but were not the same size (PELLETS = 4.75 km^2, CONTROL = 7.69 km^2) so extra steers were added to the groups to ensure that the stocking rates in the paddocks were similar and matched the assessed carrying capacity of the paddocks as assessed by DAF Rangelands scientists in July. However, only the data from the weaner heifers in each group was used in the comparison of treatments as there were insufficient steers in the PELLETS group to allow statistical comparisons (i.e. the steers were “dummy grazers”). The number of animals in the paddocks and the number whose data contributed to the analyses each year is shown in the tables below.

In each year the cattle used for the feeding trials were weaners that had been weaned from cows in various paddocks on VRRS at the first mustering round in May. They were kept in one mob for education and training before branding, and were then allocated randomly to the treatment groups (stratified by LW) and taken to their separate paddocks, with pellet feeding commencing in early September and continuing until the first sizeable (50 mm) rains of the wet season were recorded.

2023

The feeding trial at VRRS in 2023 aimed to document the effects on LWG during the dry season of feeding custom soybean meal based Ridley weaner pellets to weaners grazing native pasture. The performance of the group fed pellets (PELLETS) was compared to a group that grazed in a similar paddock but did not receive pellets (CONTROL). The pellets were fed three times a week in troughs in the paddock at a rate of 0.6% of liveweight, and the average pellet intake over the feeding period was 1.27 kg/head/day.

The weaners were weighed on 5/6/23 before they were branded and this weight was used to randomly allocate them to treatments (stratified by weight) to give two groups with similar average weights. They were then put into their respective paddocks and grazed there until they were mustered and weighed on 6/9/23. They were returned to their paddocks on the same day and the pellet feeding to the PELLETS group commenced. More than fifty mm of rain fell in early December and so both groups were mustered and weighed on 12/12/23 and pellet feeding ceased. The LW data recorded was used to calculate weight gain and ADG over the feeding period and ADG (Table 2). The groups remained in their paddocks over the wet season and were then weighed on 21/5/24 after the wet season had finished, to see if there had been any compensatory gain in the CONTROL group. The LWG data is summarised in Table 2 below.

Table 2. Weight gain data from the two treatments in the 2023 feeding trial – VRRS.

Treatment	Total number in paddock	Number in analyses (just heifers)	Avg. weight 6/9/23	Avg. weight 12/12/23	Feeding period Avg weight gain (kg)	Av ADG (kg/day)	Avg. weight 21/5/24
PELLETS	60	38	188.0	240.0	52.3	0.539	343.2
CONTROL	105	49	186.3	196.4	10.6	0.110	287.0
Difference			1.7	43.6	41.7	0.429	56.3

The average ADG of the PELLETS group during the 97-day feeding period in 2023 was 0.539 kg/day (range = 0.376 – 0.804 kg/day). The PELLETS group gained 44 kg more LW than the CONTROL group, and their average ADG was 0.43 kg/day higher during this time. There was no compensatory gain over the subsequent wet season, but rather the average LWG of the PELLETS group was 12.6 kg more the CONTROL group. Overall by May, after the post-weaning wet season, the PELLETS group had gained 56 kg more than the CONTROL group.

2024

The feeding trial at VRRS in 2024 was similar to that in 2023 except that Ridley Rumevite® Northern Weaner Pellets were fed. The performance of a group of weaner heifers fed pellets (PELLETS) was compared to a group that grazed in a similar paddock but did not receive pellets (CONTROL). The pellets were fed three times a week in troughs in the paddock at a rate of 0.9% of liveweight, and the average pellet intake over the feeding period was 1.97 kg/head/day.

The weaners used in the trial were weighed on 19/6/24 before they were branded and this weight was used to randomly allocate them to treatments (stratified by weight) to give two groups with similar average weights. They were then put into their respective paddocks and grazed there until they were mustered and weighed on 3/9/24. They were returned to their paddocks on the same day and the pellet feeding to the PELLETS group commenced. The pellet feeding continued until

the first sizeable (50 mm) rains of the wet season were recorded. In 2024 this occurred in late November and both groups were mustered and weighed again on 27/11/24 and pellet feeding ceased – a total of 85 days. The LW data recorded was used to calculate weight gain and ADG over the feeding period (Table 3). The groups remained in their paddocks over the wet season and were then weighed on 11/5/25 after the wet season had finished to see if there had been any compensatory gain in the CONTROL group. The LWG data is summarised in Table 3 below.

Table 3 Weight gain data from the two treatments in the 2024 feeding trial – VRRS.

Treatment	Total number in paddock	Number in analyses (just heifers)	Avg. weight 3/9/24	Avg. weight 27/11/24	Feeding period Avg weight gain (kg)	Av ADG (kg/day)	Avg. weight 11/5/25
PELLETS	60	51	188.5	249.6	61.0	0.718	340.4
CONTROL	105	67	184.3	214.2	29.9	0.352	318.1
Difference			4.2	35.4	31.1	0.366	22.3

Significant rain fell over the 2024 dry season (September 100.4mm, October 27.6mm and November 84.5mm) resulting in both treatments gaining considerably more weight than usual over the dry season. The CONTROL treatment gained 30 kg at 0.352 kg/day over the 85 day feeding period. The average ADG of the PELLETS group during the 85 day feeding period in 2024 was 0.718 kg/day (range = 0.553 – 0.965 kg/day). The PELLETS group gained 31 kg more LW than the CONTROL group, and their average ADG was 0.366 kg/day higher during this time.

There appeared to be some compensatory gain in the 2024-year group when the PELLETS group gained 13 kg less than the CONTROL group over the wet season. However, this result may be confounded by pasture type, as the 2024-year group grazed fresh pasture that had re-grown after a fire in the late wet season.

2025

The feeding trial at VRRS in 2025 was similar to the one in 2024, and Ridley Rumevite® Northern Weaner Pellets were used again. The performance of a group of weaner heifers fed pellets (PELLETS) was compared to a group that grazed in a similar paddock but did not receive pellets (CONTROL). The pellets were fed three times a week in troughs in the paddock at a rate of 0.9% of liveweight per day, and the average pellet intake over the feeding period was 1.76 kg/head/day.

Weaners were weighed on 1/7/25 before they were branded and this weight was used to randomly allocate them to treatments (stratified by weight) to give two groups with similar average weights. They were then put into their respective paddocks and grazed there until they were mustered and weighed on 2/9/24. They were returned to their paddocks on the same day and the pellet feeding to the PELLETS group commenced. The pellet feeding continued until the first sizeable (50 mm) rains of the wet season were recorded. In 2025 this occurred in late November and both groups were mustered and weighed again on 26/11/25 and pellet feeding ceased – a total of 85 days. The LW data recorded was used to calculate weight gain and ADG over the feeding period and ADG (Table 4). The groups remained in their paddocks over the wet season and were then weighed on 11/5/25 after the wet season had finished, to see if there had been any compensatory gain in the CONTROL group. The LWG data is summarised in Table 4 below.

Table 4. Weight gain data from the two treatments in the 2025 feeding trial – VRRS.

Treatment	Total number in paddock	Number in analyses (just heifers)	Avg. weight 2/9/25	Avg. weight 26/11/25	Feeding period Avg weight gain (kg)	Av ADG (kg/day)	Avg. weight 21/5/25
PELLETS	60	60	170.6	208.0	37.4	0.413	281.6
CONTROL	105	75	170.9	171.0	0.02	0.000	265.2
Difference			*-0.3*	*37.0*	*37.2*	*0.413*	*16.5*

Some rainfall occurred during the 2025 dry season (October 21.2mm and November 51.6mm), however the CONTROL group did not gain any weight during the 85 day feeding period. The PELLETS group gained 37 kg more LW than the CONTROL group, and their average ADG was 0.413 kg/day (range 0.106-0.700 kg/day) higher during this time.

There appeared to be some compensatory gain in the 2025 year group when the PELLETS group gained 20 kg less than the CONTROL group over the wet season. The implications of this on the profitability of the feeding strategy are discussed in the following section.

Summary of data to use in economic evaluations of the feeding strategy

It should be noted that the weaner pellets were not designed for the purpose in which they were used in this study, but rather for short term feeding to weaners. Summarising the data from the feeding trials at VRRS in 2024 and 2025 found that this resulted in an average ADG of 0.566 kg/day during the feeding period which would result in LW increasing by 45 kg over 80 days. Steers are likely to have 9% higher LWG than heifers (Zinn et al. 2008). If cattle are fed during the first dry season after weaning and then held until the following year for sale then it is likely that some of the benefits from feeding will be lost through compensatory gain by the animals that are not fed. Compensatory gain in this study ranged from -12.6 to 20 kg with an average of 7 kg. However, the -12.6 figure in the first year is unusual as some compensatory gain would usually be expected. For example, in a study at VRRS, Silva et al. (2020) found that approximately 53% of the difference in LW achieved by feeding supplements to heifers during the dry season after weaning was compensated in the subsequent wet season (data from one year group). Therefore, for the purposes of economic evaluation we have assumed that the increase in LWG in animals fed pellets in the first dry season after weaning will be reduced by 15 kg if they are held for another wet season before sale.

Although the data produced in this study was from weaners, it is considered that the weight gains would be similar if the pellets were fed to steers that were a year older. This is supported by the data recorded at Hodgson Downs where the pellets were fed to 18 month-old heifers and steers and similar rates of LWG were recorded. The feeding trials at Hodgson Downs (section 3.2.8) were carried out on 18-24 month-old animals and the average ADG from three years of feeding trials was 0.565 kg/day. So the rates of LWG were similar when the pellets were fed to 1 year-old animals at VRRS (0.566 kg/day) and 2 year-old animals at Hodgson Downs (0.565 kg/day).

It is acknowledged that some properties may choose to feed weaners, and when this is the case compensatory gain should be considered when evaluating the benefits of the strategy. However, to avoid the inefficiency associated with compensatory gain, the feeding strategy to be evaluated

from this research is feeding Ridley Rumevite® Northern Weaner Pellets at a rate of 0.9% of LW to steers grazing native pasture for 80 days during the dry season to gain an extra 45 kg at an average ADG of 0.566 kg/day. The most profitable group to feed is likely to be steers that did not quite make the recommended minimum target weight for live export (300 kg). If steers weighing 255-299 kg were fed the pellets for 80 days their LW is likely to increase by 45 kg (at 0.565 kg/day), and these animals would then make the minimum weight for live export and could be sold at the end of the feeding period rather than holding them on the property for another wet season. Similarly, such a feeding program would increase the pre-mating weights of 2 year-old maiden heifers by 45 kg, and the equations of Schatz and Hearnden (2017) can be used to estimate the increases in pregnancy rate from different premating weights. For example, increasing the pre-mating weight of Brahman maiden heifers with an average pre-mating weight of 220 kg by 45 kg to 265 kg is likely to increase their pregnancy rate from 63% to 84% (by 21%). The full economic impacts of these strategies are assessed in section 3.3.

3.1.2 Katherine Research Station (KRS) pellet feeding trials.

Feeding trials were conducted at KRS in the dry seasons of 2023, 2024 and 2025 in a similar way to the trials at VRRS except that shipper pellets from Northern Feed Company (NFC), produced in Katherine, were used. The pellet ingredients were: Cavalcade hay, Rhodes hay, corn, sorghum, soymeal, molasses, and ruminant premix. A typical nutritional analysis of the pellets is detailed below in Table 5. In 2023 pellets were fed at a rate of 1.2% body weight, but following manufacturer advice this was increased to 2.5% bodyweight in 2024 and 2025.

Table 5. Analysis (as fed) of the Shipper Pellets used in 2023- 2025.

Ingredient	Amount
Protein	18%
Energy	10.5-11.5 ME/kg
Starch	8-35%
Urea	0.4%

2023

The feeding trial at KRS in 2023 aimed to document the effects on LWG during dry the dry season of feeding NFC shipper pellets to weaners grazing native pastures in paddocks at KRS. The performance of the group fed pellets (PELLETS) was compared to a group that grazed in a similar paddock but did not receive pellets (CONTROL). The pellets were fed daily Monday-Friday, with Saturday and Sunday feed supplied on the Friday, and were fed at a rate of 1.2% of bodyweight. The average pellet intake over the feeding period was 2.16 kg/head/day.

The paddocks that the treatments grazed in were not the same size (PELLETS= 0.87 km^2, CONTROL = 0.97 km^2), despite the slight difference in paddock size the stocking rate per km^2 was the same in each paddock. The number of animals in each paddock is shown in Table 6.

Weaner heifers that had been weaned at the first round mustering in April 2023 from nearby NT Government leased paddocks on Manbulloo Station were used in the trial. They were kept as one

mob from weaning until 14/09/23 when they were split into the two groups for the trial and moved to separate paddocks. Group allocation was done by stratified randomisation based on weight prior to branding in June to give both groups the same average starting weight. Pellet feeding commenced on 14/09/23 following the drafting of the two treatment groups. Both groups remained in their respective paddocks and were reweighed on 13/12/23 when pellet feeding finished after 90 days. There were 11 extra animals in the PELLETS group (to ensure that the stocking rates in the paddocks were similar) whose data was included in calculations of feed intake (n=60), but their liveweight gain data was not assessed as they had a different history and could not be considered similar animals. Similarly, there were 10 extra animals in the CONTROL group to keep the stocking rates even, but their liveweight data was also not assessed. The groups remained on KRS and grazed together in one mob until 16/07/24 when they were re-weighed and a wet season LWG was calculated. The LWG data is summarised in Table 6.

Table 6. Weight gain data from the two treatments in the 90 day feeding trial at KRS in 2023.

Treatment	Total number in paddock	Number in group	Avg. Wt. (kg) 14/09/23	Avg. Wt. (kg) 13/12/23	Avg. LWG (kg) (± SD)	Avg. ADG (kg/day)	Avg. Wt. 16/07/24 (kg)
PELLETS	60	49	179.3	206.8	27.5 ± 8.6	0.306	282.2
CONTROL	59	49	176.2	176.3	0.1 or ± 5.6	0.001	271.2
Difference			*3.1*	*30.6*	*27.4*	*0.305*	*11.2*

The CONTROL group only gained an average of 0.1 kg during the feeding period while the PELLETS group gained 27.5 kg. The average ADG of the PELLETS group during the feeding period was 0.306 kg/day (range = 0.098 – 0.5 kg/day). The PELLETS group gained 27.4 kg more LW than the CONTROL group during the feeding period, and the ADG was 0.305 kg/day higher.

There appeared to be some compensatory gain in the CONTROL group, with the PELLET animals gaining 19.5kg less than the CONTROL group over the wet season (CONTROL = 94.9 kg, ex-PELLET = 75.4 kg).

2024

The feeding trial at KRS in 2024 was very similar to in 2023, except pellets were fed at a higher a rate (1.2% in 2023 vs 2.5% in 2024). The performance of the group fed pellets (PELLETS) was compared to a group that grazed in a similar paddock but did not receive pellets (CONTROL). The pellets were fed daily Monday-Friday, with Saturday and Sunday feed supplied on the Friday. The pellets were fed at a rate of 2.5% of bodyweight and the average pellet intake over the feeding period was 5.01 kg/head/day.

The paddocks used in 2024 were the same ones used in 2023, and to account for the slight difference in paddock size, some extra animals (that were not included in the analysis) grazed with the CONTROL group to ensure that the stocking rate was the same in both paddocks.

Weaner heifers that had been weaned at the first-round mustering in April 2023 from nearby leased paddocks on Manbulloo Station were used in the trial. They were kept as one mob from weaning until 02/08/24 when they were split into the two trial paddocks. Group allocation was done by stratified randomisation based on weight prior to branding in June to give both groups similar average weight. Pellet feeding commenced on 02/09/24 following the drafting of the two treatment

groups and concluded on 25/11/24 due to heavy rainfall. Both groups remained in their respective paddocks and were reweighed on 28/11/24. Heifers were not retained at KRS after feeding in 2024, so no wet season LWG could be measured. The LWG data is summarised in Table 7.

Table 7. Weight gain data from the two treatments in the 84-day feeding trial at KRS in 2024.

Treatment	Number of head	Avg. weight (kg) 14/09/23	Avg. weight (kg) 28/11/24	Feeding period Avg. weight gain (kg) (± SD)	Avg. ADG (kg/day)
PELLETS	45	180.4	219.9	40.4 ± 7.1	0.449
CONTROL	45	176.7	167.2	-9.3 ± 7.5	-0.104
Difference		*3.7*	*52.7*	*49.7*	*0.553*

The CONTROL group lost 9.3 kg during the feeding period while the PELLETS group gained 40.4 kg and so the LWG of the PELLETS group was 49.7kg more than the CONTROL group. The average ADG of the PELLETS group during the feeding period was 0.449 kg/day (range = 0.239 – 0.589 kg/day) which was 0.553 kg/day higher than the CONTROL group.

2025

The feeding trial at KRS in 2025 was very similar to in 2024. The performance of the group fed pellets (PELLETS) was compared to a group that grazed in a similar paddock but did not receive pellets (CONTROL). The pellets were fed daily Monday-Friday, with Saturday and Sunday feed supplied on the Friday, and were fed at a rate of 2.5% of LW. The average pellet intake over the feeding period was 5.3 kg/head/day.

The same paddocks were used again in 2025, and again some extra animals (that were not included in the analysis) grazed with the CONTROL group to ensure that the stocking rate was the same in both paddocks.

Weaner heifers that had been weaned at the first-round mustering in April 2023 from nearby NT Government leased paddocks on Manbulloo Station were used in the trial. They were kept as one mob from weaning until 03/09/25 when they were split into the two trial paddocks. Group allocation was done by stratified randomisation based on weight to give both groups the same average weight. Pellet feeding commenced on 03/09/25 following the drafting of the two treatment groups and concluded on 03/12/25 when cattle were reweighed. Heifers were retained at KRS after the feeding period in 2025 until 30 March 2026 when they were reweighed. The LWG data is summarised in Table 8.

Table 8. Weight gain data from the two treatments in the 90 day feeding trial at KRS in 2025.

Treatment	Number of head	Avg. weight (kg) 14/09/23	Avg. weight (kg) 28/11/24	Feeding period Avg. weight gain (kg) (± SD)	Avg. ADG (kg/day)	Avg. weight 30/03/2026
PELLETS	41	158.2	236.9	78.7 ± 10.7	0.86	265.2
CONTROL	40	158.5	188.1	29.6 ± 4.9	0.33	238.3
Difference		*-0.3*	*48.8*	*49.1*	*0.54*	*26.9*

There was considerable late dry season rain during 2025 (September 3mm, October 58.2mm and November 78.6mm) which may have contributed to higher dry season weight gains recorded compared to previous years. The CONTROL group gained 29.6 kg during the feeding period which is an unusually high WLG over a dry season at KRS. However, the PELLETS group gained 49.1kg more LW than the CONTROL group during the feeding period, and their ADG was 0.539kg/day higher. The average ADG of the PELLETS group during the feeding period was 0.865 kg/day (range = 0.456 – 1.09 kg/day).

There was some compensatory gain over the 2025-26 wet season, with the CONTROL animals having greater wet season LWG than the PELLET heifers (PELLETS = 28.3 kg, CONTROL = 50.2 kg). The small amounts of weight gained over the 2025/26 wet season are probably explained by the final weight being recorded in March and not later in the year, and that KRS experienced quite a bit of flooding during this time. At the time of the recording of the final weight on 30/3/26 the average weight of the PELLETS group was 27 kg heavier than the CONTROL group.

Summary of data to use in economic evaluations of the feeding strategy

The feeding strategy to be evaluated from this research is feeding NFC shipper pellets to heifers grazing native pasture for 90 days during the dry season at a rate of 2.5% of LW. It should be noted that the shipper pellets were not designed for this purpose, but their intended purpose is for feeding to cattle in the live export supply chain. Summarising the data from the feeding trials at KRS in 2024 and 2025 (data from 2023 was not included as the pellets were fed at a lower rate) found that this resulted in an average ADG of 0.657 kg/day for heifers during the feeding period which would result in LW increasing by 48 kg over 90 days. Steers are likely to have 9% higher LWG than heifers (Zinn et al. 2008). If cattle are fed during the first dry season after weaning and then held until the following year for sale then it is likely that some of the benefits from feeding will be lost through compensatory gain. Compensatory gain in this study averaged 20kg.

3.2. Results from feeding trials on commercial properties

The results from the feeding trials on commercial properties are presented separately in sections 3.2.1 to 3.2.9.

3.2.1 Short term feeding followed by floodplain grazing – Top End

The results from the three years of data collection are summarised below.

2023

In the dry season of 2023, weaners from AACo properties in the VRD were trucked to LaBelle shortly after weaning where they were weighed on arrival and drafted into groups. Those weighing 140-180 kg were put in House West paddock (a 750ha paddock of predominantly Tully grass) for feeding with pellets and loose mix supplement for 1-3 months before being moved to a floodplain paddock for grazing during the dry season.

Groups of weaners arrived on numerous different dates and stayed in House West paddock for varying amounts of time, so the data was sorted into groups that had experienced the similar conditions for analyses. In 2023 feeding in House West began on 11/5/23 and the cattle were

mustered and weighed on 28th and 29th of August before being moved to the floodplain paddock (South Nelly) on 28/8/23. Cattle were mustered from the floodplain in groups and weighed as they came off on the following dates; 15, 16, 17, 18, 22, 29, 30 of November 2023; 1, 7, 8, 9, 11, 12 of December 2023 and the 2, 3, 6 of February 2024.

The weaners in House West paddock were fed Milne Early Weaner Pellets in 1000 kg bags and Red Range 150+ Loose mix supplement in 500 kg bags. The bags were placed on the ground and the tops cut off so animals had ad libitum access to both feeds. The details of the feeds are shown in Tables 9 and 10 below.

The nutritional content of the pellets is shown in Table 9. They are made from lupins, barley, wheat, cereal by-products, canola meal, lime-sand, mono-calcium phosphate, salt, vitamin/trace mineral premix, lasalocid sodium. The nutritional content of the Red Range supplement is shown in Table 10.

Table 9. Milne Early Weaner Pellets nutrient analysis.

Nutrients	Content - Dry matter basis
Crude Protein (min)	21.00%
Metabolisable Energy (est)	13.0 MJ/kg
Crude Fibre (max)	10.0%
Calcium (min)	1.1%
Phosphorus (min)	0.4%
Lasolocid acid	60ppm

Table 10. Red Range 150+ supplement nutrient analysis.

Nutrients	Content - Dry matter basis
Crude Protein	13.24%
Urea equivalent	8.34%
Total Crude Protein	37.18%
Metabolisable Energy (mj ME/kg)	8.07
Calcium	5.83%
Phosphorus (min)	2.28%
Sodium	3.09%
Sulphur	1.14%
Monensin	0.04%

It is not possible to calculate accurate feed intake data as residues were not recorded and animals came and left the paddock frequently. Assumptions and best guesses were used to calculate estimated intake of the feeds were used, for example; the number of animals in the paddock was assumed to be the average of the starting and finishing number of animals in the paddock during the period. From this, weaner pellets were estimated to have been consumed at an average rate of 0.62 kg/head/day by 669 animals in the paddock and the 150+ weaner lick was also consumed at an average rate of 0.25 kg/head/day. The cost of the feeds was $1.08 for the Milne pellets and $1.50 for the loose mix supplement. Using the estimated relative intakes of each supplement and their costs, it was calculated that the average cost per kg of the supplement consumed was $1.20/kg and that average total intake of these two supplements was 0.871 kg/day. So, on average the cost of the feed (both the pellets and the loose mix was $1.05/day).

The ADGs of animals in both their time being fed in House West paddock and while grazing on the floodplain are shown in Table 11. The data is grouped based on the month of arrival. Average ADG while being fed in House West paddock ranged from -0.063 kg/day for weaners that arrived in August and had an average of 12 days on feed, to 0.346 kg/day for weaners that arrived in May and had an average of 105 days on feed. Mean ADGs while grazing on the floodplain ranged from 0.379 to 0.407 kg/day and there did not seem to be a consistent effect of time spent grazing on the floodplain.

Table 11. Summary of liveweight gain performance grouped by month of arrival – pellet feeding and floodplain grazing 2023.

ADGs are presented for the periods while on feed in House West and while grazing on the flood plain (FP)

Arrival month	N	Avg 1st Wt (kg)	2nd Wt date	Avg 2nd Wt (kg)	Avg days fed	Avg ADG (kg/day)	Avg Days on FP	Avg FP ADG (kg/day)	No. in FP ADG
May	377	167.0	28/08/2023	203.3	105	0.346	107	0.386	350
Jun	257	168.8	28/08/2023	178.5	71	0.136	109	0.399	240
Jul	333	166.6	28/08/2023	167.5	39	0.013	108	0.379	309
Aug	29	168.4	28/08/2023	167.7	12	-0.063	106	0.407	26
All	996	167.4	28/08/2023	183.9	72	0.169	108	0.388	925

For the economic evaluation of the feeding strategy, the only data that was used was from steers that were fed in House West paddock for 30-90 days and then grazed on the floodplain for 60-130 days. The average ADG of these animals over those time periods was 0.319 kg/day. The average feeding times for these animals were 43 days in House West and then floodplain grazing for 68 days, and so the average amount of weight put on over these 112 days at 0.319 kg/day was 35.7 kg.

2024

In the dry season of 2024, weaners from AACo properties in the VRD were trucked to LaBelle shortly after weaning, where they were weighed on arrival and drafted into groups. Those weighing

150-270 kg were put in House West paddock (a 750ha paddock of predominantly Tully grass) for feeding with the same Milne pellets and loose mix supplement for 1-3 months (the average number of days on feed is shown in table 12 below) before being moved to a floodplain paddock for grazing during the dry season. The method of feeding in House West Paddock was the same as in the previous year.

Groups of weaners arrived on numerous different dates between 07/05/24 to 10/08/24 and stayed in House West paddock for varying amounts of time, so the data was sorted into groups that had experienced the similar conditions for analyses. In 2024 feeding in House West began on 7/5/24 and groups of cattle were mustered and weighed before being moved to the floodplain paddocks on 8/08/2024,12/09/2024 and 26/09/2024. Cattle were mustered from the floodplain in groups on various dates and weighed as they came off the floodplain.

The ADGs of animals in both their time being fed in House West paddock, while grazing on the floodplain, and over both these periods combined are shown in Table 12. The data is grouped based on the amount of time they spent grazing on the floodplain (either 30-59 days or 60-130 days) and their weight range on arrival from the VRD (either 150-224 kg or 225-270 kg). Average ADGs while being fed in House West paddock ranged from 0.201 to 0.325 kg/day and average ADGs while grazing on the floodplain ranged from 0.361 to 0.453 kg/day.

The groups considered most likely to be profitable to feed were the steers that weighed 225-270 kg on induction, as these only needed to put on 30 – 75 kg to reach the live export target and would not need to be held for another year to reach this weight. Of the steers in this weight range, those that spent 30-59 days grazing on the floodplain were fed in House West paddock for an average of 34.8 days and then grazed on the flood plain for an average of 49.2 days, and over these 84 days their average weight increased by 25 kg at an average ADG of 0.296 kg/day. Those that spent 60-130 days grazing on the floodplain were fed in House West paddock for an average of 41.7 days and then grazed on the flood plain for an average of 86.4 days, and over these 128 days their average weight increased by 50 kg at an average ADG of 0.391 kg/day.

Table 12. Data summary of performance of cattle of two weight ranges on induction, that spent either 30-59 or 60-130 days grazing on the floodplain (FP) - 2024.

	30-59 days on Floodplain		**60-130 days on Floodplain**	
Induction weight range	150-224 kg	225-270 kg	150-224 kg	225-270 kg
Number of animals	179	149	143	96
Avg. Induction Weight (kg)	201.3	245.6	194.3	247.2
Avg. Days on feed	34.9	34.8	43.4	41.7
Avg. ADG on feed (kg/day)	0.213	0.201	0.325	0.226
Avg. Weight onto FP (kg)	209.1	252.7	211.8	258.2
Avg. days on FP	48.8	49.2	91.5	86.4
Avg. ADG on FP (kg/day)	0.404	0.361	0.424	0.453
Avg. ADG: Feed + FP (kg/day)	0.331	0.296	0.415	0.391

2025

In the dry season of 2025, weaners from AACo properties in the VRD were trucked to LaBelle shortly after weaning where they were weighed on arrival and drafted into groups. Those weighing 150-270 kg were put in House West paddock (a 750ha paddock of predominantly Tully grass) for feeding with the same Milne pellets and loose mix supplement for 1-3 months (the average number of days on feed is shown in Table 13 below) before being moved to a floodplain paddock for grazing during the dry season. The method of feeding in House West Paddock was the same as in the previous years.

Groups of weaners arrived on numerous different dates between 13/04/25 to 3/06/25 and stayed in House West paddock for 1-3 months before being moved to the floodplain. Data from the time the cattle spent grazing on the floodplain was not able to be sourced in time for reporting in 2025/26, so only data from the feeding in House West paddock is presented for 2025.

The groups considered most likely to be profitable to feed were the steers that weighed 225-270 kg on induction, as these only needed to put on 30 - 75 kg to reach the live export target and not need to be held for another year to reach this weight. On average the steers in this weight range spent 35.2 days being fed in House West paddock and during this time they had an average ADG of -0.159 kg/day (Table 13). There was no easily identifiable reason for the lower weight gain in 2025.

Table 13. Summary of performance of cattle in two weight ranges at induction during the pellet feeding period in 2025.

Induction weight range (kg)	N	Avg DOF	Avg induction weight (kg)	Avg ADG (kg/day)
150-225	460	37.0	193.3	-0.001
226-279	223	35.2	248.4	-0.159

Summary of data to use in economic evaluations of the feeding strategy

Data from this site will only be used in economic evaluation of the strategy of feeding steers that just miss the live export target weight. This is because it is not cost effective to use the floodplain grazing strategy with heifers prior to mating as it would involve considerable transporting of heifers back and forth between properties. Therefore, data from steers in the 245-299 kg weight range in each year of the study were pooled to calculate the average ADG to use for this strategy in economic evaluation. On average these steers were fed pellets and weaner mix for 43 days and then grazed on the floodplain for 68 days, and their average ADG over this period was 0.367 kg/day. At this ADG they would need a total of 123 days to gain 45 kg under this strategy.

In comparison, a group of similar animals that stayed in the VRD had a dry season average ADG of -0.056. Therefore, the floodplain grazing strategy increased dry season ADG by 0.423 kg/day compared to animals that remained in the VRD.

3.2.2 Dryland forage sorghum grazing - Sturt Plateau

A Sturt Plateau cattle property grazes a 382 ha cultivation area of forage sorghum with weaners each dry season, in conjunction with a neighbouring 33 km^2 native pasture paddock to improve dry season weight gains. The performance of weaners grazing under this system was documented with three year-groups of weaners.

2023

Weaners were accumulated in the yards for education/training and then branding after being weighed. In 2023 three groups of weaner steers were weighed on the following dates: Group 1 on 22/06/2023, Group 2 17/07/2023, and Group 3 on 16/08/2023. After their weight was recorded, they were put into large native pasture paddock with access to the cultivation paddock. The weight of a group of weaner heifers that were used as a CONTROL group to get a measure of LWG without access to the cultivation was recorded on 27/06/2023 and they were then put into a similar 41 km^2 native pasture paddock.

The end of dry season weight for the control group of heifers was recorded on 26/10/23. End of dry season weights were recorded for steers when groups of animals were mustered from the paddocks on several occasions during November and early December (Table 14).

Table 14. Weight gain performance of four groups of weaners with access to dryland sorghum over the 2023 dry season.

Group	No. animals	Initial date	Avg initial Wt (kg)	Avg LWG (kg)	Avg no. days	Avg ADG (kg/day)	Max ADG (kg/day)
1	146	22/06/2023	230	-2.6	149	-0.017	0.189
2	149	17/07/2023	192	5.1	124	0.042	0.335
3	148	16/08/2023	216	-0.8	95	-0.006	0.291
Control	135	27/06/2023	300	-9.5	121	-0.079	0.115

One group of steers (Group 2) gained 5 kg over the dry season while the other two groups lost a small amount of weight. The overall average LWG of the steers in all three groups was 0.007 kg/day. The CONTROL group of heifers lost an average of 9.5 kg over the dry season at a rate of 0.079 kg/day. The average LWG of the CONTROL heifers was 0.086 kg/day less than the steers. It should be noted that the CONTROL heifers may have lost more weight if their end of dry season weight had been recorded like the steers in November instead of in October.

Within each group there was a wide range of ADG's and this is shown for Group 3 animals in Figure 1. As the gate between the paddock containing the forage sorghum cultivation and the native pasture was left open so that the weaners could move between the paddocks as they pleased, there was no way of knowing how much time different animals spent grazing the crop. It is likely that animals that had higher ADG's spent more time grazing the crop, but there is no way of knowing if this is the case. The maximum ADG recorded in each group is shown in Table 14 to give an indication of what sort of ADG might be achieved by animals that spent a lot of time on the cultivation.

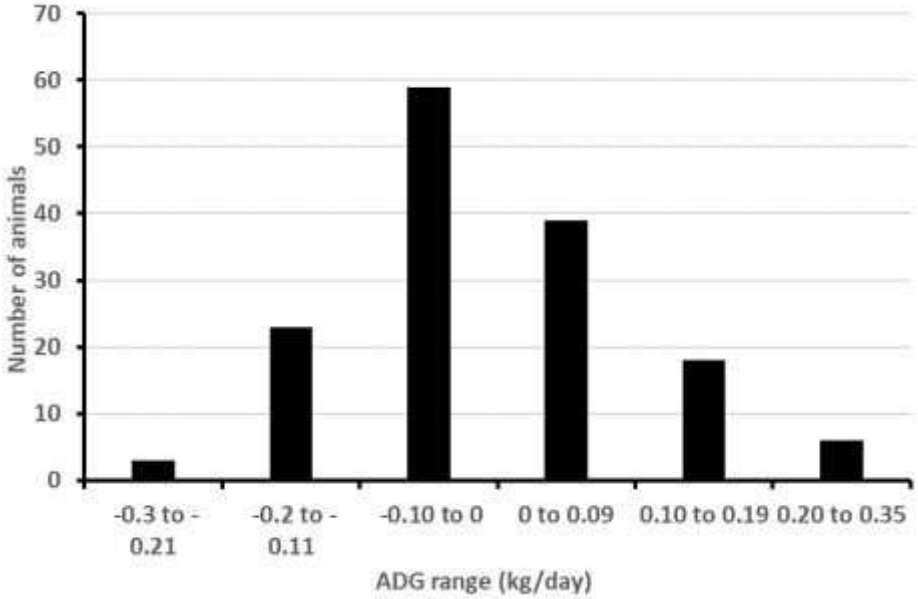


Figure 1. The number of animals in each average daily gain range for Group 3 in 2023.

2024

The same methodology was used in 2024 as was used in 2023, except that the LWG of a control group of heifers was not recorded. Three groups of weaner steers were weighed prior to branding on 07/08/24, 17/08/24 and 29/08/24 and then released into the trial paddocks. Weaners were removed from the paddocks at the end of dry season musters between 08/11/24 and 26/11/24. The overall dry season LWG for all animals was -0.004kg/day, which basically means that the animals just maintained weight over the dry season (Table 15). Again, there was large variation in LWG, and Figure 2 shows this variation by comparing ADG to induction weight. There was a trend for animals that were heavier at induction having lower ADGs amongst all three groups of steers.

Table 15. Liveweight and ADG of cattle with access to dryland sorghum – Sturt Plateau 2024.

Induction date	No. of head	Avg. Start weight (kg)	Avg. Exit weight (kg)	Avg. ADG (and range) (kg/day)	Avg. days in paddocks (and range)
7/08/2024	150	222.6	220.1	-0.029 (-0.295 to 0.230)	102 (93-104)
17/08/2024	150	207.7	208.2	0.014 (-0.265 to 0.374)	91 (83-94)
29/08/2024	100	220.5	219.9	0.007 (-0.277 to 0.429)	79 (71-82)
All animals				-0.004	

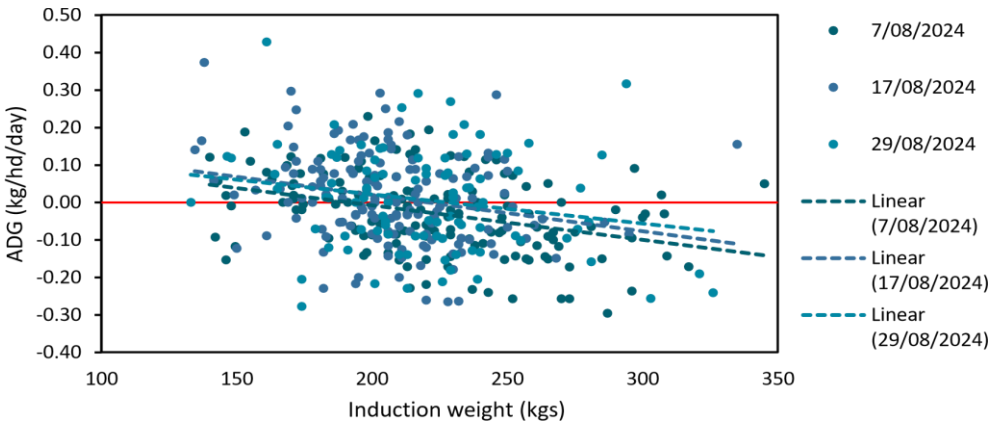


Figure 2. ADG by induction weight and induction date of cattle with access to dryland sorghum – Sturt Plateau 2024.

2025

A similar methodology was used in 2025 as was used in 2024, except that the cultivation was fertilised but not replanted prior to the 2024/25 wet season as it was thought that it would re-grow from the previous year's planting. However, after a promising start to the wet season there was a prolonged dry period and it is estimated that growth the silk sorghum was only about 20% of growth in the previous year.

Initial weights were collected for four groups of weaner steers on 26/07/25, 15/09/25, 26/09/25 and 06/10/25 before they were put into the trial paddocks, again with the gate open between the native pasture paddock and the cultivation. End of dry season weights were recorded in November between 11/11/25 and 28/11/25 and weight gains and ADGs were calculated. The overall average LWG was -0.194 kg/day (Table 16). There was a trend for animals that were heavier at induction to have a greater weight loss (Figure 3), which was consistent with previous years.

Table 16. Summary of liveweight and ADG of cattle with access to dryland sorghum in 2025 – Sturt Plateau.

Induction Date	No. of head	Av Start weight (kg)	Av Exit Weight (kg)	ADG (Range) (kg/day)	Av. Days on feed (Range)
26/07/2025	145	229.7	213.3	-0.140 (-0.405 to 0.242)	116 (108-128)
15/09/2025	95	233.3	220.4	-0.196 (-0.554 to 0.105)	65 (57-77)
26/09/2025	98	218.0	204.6	-0.244 (-1.048 to 0.113)	58 (46-63)
6/10/2025	96	213.1	203.1	-0.222 (-0.727 to 0.113)	47 (36-53)
All animals				-0.194	

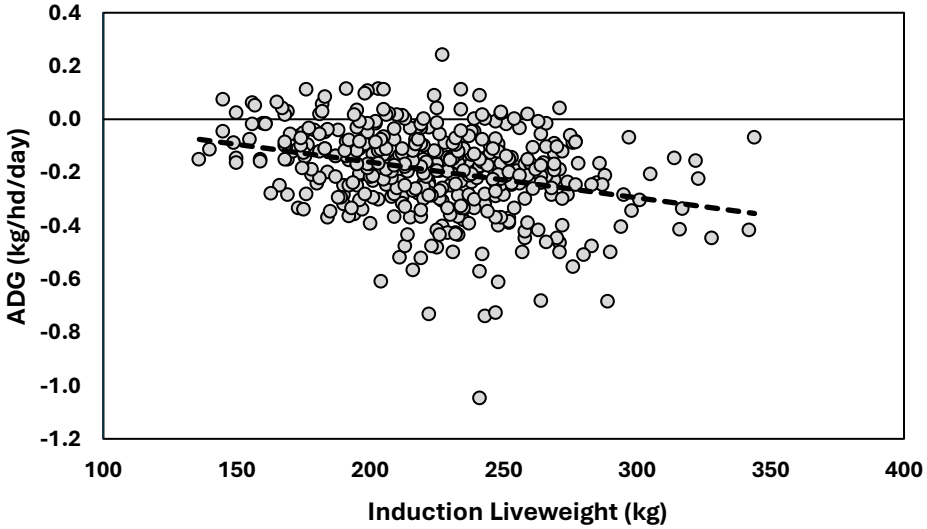


Figure 3. ADG by induction liveweight (with regression line) of cattle grazing forage sorghum and native pasture in 2025.

Summary of data to use in economic evaluations of the feeding strategy

The feeding strategy to be evaluated from this site is growing a crop of forage sorghum in the Sturt Plateau district and allowing steers grazing native pasture to access it during the dry season. The steers with access to the cultivation lost a small amount of weight over the dry season in two out of three years and gained a small amount of weight in the other year. The overall average LWG over the three years was -0.040 kg/day. In the year in which a group of heifers acted as a control treatment, their average LWG was 0.086 kg/day less than the steers.

3.2.3 Corn-based ration fed in self-feeders to cattle grazing native pasture - VRD

A VRD cattle property feeds a purchased grain ration to steers from self-feeders in a native pasture paddock to try to increase the number that meet the target minimum weight for live export. Details of the ration are provided in Table 17. The cattle were also provided with *ad lib* access to loose mix supplement that contained 10% cottonseed meal, 20% urea, 26% MCP, 20% Gran Am, 16% salt. LWG performance of the fed steers was compared to others in a similar paddock that were not fed the grain ration but received the same mineral supplement. The group fed the grain ration were kept in a 2,400 ha paddock of native pasture and the grain ration was fed from three Advantage Self Feeders in the paddock for approximately 80 days. More details on the specific methodologies each year are provided below.

Table 17. The nutritional details of the corn-based grain ration fed in self-feeders.

Composition: Corn (cracked), Chickpeas (cracked), Lupins (cracked), mineral supplement mix.

Nutrient	Unit	Amount
Protein	%	14
Energy	MJ/kg	12.7
Calcium	%	0.75
Phosphorus	%	0.4
Vitamin A	IU/kg	4200
Vitamin E	IU/kg	10.4
Sodium Monensin	mg/kg	50.7
Flavophospholipol	Mg/kg	5

It should be noted that there were some issues with the feeding trials that compromised their rigour and limit the usefulness of the data obtained. The biggest issue was with paddock security as large numbers of animals entered the paddock in which the grain ration was being fed from self-feeders, and so individual intake of the grain ration was likely lower than intended. Another factor that limited the rigour of the trial was that the group fed grain (GRAIN) were sometimes not weighed on the date when feeding finished, but sometime later. For example, in 2025 grain feeding finished on 26/09/25 but final weighing was conducted on 28/10/25 and cattle may have lost considerable weight between the two dates. Also, the control group was sometimes not weighed at the same time as the GRAIN group which likely affected their LWG recorded. For example, in 2023 the GRAIN group was weighed on 14/12/23 while the control group was weighed on 29/10/23, and it is possible that there could have been considerable weight loss between October and December that was not recorded for the control group. These factors do not allow a good comparison of the treatments but are often unavoidable when conducting trials on commercial properties. While it is possible that other commercial properties would have similar issues if they tried to implement the same strategy, the data presented here should be viewed as a record of what occurred on an extensive property rather than a rigorous comparison of treatments. Due to these deficiencies in the trial, the company that produces the grain ration has requested that their name not be mentioned, and they have provided data from some of their own trials which they believe are more representative of LWG performance of cattle eating their ration.

2023

In 2023 the grain ration was fed to a group of approximately 18 month-old artificial cryptorchid (short-scrotum castrated) male cattle from 26/09/23 – 14/12/23 (102 days). The grain ration was fed approximately every two weeks during this period. There were 240 animals in the GRAIN paddock, but data was only collected for 126 animals as some animals were added to the paddock later without their initial weight being recorded.

Initially there were two CONTROL groups: one paddock of artificial cryptorchid males comparable to the GRAIN group, and one paddock of young bulls. However, most of the CONTROL artificial

cryptorchid males escaped the paddock, and so only the bulls were available as a comparison group. This comparison is not ideal, as there is a sex effect between the groups, the bulls had a higher starting weight, and the final dry season weight was recorded on 29/10/23 for the bulls while the GRAIN animals were weighed on 14/12/23. It was assumed that the bulls would have maintained the same weight between 29/10/23 and 14/12/23 for comparison to the GRAIN group, but it is possible that they could have lost weight during this time.

While the weight of GRAIN animals was recorded on 3/09/23 and 14/12/23 (102 days), the feeding period was from 25/09/23 to 14/12/23 (80 days). It can be assumed most of the LWG occurred during the feeding period, so ADG was calculated over 80 days (Table 18).

Table 18. Weight gain data from the two treatments in the 2023 corn-based ration feeding trial.

Treatment	Number	Avg. initial weight (kg)	Avg. 2nd weight (end of dry season) (kg)	Avg. weight gain (kg)	Avg. ADG (kg/hd/day)
GRAIN	126	255.4	281.4	26	0.325
CONTROL	31	380.7	385	4.3	0.054
Difference		125.3	103.6	21.7	0.271

A total of 24.2 tonnes of the grain ration was fed to 240 animals over 80 days, with individual intake averaging 1.26 kg/head/day (a total of 101 kg/head over the feeding period). At a feed cost of $0.955/kg, cattle consumed $96.30 worth of the grain ration per head. The average LW gain was 21.7 kg more weight than the CONTROL group.

2024

In 2024 the same ration as the previous year was fed to a group (GRAIN) of artificial cryptorchid males (n=180) and entire males (n=30). A comparison (CONTROL) group (castrates n=195, bulls n=40) was in the paddock next to the one in which the grain ration was fed.
GRAIN animals were mostly between 231 - 270kg at induction, and CONTROL animals were mostly above 270kg (there were some animals outside these target ranges in each paddock). There were four additional animals in the ration paddock and 13 in the pasture paddock that were excluded from analyses as they were over 370 kg at the start of the trial but were accounted for in paddock numbers (for calculation of intake, stocking rates etc.).

Animals were inducted into the paddocks in five groups between 20/05/24 and 20/06/24. Weights recorded on these dates were used as initial weights as the cattle were not weighed again when feeding of the grain ration commenced on the 1/9/24. The feeding period was 80 days and finished on 20/11/24. A total of 24.4 tonnes of the grain ration was fed over 80 days.

LWG was calculated from the recording of the initial weight to the end of the feeding period (155 to 186 days). ADG was calculated for both the period between the dates when LW was recorded and for the 80-day feeding period. The GRAIN group had an average ADG of 0.098 kg/day over the 155-186 days between weigh dates, while the CONTROL group had an average ADG of -0.09 kg/day (Table 19). As a result, the GRAIN group on average gained 33.5 kg more LW over the dry season. It can be assumed most of the weight gain occurred during the feeding period, and the average ADG over this 80-day period was 0.214 kg/hd/day for the GRAIN group. The data from

artificial cryptorchid and entire males were analysed separately, and the artificial cryptorchids performed better than the bulls in both treatment groups (Table 19).

Table 19. Weight gain by induction date and sex in the corn-based ration feeding trial – VRD 2024.

		GRAIN						CONTROL				
Induction date	Sex	No.	Start Wt. (kg)	End Wt. 20/11/24 (kg)	LWG (kg)	ADG (kg/day)	80d ADG (kg/day)	No.	Start Wt. (kg)	End Wt. 20/11/24 (kg)	LWG (kg)	ADG (kg/day)
20/05/24	Bull	9	251.4	262.3	10.9	0.059	0.136	9	284.6	276.9	-7.7	-0.041
	Steer	112	253.8	270.6	16.8	0.090	0.208	94	283.9	264.2	-19.7	-0.106
21/05/24	Bull	2	259.0	301.5	42.5	0.230	0.531	5	287.2	269.4	-17.8	-0.096
	Steer	45	257.4	287.4	30.0	0.162	0.352	32	287.2	272.6	-14.7	-0.079
14/06/24	Bull	11	248.6	252.2	3.5	0.022	0.044	5	306.0	287.6	-18.4	-0.114
	Steer	0						0				
18/06/24	Bull	3	248.7	261.0	12.3	0.079	0.154	1	283.0	269.0	-14.0	-0.089
	Steer	21	254.9	277.7	22.8	0.145	0.289	69	303.6	293.5	-10.0	-0.064
19/06/24	Bull	0						1	322.0	325.0	3.0	0.019
	Steer	1	243.0	305.0	62.0	0.397	0.775	0				
20/06/24	Bull	15	249.2	238.3	-10.9	-0.070	-0.136	7	275.9	247.7	-28.1	-0.182
	Steer	1	237.0	257.0	20.0	0.129	0.250	0				
All dates	Bull	40	250.0	252.4	2.4	0.010	0.030	30	285.3	267.8	-17.5	-0.105
	Steer	180	254.7	275.7	21.1	0.117	0.254	195	291.4	275.9	-15.5	-0.087
All animals		220	253.8	271.4	17.7	0.098	0.214	225	290.6	274.4	-15.8	-0.090

2025

In 2025 the same ration as previous years was fed, however in 2025 it was fed to two paddocks: Paddock 1 had males (mixed entire and castrates), and Paddock 2 had heifers. Animals were added to Paddock 1 at various times between 10/05/25 and 10/06/25 and induction weights were recorded as they were added. Paddock 1 was originally stocked with 665 head, but upon the final muster an additional ~200 head were mustered. Induction weights were recorded for Paddock 2 animals on 3/08/25. Paddock 2 was initially stocked with 350hd and upon final muster an additional ~300 head were mustered. This highlights the difficulty of doing rigorous research trials on commercial properties when paddock security is not good, and also the attractiveness of the grain ration to animals from other paddocks.

Both paddocks had ad-lib access to dry season dry lick supplement (urea/MCP/salt/Gran Am/trace mineral supplement) and 35 kg molasses blocks. Feeding of the corn ration began on 03/08/25

and concluded on 25/09/25 in Paddock 1 and 26/09/25 in Paddock 2, with final weighing occurring on 28/10/25. So while the feeding period was 53 days for both paddocks, the period between the recording of induction weight and final weight was up to 138 days for Paddock 1 animals. The grain ration was fed from Advantage Self Feeders in the paddock (Paddock 1 n=8 feeders, Paddock 2 n=6 feeders). A control paddock was originally intended, but this did not eventuate due to low pasture availability in the control paddock. Some of the animals from this "control group" were among the extra animals that entered Paddock 1, but their data was not included in the corn ration evaluation as it is not known when these animals entered Paddock 1 and how much time they would have had access to the corn ration.

The GRAIN animals averaged 0.107 kg/hd/day (Paddock 1) and 0.025 kg/hd/day (Paddock 2), while the CONTROL males averaged -0.003 kg/hd/day (Table 20). A total of 120.7 tonnes of grain ration were fed, at a cost of $113,615.35. The ration was planned to be fed at 1 kg/hd/day, but due to the large number of additional animals that entered the paddock on unknown dates, it is not possible to calculate the actual average consumption per head. The 2025 data was excluded from the final economic analyses due to the high uncertainty of paddock numbers and ration intake.

Table 20. Liveweight gain performance of cattle fed the corn-based grain ration – VRD 2025.

Sex	Induction Date	Number	Avg. Start Wt. (kg) (±SD)	Avg. Exit weight (kg)	ADG (kg/day)
Heifers	3/08/25	255	321.8 ± 40	324.0	0.025
Males	10/05/25-10/06/25	408	292.0 ± 43	309.3	0.107

Summary of data to use in economic evaluations of the feeding strategy

As discussed, that there were issues with the feeding trials that compromised their rigour and limit the usefulness of the data obtained. The main issue was large numbers of extra animals entering the paddock in which the grain ration was being fed, and so individual intake of the grain ration was unknown and was likely lower than intended. Other issues regarding dates when cattle were weighed were discussed at the start of this results section. Due to the problems with collecting reliable data from the feeding trials, the company that produces the grain ration has asked that their name not be associated with the trial results, and they have provided data from one of their own trials which they believe is more representative of LWG performance of cattle eating their ration. This trial was conducted in 2017 with 74 weaner Brahman steers and heifers (average entry weight = 141 kg) that were yard fed for 62 days. The same grain ration was fed, and animals also had ad libitum access to high quality Rhodes grass hay. Intake of the grain ration was 3.24 kg/hd/day, which was considerably higher that the intakes in the feeding trials in in this study. The average ADG over the 62 days was 0.79 kg/day This ADG and average intake is used in the economic evaluation.

3.2.4 Pivot irrigated improved pasture in the Douglas Daly district

The property in the Douglas Daly district has established areas of Rhodes grass pasture under pivot irrigation. One pivot is 100ha and the other is 50 ha. Each year the pivot areas are cut twice

for hay production and then used for grazing by weaners. The LWG performance of weaners grazing these areas was recorded for three year groups of weaners.

The costs associated with establishing and equipping the pivot areas were approximately; clearing = $150/ha, stick raking = $450/ha, ploughing (x2) = $75/ha, pivot irrigator = $8,000, and the bore cost $7000. The annual costs were; fertiliser and seed = $300/ha, weed spraying $30/ha plus the cost of water. Details of the irrigation rates and animal performance are provided separately for each year below.

2023

In 2023 data was recorded from weaners grazing the 100 ha pivot. The pivot was grazed by 675 small weaners during the 2023 dry season starting on 21/8/23. They grazed there until 23/11/23, and individual weights were recorded for a sub-group of 111 animals from within the mob at the start and end of the grazing period. Their average starting and finishing weights were 128 kg and 185 kg respectively (average LWG = 57 kg), with an average ADG of 0.51 kg/day over 94 days.

Thirty mm of water over the irrigated area was applied through the pivot per week. Over 13.4 weeks this equates to 3.9 ML of water being applied to the 100 ha. At the price of $120/ML the total annual cost of irrigating the pivot for was $46,800 (i.e. $468/ha).

2024

The 100 ha pivot was grazed by 663 small weaners during the 2024 dry season starting on 29/7/24. They grazed there until 5/11/24, and individual weights were recorded for a sub-group of 347 animals from within the mob at the start and end of the grazing period. Their average starting and finishing weights were 148 kg and 177 kg respectively (average LWG = 29 kg), with an average ADG of 0.29 kg/day over 99 days.

Thirty mm of water over the irrigated area was applied through the pivot per week. Over 14.1 weeks this equates to 4.1 ML of water being applied to the 100 ha. At the price of $120/ML the total annual cost of irrigating the pivot for was $49,200 (i.e. $492/ha).

2025

The 50 ha pivot was grazed by 236 weaners during the 2025 dry season starting on 15/8/25. They grazed there until 2/12/25, and individual weights were recorded at the start and end of the grazing period. The average starting and finishing weights are shown separately for males and females in Table 21. Average ADG was 0.384 kg/day for males and 0.383 kg/day for females over 109 days. There was no effect of starting liveweight on ADG (Figure 4).

Table 21. Liveweight gain of weaners grazing center-pivot irrigated Rhodes grass in 2025.

Sex	Weight START (kg)	Weight END (kg)	ADG (kg/day)	Weight Gain (kg)
Male	198.9	240.7	0.384	41.8
Female	151.0	192.7	0.383	41.7

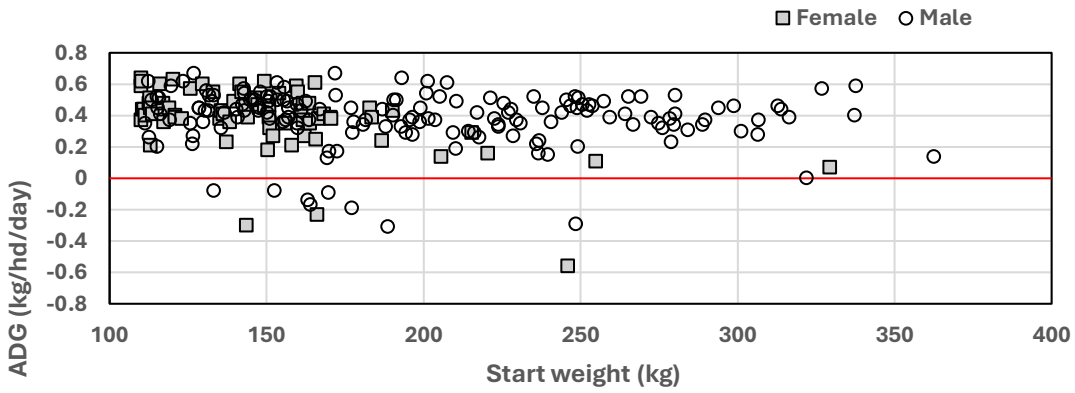


Figure 4. Effect of starting liveweight on ADG in weaners grazing pivot irrigated Rhodes grass.

Twenty five mm of water over the irrigated area was applied through the pivot per week. Over 15.6 weeks this equates to 1.9 ML of water being applied to the 50 ha. At the price of $120/ML the total annual cost of irrigating the pivot for was $22,900 (i.e. $229/ha).

Summary of data to use in economic evaluations of the feeding strategy

The feeding strategy to be evaluated from this site is using pivot irrigated Rhodes grass to increase the growth rate of cattle over the dry season to get a greater proportion of steers reaching the target minimum weight for live export after one post weaning wet season. The overall average ADG from all animals over the 3 years was 0.393 kg/day, and at this growth rate a grazing period of 115 days is required to increase LW by 45 kg.

3.2.5 Silage based total mixed feedlot ration – Victoria River District

A considerable amount of data was collected from animals that were fed in the feedlot at Legune station from 2023 to 2025. While some of this has been presented in the reports for each of the years below, only data that is relevant to the identified feeding strategies was used to evaluate the proposed feeding strategies and included in the summary of data.

2023

Normal feeding operations in the Legune feedlot in 2023 were disrupted by the suspension of live export to Indonesia from July to September due to concerns around suspected Lumpy Skin Disease. As a result, different classes of animals were fed in the feedlot than normally occurs. In 2023 when weaning musters of paddocks on the property were conducted, small weaners (<160 kg) were drafted off and put into the feedlot. They stayed in the feedlot for various lengths of time until they were considered to have grown enough to be put out onto pasture. As a result, there were lots of animals coming and going at different times. The data was therefore sorted into groups that came and went at the same time, and that included enough animals to give reliable average

LWG data. All the animals in the feedlot were weighed on 2/11/23 when the feedlot finished operating for the year and ADG was calculated from the feedlot entry date to this date.

Average ADG ranged from 0.21 kg/day to 0.6 kg/day (Table 22), which was lower than the 0.7 kg/day expected by the manager. Feed intake data was not adequately recorded to allow proper assessment, and so only data recorded in 2024 and 2025 has been included in the assessment of the feeding strategy. The 2023 data is just presented to give a record of the performance of these animals.

Table 22. Performance of small weaners fed a silage-based feedlot ration for various periods of time – VRD 2023.

Feedlot entry date	Number animals	Avg. ENTRY Weight (kg)	Avg. weight on 2/11/23	Avg. number days on feed	Average ADG (kg/day)
17/7/23	112	111.1	174.6	108	0.59
20/7/23	136	115.0	178.1	105	0.60
3/8/23	37	115.8	163.1	91	0.52
11/8/23	19	117.7	146.1	83	0.34
21/8/23	15	115.6	147.8	73	0.44
30/8/23	28	117.3	131.0	64	0.21

2024

In the dry season of 2024, cattle of various ages (ranging from 1.5 to 3.5 years old), sexes and initial weights were fed in the Legune feedlot for a differing periods of time according to when they reached the target weight for sale. Most cattle were destined for the live export market with a target weight of 300-350 kg, but some older animals were fed to heavier weights for other markets.

Prior to entry to the feedlot the animals were mustered from the paddock they had been in and walked to the feedyard (a distance of 10-15km). They were then weighed and allocated to feed pens according to their weight. They were fed a starter ration (with higher hay content) for 7 days and then transitioned to the silage grower ration.

The silage grower ration was mixed on station from 65% sorghum silage, 20.5% cracked corn (purchased from OrdCo Kununurra), 9% cotton seed, 3.5% soybean meal, and 2% mineral supplement. The sorghum silage was grown and made on the station and the total cost of the ration (including the purchased commodities) was $303.58/tonne ($0.30/kg). The nutritional analysis of the diet was: DM = 54.6%, ME = 11.81 MJ/kg, CP = 13.73 %

Individual feed intake per head per day was estimated using the advising nutritionist's model which used induction weight, exit weight, ADG, and the amount of feed fed to the pen. Average estimated individual feed intake of steers weighing 230-300 kg was 12 kg/hd/day as fed (or 6.5 kg/hd/day DM basis).

The labour cost was calculated for each animal according to how long they were in the feedlot. The salaries of the feedyard supervisor and feedyard assistant were divided by the number of animals

in the feedyard at the time to give a labour cost on a per head per day basis. A typical day for the feedyard workers involved 4 hours feeding and 4 hours yard maintenance, cattle checks, data entry etc. One full time employee was required per 3,000 animals, so there were usually 2 staff at the feeding complex.

While data was recorded from animals in other weight ranges and classes, only data from animals in the weight range considered to be most likely to be profitable to feed were included in the data summaries presented here. Data from animals weighing 200-280 kg at induction and that were fed for 30-90 days on feed (DOF) is summarised in Table 23. Data from steers, spayed heifers and entire males is presented separately. The average ADG of steers was 1.145 kg/day and so the average amount of weight gained over the average 56 days on feed was 64 kg.

Table 23. Performance of cattle fed a silage-based feedlot ration for 30–90 days – VRD 2024.

Class	Average DOF	Number	Avg. Induction weight (range) (kg)	Avg. ADG (range) (kg)	Avg. Feed Intake (kg/ hd/day)
Steer	56.1	399	240.8 (200-280)	1.145 (0.159 - 2.445)	13.7
Entire male	53.6	671	235.0 (200-280)	1.366 (0.193 - 2.703)	13.3
Spay female	32.9	46	254.1 (200-280)	1.174 (0.361 - 2.405)	15.1

2025

From July to September in 2025, animals were inducted into the feedlot at Legune and were fed for varying times depending on the target market requirements. Most cattle were destined for the live export market but some targeted other markets. Data used in this study was only from Brahman and Tropical Composite cattle that were in the feedyard for between 30 and 90 days.

At induction into the feedyard the cattle were given botulism and 5-in-1 vaccinations, and a HGP implant. A high hay content induction ration was fed for the first 7 days and then they transitioned to a “high corn” grower ration (cost $298.65/tonne). The contents of the grower ration were: Silage (64.9%), Cavalcade (1.1%), Corn (20.1%), Soybean Meal (2.3%), Cotton Seed (10.2%), Mineral supplement (1.5%). The nutritional analysis of the diet was: DM = 54.6%, ME = 11.81 MJ/kg, CP = 13.73 %, and average estimated individual feed intake of steers weighing 230-300 kg was 12 kg/hd/day as fed (or 6.5 kg/hd/day DM basis).

Average ADG reduced as induction weight range increased (Table 24). The average ADG of steers in the 200-270 kg weight range (considered most profitable to feed) was 0.83 kg/day and so the average amount of weight gained over the average 63 days on feed was 53 kg. This average ADG was considerably lower than that recorded in 2024 from a similar ration. There was no readily identifiable reason for the lower ADG in 2025.

Table 24. Performance of cattle fed a silage-based ration in the feedlot in 2025 - VRD.

Induction Wt. range (kg)	Avg. Days on feed	N	Avg. Induction Wt (kg)	Avg. ADG (kg/day)	Min ADG (kg/day)	Max ADG (kg/day)
150-200	75.1	168	180.0	1.33	0.68	1.95
200-270	63.4	298	231.3	0.83	0.05	1.90
>275	52.3	87	343.0	0.75	0.05	1.81

Summary of data to use in economic evaluations of the feeding strategy

The feeding strategy to be evaluated from this site is feeding a silage based total mixed ration in a feedlot to steers that are not likely to reach the recommended target minimum live export weight of 300 kg by mid dry season. Once fed for ~50 days they can then be exported rather than being held on the station for another year.

LWG data from steers in the 220 - 280 kg LW range at induction from all years was pooled and the average ADG of these animals was 1.192 kg/day. At this rate of LWG feeding for 38 days would increase LW by 45 kg.

3.2.6 Silage-based total mixed feedlot ration – Sturt Plateau

Maryfield Station is located near Larrimah and has a large feedlot. They grow forage sorghum which they make silage from and then mix with other purchased ingredients (details below) to produce a total mixed ration which they feed to cattle in the feedlot.

Their feeding system is similar to that at Legune Station in that they mostly feed young animals during the dry season that have not reached the minimum live export target weight. Feeding these animals in the feedlot until they reach the target weight means that they don't have to be held for another year grazing pasture before they reach the target weight. Some other classes of cattle (e.g. small weaners) are also fed, but data from these animals was not included in this study.

Cattle are weighed at the start and end of their time in the feedlot and this data was used to calculate ADG. This data was then used to evaluate the profitability of the strategy compared to cattle that just graze pasture and do not put on any weight over the dry season.

2023

The feedlot activities in 2023 were reduced and were not the usual strategy used during a typical year due to the temporary suspension of live export to Indonesia and the uncertainty around marketing of animals once they had been fed in the feedlot.

Weaners from other company owned properties in the VRD were trucked (around 900km) to Maryfield between July and August in 2023 and turned out into holding paddocks (separate paddocks for males and females). The animals that had been accumulated in the paddocks were mustered in October and weighed and inducted into the feed yard. Data recorded from steers and young bulls are reported separately here.

Feeder steers were mustered on the 15/09/2023 and weighed and inducted into the feed yard, and feeding commenced on this day. Due to a delay in feed commodities arriving for the grower ration, the steers were initially fed a starter ration (64% sorghum silage, 33.8% corn, 0.22% mineral supplement) and cavalcade hay to maintain weight until the grower ration was ready to be fed. The steers were weighed on 26/10/2023 and the grower ration (61.5% sorghum silage, 31.5% corn, 5% Soybean meal, 2% mineral supplement) was fed from this date until 27/11/2023 when a final weight was recorded.

Data was only used data from animals that were in a group that experienced the same conditions for a relevant period of time. Many other animals came and went from the feedyard at various times, but their data was not used. Data from the 41 day period when the starter ration was fed was evaluated from four pens of steers (total N = 70, average induction weight = 259 kg) and the average ADG was -0.10 kg/day during this time. Data from the 31 day period when the grower ration was fed was evaluated from three pens of steers (total N = 70) and the average ADG was 1.33 kg/day during this time. Average ADG over the whole 72 days in which both rations were fed was 0.52 kg/day. It was intended that the animals would be fed the grower ration for longer (e.g. 90 days), but a decision was made to sell them sooner due to a marketing opportunity.

Groups of young bulls were fed in 2023 in much the same way as the steers. They were mustered from the holding paddock on 15/9/23 and weighed and inducted into the feed yard, and feeding commenced on this day. They were fed the same rations as the steers for similar periods of time. Data was evaluated from five groups of young bulls (total N = 79, average induction weight = 253 kg) and their average ADG over the 42 day period they were fed the starter ration was -0.33 kg/day. Their average ADG over the 32 days they were fed the grower ration was 1.18 kg/day. Average ADG over the whole 74 days in which both rations were fed was 0.36 kg/day.

2024

In the dry season of 2024, young cattle of various ages (ranging from 1.5 to 2 years old) were fed in the Maryfield feeding complex for differing periods of time according to when they reached the target weight for market. Most cattle were destined for the live export market with a target weight of 300 kg, but some younger animals were fed to lighter weights for other markets. The animals fed were either trucked from another station in the VRD or from paddocks on Maryfield. They were accumulated in holding paddocks until they were inducted into the feedyard. Prior to induction they were drafted into groups of the same sex and similar weight. At induction they were weighed, given an insecticidal fly tag, a HGP, and a Marks-Min injectable trace mineral and Vitamin B12 supplement.

After induction the cattle were fed a starter ration (with higher hay content) for 7 days and then transitioned to a grower ration. The starter ration was called the “EWP Cavalcade ration” and cost = $511.09/t. It contained: Cavalcade hay (55%), Corn (22.5%), Water (12.5%), Soybean Meal (4%), Cotton Seed (4%), Supplement (2%). The nutritional analysis of the starter ration was: DM = 78.47%, ME = 10.48 MJ/kg, CP = 16.04%, The grower ration was called "Feeder Cavalcade ration” (cost = $473.26/t) and contained: Cavalcade (34.5%), Corn (39%), Water (12.5%), Soybean Meal (1.5%), Cotton Seed (10.5%), Supplement (2%). The nutritional analysis of the grower ration was DM = 78.14%, ME = 11.57 MJ/kg, CP = 15.44%. The average estimated individual feed intake of steers weighing 230-300 kg was 9.5 – 10 kg/hd/day as fed.

Cattle of 2 breeds (Brahman, and Composite) and 3 “sexes” (bulls, steers and spayed heifers) were fed. Data was only included in this analysis from groups (minimum group size of 10 animals) that entered the feedlot on the same date and were fed for at least 30 days in the same group). The LWG data recorded is summarised in Table 25. The average ADGs for the different breed/sex combinations were: Brahman bulls = 1.05 kg/day, Brahman steers = 1.13 kg/day, Composite bulls

= 1.00 kg/day, Composite steers = 1.05 kg/day, and Composite heifers = 0.92 kg/day. Typically bulls have higher ADGs than steers, but this did not occur in this case.

Labour cost: 2 FTEs were allocated to the feedyard and they spent ~6hrs mixing and feeding cattle, ~1hr completing bunk scores, recording and setting up rations each day, 4 days a week they spent 2 hours cleaning troughs, and the remainder of the time was spent unloading commodities and on pen maintenance.

Table 25. Performance of cattle fed a silage-based feedlot ration in 2024 – Sturt Plateau.

Breed	Sex	DOF range	Avg. DOF	N	Avg. Entry Weight (kg)	Avg. Exit Weight (kg)	Avg. ADG (kg/day)
Brahman	Bull	46-60	47.0	36	239.9	281.2	0.878
Brahman	Bull	61-85	75.1	136	222.3	308.8	1.160
Brahman	Steer	30-45	37.7	178	264.7	303.9	1.040
Brahman	Steer	46-60	47.3	15	238.6	288.2	1.048
Brahman	Steer	61-85	72.3	85	224.6	318.9	1.304
Composite	Bull	30-45	37.0	544	262.9	301.8	1.051
Composite	Bull	46-60	52.1	353	234.9	284.3	0.945
Composite	Bull	61-85	65.1	85	262.3	325.7	0.967
Composite	Steer	30-45	36.6	157	261.0	299.2	1.040
Composite	Steer	46-60	51.9	29	216.3	268.5	1.007
Composite	Steer	61-85	71.4	22	225.0	308.8	1.174
Composite	Heifer	30-45	34.7	224	226.6	258.8	0.923
Composite	Heifer	46-60	48.5	36	224.7	267.1	0.873
Total	Total	Total	46.9	1900	244.0	291.9	1.011

2025

From May to September in the dry season of 2025, young cattle of various ages (ranging from 1.5 to 2 years old) were fed in the Maryfield feeding complex for differing periods of time according to when they reached the target weight for market. Most cattle were destined for the live export market with a target weight of 300 kg, but some younger animals were fed to lighter weights for other markets. The animals fed were either trucked from another station in the VRD or from

paddocks on Maryfield. They were accumulated in holding paddocks until they were inducted into the feedyard. Prior to induction they were drafted into groups of the same sex and similar weight. At induction they were weighed, given an insecticidal fly tag, a HGP, and a Marks-Min injection.

Two different rations were fed in 2025. These were;

High corn (cost $303.54/tonne); Silage (64.9%), Cavalcade (1.05%), Corn (20.1%), Soybean Meal (2.3%), Cotton Seed (10.2%), Mineral Supplement (1.5%). This ration was fed up until1/9/25. The nutritional analysis of the ration was: DM = 52.7%, ME = 11.64 MJ/kg, CP = 14.28 % and average estimated individual feed intake of steers weighing 275-335 kg was 13.74 kg/hd/day as fed.

Low corn (cost $246.50/tonne): Silage (75.2%), Cavalcade (1.05%), Corn (10%), Soybean Meal (1.6%), Cotton Seed (10.5%), Mineral Supplement (1.7%). This ration was fed from 1/9/25. The nutritional analysis of the ration was: The nutritional analysis of the ration was: DM = 47.12%, ME = 11.09 MJ/kg, CP = 13.81% and average estimated individual feed intake of steers weighing 270340 kg was 15.15 kg/hd/day as fed.

The ADG of groups of cattle fed the low corn ration in 2025 ranged from 0.518 kg/day to 1.303 kg/day (Table 26), with an overall average ADG of 1.0 kg/day. ADG of groups of cattle fed the high corn ration in 2025 ranged from 0.69 kg/day to 1.68 kg/day (Table 27), with an overall average ADG of 1.21 kg/day. ADG tended to decline the longer animals were fed (Figure 5).

Table 26. Performance of cattle fed the low corn feedlot ration in 2025 – Sturt Plateau.

Breed	Sex	No. head	DOF	Induction date	Induction weight (kg)	End weight date	End weight (kgs)	ADG (± SE)
Composite	Heifer	39	39	16/09/2025	274.6	25/10/2025	315.9	1.058 ± 0.44
Composite	Heifer	38	41	14/09/2025	252	25/10/2025	305.4	1.303 ± 0.35
Composite	Male	41	68	18/09/2025	206.2	25/11/2025	288.5	1.21 ± 0.28
Composite	Male	61	84	2/09/2025	187.8	25/11/2025	281.2	1.112 ± 0.31
Composite	Male	53	40	1/11/2025	298.3	11/12/2025	319	0.518 ± 0.52
Composite	Steers	68	85	1/09/2025	189	25/11/2025	280.4	1.075 ± 0.27
Brahman	Heifer	41	83	17/09/2025	273.4	9/12/2025	332.2	0.709 ± 0.27
Brahman	Heifer	48	84	16/09/2025	275.4	9/12/2025	383.2	1.284 ± 0.24
Brahman	Heifer	39	84	16/09/2025	270.2	9/12/2025	370	1.188 ± 0.24
Brahman	Heifer	30	84	16/09/2025	261.8	9/12/2025	333.1	0.849 ± 0.24
Brahman	Heifer	30	86	14/09/2025	279.2	9/12/2025	383.5	1.213 ± 0.16
Brahman	Heifer	46	86	14/09/2025	271.3	9/12/2025	328.8	0.669 ± 0.26
Brahman	Bull	41	50	22/10/2025	276.3	11/12/2025	318.3	0.839 ± 0.25

Table 27. Performance of cattle fed a high corn feedlot ration in 2025 – Sturt Plateau.

Breed	Sex	No. head	DOF	Induction date	Induction weight (kgs)	End weight date	End Weight (kgs)	ADG (± SE)
Composite	Steers	70	39	2/06/2025	299.9	11/07/2025	352.9	1.361 ± 0.32
Composite	Bull	43	51	2/06/2025	256.1	23/07/2025	337.6	1.597 ± 0.24
Composite	Bull	34	53	31/05/2025	257.5	23/07/2025	346.8	1.684 ± 0.18
Composite	Bull	35	31	24/06/2025	251.2	25/07/2025	294.4	1.394 ± 0.66
Composite	Bull	36	32	15/07/2025	262.6	16/08/2025	304.1	1.297 ± 0.42
Composite	Bull	30	37	10/07/2025	271.3	16/08/2025	304.7	0.901 ± 0.28
Composite	Heifer	89	36	15/07/2025	304.1	20/08/2025	343.7	1.099 ± 0.35
Composite	Heifer	25	37	14/07/2025	306	20/08/2025	340.4	0.929 ± 0.37
Composite	Bull	34	48	3/07/2025	268.3	20/08/2025	335	1.389 ± 0.22
Composite	Heifer	66	38	15/07/2025	279.7	22/08/2025	337.4	1.518 ± 0.37
Composite	Heifer	175	71	12/06/2025	256.3	22/08/2025	334.6	1.103 ± 0.21
Composite	Heifer	171	40	14/07/2025	258.2	23/08/2025	301.9	1.092 ± 0.25
Composite	Heifer	32	40	14/07/2025	244.9	23/08/2025	272.5	0.69 ± 0.22

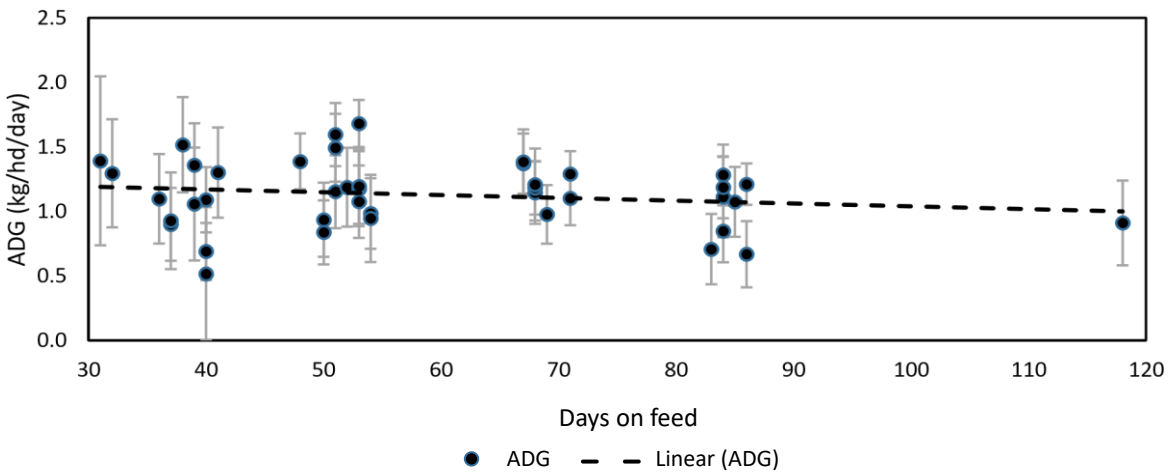


Figure 5. ADG vs days on feed with regression of cattle fed a high corn feedlot ration – Sturt Plateau 2025.

Summary of data to use in economic evaluations of the feeding strategy

The feeding strategy to be evaluated from this site is feeding a silage based total mixed ration in a feedlot to steers that are not likely to reach the recommended target minimum live export weight of 300 kg by mid dry season. Once fed for 30-50 days to reach the target weight they can be exported rather than being held on the station for another year.

LWG data from steers in the 220 - 280 kg LW range at induction from all years was pooled and the average ADG of these animals was 1.248 kg/day. At this rate of LWG feeding for 36 days would increase LW by 45 kg.

3.2.7 Silage-based total mixed feedlot ration – Top End

Claravale station (south-west of Pine Creek) has a feedlot in which they feed young cattle until they reach the target weight for live export, so that they don't have hold these cattle for another year grazing pasture until they reach the target export weight. Some other classes of cattle (e.g. small weaners) are also fed, but data from these animals was not included in this study.

They feed a feedlot ration of silage (56%), cottonseed (24%), cavalcade (13%), molasses (4%), concentrate (2%), and Silk sorghum hay (1%). Most of the ration ingredients are grown on the property and the silage is produced there by contractors.

Cattle are weighed at the start and end of their time in the feedlot and this data was used to calculate ADG. This data was then used to evaluate the profitability of the strategy compared to cattle that just graze pasture and do not put on any weight over the dry season.

2024

In 2024 two groups of animals were recorded, one group was inducted on 06/06/24 and one on the 19/06/24. Animals were reweighed on 20/09/24 (with some animals sold at this point as they had reached the target weight) and weighed again on 15/11/24 (162 and 149 days on feed respectively) just before sale. Animals ranged from 110-344kg at induction, however only animals between 200-280kg were included in the results as this is the weight range that it was determined would be most cost effective to feed. Tables 28 and 29 show data for animals inducted on 06/06/24 and 19/06/24 respectively. The ADG was higher on 20/09/24 than on 15/11/24 for both steers and heifers in both groups, it is unclear what caused this difference. ADG were also higher for animals inducted on 19/06/24 vs animals inducted on 06/06/24, and it is unclear what caused this difference. Many more animals were fed than are included in the data summary tables, but their data was not included if they were not in the 200-280 kg starting weight range or did not undergo the same conditions for the same period of time as the other animals in the groups in Tables 28 and 29.

Table 28. Feedlot ADG (kg/hd/day) by starting weight bracket and sex for animals inducted on 06/06/24 – Top End.

		106 days in feedlot			162 days in feedlot		
Sex	Wt range	Number	LWG (kg)	ADG (kg/day)	Number	LWG (kg)	ADG (kg/day)
Heifers	200-220	55	77.3	0.73	21	101.3	0.63
	220-240	29	84.7	0.80	7	102.3	0.63
	240-260	14	91.6	0.86			
	260-280	6	83.5	0.79			
	All heifers	104		0.80	28		0.65
Steers	200-220	41	75.4	0.71	21	107.2	0.66
	220-240	9	73.7	0.75	7	104.5	0.65
	All steers	50		0.71	28		0.66

Table 29. Feedlot ADG (kg/hd/day) by starting weight bracket and sex for animals inducted on 19/06/24 – Top End.

		106 days in feedlot			162 days in feedlot		
Sex	Wt range	Number	LWG (kg)	ADG (kg/day)	Number	LWG (kg)	ADG (kg/day)
Heifers	200-220	12	97.2	1.04	4	135.5	0.91
	220-240	5	95.6	1.03			
	240-260	4	94.5	1.02			
	260-280	5	103.4	1.11			
	All heifers	26		1.05	4		0.91
Steers	200-220	10	94.9	1.02	5	126	0.85

The cost of feedlot ration was $276.30/tonne (value calculated by producer). Data provided by Claravale estimated an intake of 9 kg/hd/day, giving an average feed cost of $2.48/hd/day.

2025

In 2025, the same feedlot ration was fed as the previous year. Cattle were inducted on dates between 12/09/25 and 28/10/25 and total days on feed for groups were 30-67 days. Many more animals were fed than are included in the data summary tables, but their data was not included if they did not undergo the same conditions for the same period of time as the other animals in the groups in Table 30, or their starting weight was not in the 200-280 kg weight range.

Table 30. Feedlot ADG (kg/hd/day) of three pens of cattle with a starting weight between 200-280 kg in 2025 – Top End.

Pen ID	Animal type	Induction date	No. head	Av. Days on feed	Av. Starting weight (kg ± SD)	Av. LWG (kg)	ADG (kg/hd/day)
Pen 2	Mixed bulls and Steers	16/10/25	36	30	271.9 (± 11)	29.3 (± 15.1)	0.995
Pen 3	Mixed bulls and Steers	10/10/25	9	41	271.9 (± 5.3)	45.1 (± 18.6)	1.100
Pen 4	Heifers	12/09/25	57	67	259.1 (± 10.8)	72.6 (± 14.3)	1.080
Average							1.05

The average ADG of pens was relatively consistent ranging between 0.995 – 1.1 kg/day (average = 1.05 kg/day, Table 31). The cost of feedlot ration was similar to the previous year ($276.30/tonne; value calculated by producer).

Summary of data to use in economic evaluations of the feeding strategy

The feeding strategy to be evaluated from this site is feeding a silage based total mixed ration in a feedlot to steers that are not likely to reach the recommended target minimum live export weight of 300 kg by mid dry season. Once fed and the animals reach the target weight they can be exported rather than being held on the station for another year.

LWG data from steers and heifers in the 200 - 280 kg LW range at induction from all years was pooled and the average ADG of these animals was 0.95 kg/day.

3.2.8 Weaner pellets fed to cattle grazing native pasture – Roper region

Over three years (from 2023 to 2025) at Hodgson Downs in the Roper region south of Katherine, cattle were fed Ridley Rumevite® Northern Weaner Pellets in troughs while grazing native pasture in a very similar way to the feeding trials conducted at VRRS, except that the animals fed were 18-month-old heifers prior to their first mating rather than weaners. The results from the feeding trial each year are presented separately below.

2023

In 2023, 70 maiden heifers (approximately 20 months old) were fed the Ridley pellets in troughs in a native pasture paddock from 21/09/2023 to 6/12/2023. They consumed 9,680 kg of pellets over 75 days at a rate of 1.84 kg/day (0.8% of LW). The heifers were weighed at the start and end of the feeding period and the average ADG over this time was 0.51 kg/day. There was no control group but it is likely that heifers would normally not increase in LW at this time of year in this environment. Therefore, on average the heifers gained 38 kg at a time of year when they would not normally gain any weight. Their average weight increased from 228 kg on 21/9/23 to 265 kg on 6/12/23, and

this increase in pre-mating weight was expected to make a big difference to pregnancy rates at the subsequent mating (Schatz and Hearnden 2017).

The heifers were mated over the 2023/24 wet season and 55 were re-mustered and pregnancy tested on 2/5/24. They had an average weight of 343 kg (78 kg LWG over the wet season) and 95% (53/55) were pregnant. This pregnancy rate was much higher than what would have been expected if these heifers had not been fed, as the equation of Schatz and Hearnden (2017), predicts a pregnancy rate of 67% from heifers with a pre-mating weight of 228 kg in November prior to mating. An economic evaluation of the strategy of feeding heifers to increase pre-mating weight is shown in section 3.3.

2024

In 2024 the same Ridley weaner pellets were fed to 100 maiden heifers beginning on 22/9/24 and concluding on 21/12/24. 15,000kg of pellets were fed over the 90 days at a rate of 1.67 kg/day (0.8% of LW). Unfortunately, a few days before the heifers were weighed at the end of the feeding period, a gate was left open (not by station staff) and 51 of the heifers escaped the paddock into a much larger paddock and were not able to be retrieved for weighing. Therefore, the weights from the 49 remaining animals have been treated as indicative of all animals.

Weight gain over the 90 days averaged 0.69 kg/day with a standard deviation of 0.12. In 2024 there was early season rain at Hodgson Downs (44mm in October, 127mm in November and 63mm in December prior to second weighing), which meant green feed was available in the paddock earlier than is typical for the region, and may have influenced the higher weight gains seen in 2024 when compared to 2023.

As the heifers that escaped the paddock only exited within a few days of the end of the feeding period, the were included in the calculation of feed consumption. Average feed intake was calculated to be 1.67kg/hd/day. At a feed cost $1.16/kg, the cost per animal over the feeding period was $174. The value of the additional LW gain (average = 62 kg) at $4.00/kg was $248. So if the heifers had been sold the “profit’ of the LW gained would have been $74/hd.

94 of the heifers were mustered on 3/6/25 after the 2024/25 wet season at which time their average weight was 337 kg (wet season LWG was 73 kg) and 72% were pregnant. It is likely that the heifers would not have gained any LW between 22/9/24 and 21/12/24 if they had not been fed, and so their pre-mating weight would have been 201 kg without feeding. The equation of Schatz and Hearnden (2017), predicts a pregnancy rate of 51% from heifers with a pre-mating weight of 201 kg in November prior to mating. Therefore, the feeding program is likely to have increased pregnancy rates by around 21%.

2025

In 2025 the same Ridley weaner pellets were fed to 100 steers (average LW = 235 kg) beginning on 11/9/25 and concluding on 3/12/25. 15,000kg of pellets were fed over the 83 days at a rate of 1.8 kg/day. The average LW at the end of the feeding period increased by 41 kg to 276 kg with an average ADG of 0.495 kg/hd/day (standard deviation of 0.139). There was no effect of starting LW on ADG (Figure 6).

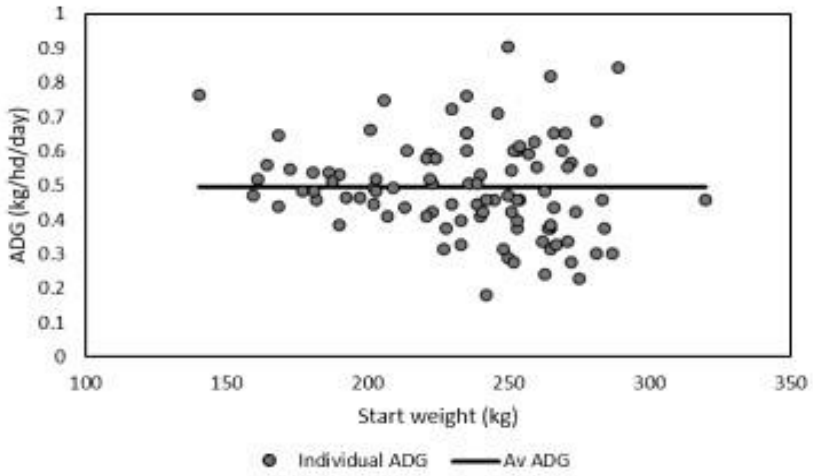


Figure 6. ADG by starting weight for steers fed Weaner pellets – Roper region 2025.

Average feed intake was calculated to be 1.81 kg/hd/day. At $0.74/kg feed cost (excluding labour), the cost of pellets consumed over the feeding period was $111.17/head. The value of the additional liveweight gain of 41.1kg (average) at $4.00/kg results in an added value per animal fed of $164.40.

Summary of data to use in economic evaluations of the feeding strategy

The feeding strategy to be evaluated from this site is feeding Ridley Rumevite® Northern Weaner Pellets at a rate of 0.8% of LW per day to steers and heifers grazing native pasture for 80 days during the dry season. The feeding trials at Hodgson Downs from 2023-2025 found that this resulted in an average ADG of 0.565 kg/day during the feeding period which would result in LW increasing by 45 kg over 80 days.

If this strategy was used in the second dry season after weaning to feed steers weighing 255-299 kg for 80 days their LW is likely to increase by 45 kg (at 0.565 kg/day), and these animals would then make the minimum weight for live export and could be sold at the end of the feeding period rather than holding them on the property for another wet season. Similarly, such a feeding program would increase the pre-mating weights of 2 year old maiden heifers by 45 kg, and the equations of Schatz and Hearnden (2017) can be used to estimate the increases in pregnancy rate from different premating weights. For example, increasing the pre-mating weight of Brahman maiden heifers with an average pre-mating weight of 220 kg by 45 kg to 265 kg is likely to increase their pregnancy rate from 63% to 84% (by 21%). The full economic impacts of these strategies are assessed in section 8.

3.2.9 Pivot irrigated improved pasture in the Katherine region

2023

In the dry season of 2023, the pivot area was grazed for 150 days starting on the 1/7/23, by 380 mixed sex small weaners weighing between 110kg and 150kg (average = 133 kg). The average ADG was 0.28 kg/day and the average LW at the end of the grazing period (1/12/23) was 175 kgs.

2024

In the dry season of 2024, the pivot was grazed for 110 days starting on the 1/6/24, by 257 mixed sex small weaners weighing between 80 and 165 kgs (average = 125 kg). The average ADG was 0.18 kg/day and the average LW at the end on the 20/9/2024 was 145 kg.

2025

In 2025, the pivot was used for grazing by older steers to increase their LWG during the dry season to ensure that a greater proportion would reach the recommended minimum sale weight for live export (300 kg) and not have to be held over for another year due to being too light. The pivot was grazed from the start of October for 110 days by 282 steers with an average starting weight of 230 kg. Grazing continued into the wet season so that the animals could be used to target sales when supply was short and the cattle price was high. A final weight was recorded on the 22/1/26 when the average LW was 285 kg, and there had been an average ADG of 0.39 kg/day.

Summary of data to use in economic evaluations of the feeding strategy

The data recorded over the first two years is not relevant to the feeding strategies being evaluated as the animals were small weaners whose rumens were not developed. Therefore, the data from 2025 (when the ADG was 0.39 kg/day) was used for economic evaluation of the feeding strategy in section 8. However the actual data recorded each year is used in the cost of feed assessments below.

3.3 Economic modelling of feeding strategies

Initially historical data recorded at VRRS over several years was evaluated to determine the classes of cattle that are likely to be most profitable to feed. The methodology used to do this is explained in section 2.3. This process identified that the most likely classes of animals to be profitable when fed are:

Class 1: Steers in the weight range 255 – 299 kg at a mid-year muster. These steers are lighter than the recommended minimum target weight for live export (i.e.. 300 kg), and so a feeding program that enabled these steers to gain an extra 45 kg in the dry season would mean that they could be exported after several months of feeding, rather than holding them for another whole year until after they reached the target weight. From historical VRRS data, the typical annual LWG of these animals is 110 kg. A dry season feeding strategy that increases annual LWG of the fed group by 45 kg, from 110 kg to 155 kg would result in the average weight of the whole year group of steers at a mid-dry season muster increasing from 292 kg to 309 kg, and the percentage of the mob that reaches the recommended target for live export of 300kg increasing from 45% to 84%. Having a greater proportion of steers turned off after one post weaning wet season frees up country to be grazed by other animals and increases production efficiency.

Class 2: Maiden heifers with a pre-mating weight (PM Wt) of <250kg. The equations of Schatz and Hearnden (2017) predict that increasing the average PM Wt of these heifers from 230 to 270 kg should increase the pregnancy rate of this group by 17%, from 69% to 86%. However, this is only likely to increase the overall pregnancy rate of the year group of heifers by 4%, since only 19% of a year group are likely to be <250kg prior to mating as two year-olds.

Class 3: First calf heifers with a pre-calving weight (PC Wt) of <430kg, which from VRRS data is usually around 82% of a year group of heifers. If these first calf heifers are fed over the dry season before calving for the first time to increase their PC weight by 40 kg, then this will likely increase the average PC Wt of the whole year group from 396 kg to 429 kg and increase their re-conception rate by around 16% (Schatz and Hearnden 2017).

Class 4: Culled cows weighing between 350 kg and 400 kg. These are usually cows that are culled for age and that have had a calf weaned in the mid dry season and so are in low body condition. They usually show compensatory gain after their calves are weaned and respond rapidly to improved nutrition. If they were fed to gain 50 kg over the dry season using one of the feeding strategies, in addition to the increase in LW, this has the effect of increasing their sale price received by $0.52/kg LW. For example; using the Rum Jungle abattoir grid for cull cows (quoted on 29/9/26), if they were sold at 350 kg LW then they would receive a price of $1.97/kg LW and return a value of $690 per cow. However, at a LW of 400 kg the sale price received would be $2.49/kg LW and such a cow would be worth $996.

Once the most profitable classes of cattle to feed were identified, a simple GM calculator from the Breedcow Dynama software suite of programs (Holmes et al. 2017) was used to calculate the dollar margin per head fed to determine if the different feeding strategies were likely to provide a positive return. This analysis included the apportioned variable costs of the equipment and

machinery used in the feeding strategy, and also took into account the opportunity cost of capital including livestock capital. This gives a more complete picture of the short-term profit of a feeding strategy compared to only considering direct feed, freight and labour costs. However, it is still only indicative of the actual profitability.

The feeding strategies evaluated with the GM calculator were:

1) Feeding “Weaner pellets” to steers in the weight range 255 – 299 kg for 80 days with an ADG of 0.57 kg/day.
2) Feeding “Shipper” pellets to steers in the weight range 255 – 299 kg for 69 days with an ADG of 0.66 kg/day.
3) Floodplain grazing steers in the weight range 255 – 299 kg for 80 days with an ADG of 0.37 kg/day, after feeding weaner pellets and weaner mix for 43 days.
4) Floodplain grazing steers in the weight range 255 – 299 kg for 123 days with an ADG of 0.42 kg/day, but with no feeding weaner pellets prior to floodplain grazing.
5) Floodplain grazing steers in the weight range 255 – 299 kg for 83 days with an ADG of 0.60 kg/day, without pre-floodplain feeding of supplements.
6) Feeding a commercial corn-based ration to steers in the weight range 255 – 299 kg for 57 days with an ADG of 0.79 kg/day.
7) Grazing steers in the weight range 255 – 299 kg on centre pivot irrigated pasture for 115 days with an ADG of 0.39 kg/day.
8) Grazing steers in the weight range 255 – 299 kg on dryland forage sorghum for 115 days with an ADG of 0.39 kg/day.
9) Feeding a silage-based feedlot ration to steers in the weight range 255 – 299 kg for 48 days with an ADG of 0.95 kg/day.
10) Feeding a silage-based feedlot ration to steers in the weight range 255 – 299 kg for 36 days with an ADG of 1.25 kg/day.
11) Feeding “Weaner pellets” to maiden heifers weighing <250kg in the dry season before being mated for the first time, for 80 days with an ADG of 0.57 kg/day
12) Feeding “Weaner pellets” to first calf heifers with a pre-calving weight of <430kg, for 80 days with an ADG of 0.57 kg/day
13) Floodplain grazing cull cows in the 350 – 400 kg weight range, for 97 days with an ADG of 0.52 kg/day (data from McCosker 2018).
14) Feeding cull cows in the 350 – 400 kg weight range a silage-based feedlot ration for 34 days with an ADG of 1.5 kg/day.

There were some scenarios where, in the opinion of the authors it was not appropriate to use the measured rate of ADG, and in these cases ADGs from other sources were used. These cases, the reason for not using the measured ADG are given below, with details of the ADG that was used.

5) Floodplain grazing steers in the weight range 255 – 299 kg for 83 days with an ADG of 0.60 kg/day. Many northern producers believe that floodplain ADG should be higher than the average of 0.37 kg/day measured in this study. Therefore, this grazing strategy was also evaluated using an ADG of 0.6 kg/day and without any feeding of pellets before cattle went onto the floodplain. The rates of ADG while eating pellets prior to going to the floodplain recorded in this study were low and so this was not included in the hypothetical scenario, to see if it would be more profitable.

6) Feeding a commercial corn-based ration to steers in the weight range 255–299 kg. The measured ADG was not used as many extra animals entered the feeding paddock each year and therefore intake of the weighed animals was much lower than had been intended, and the resulting ADGs were low (average ADG = 0.25 kg/day). Therefore, an ADG supplied by the company that

produces the feed was used (ADG = 0.79 kg/day). This came from controlled feeding trials that they had conducted (unpublished).

8) Grazing steers in the weight range 255 – 299 kg on dryland forage sorghum. The measured ADG was not used as the gate between the dryland forage sorghum and a large paddock of native pasture remained open so that cattle could move freely between them. Therefore, it is not known how much time (if any) different animals spent grazing the forage sorghum. The measured average ADG of -0.040 kg/day over three years seems much lower than that from other reports of ADG of cattle grazing dryland forage sorghum, and so an average ADG from these reports (Bowen et al. 2015) was used (0.39 kg/day).

10) Feeding a silage-based ration steers in the weight range 255 – 299 kg with an ADG of 1.25 kg/day. While the overall average ADG measured in this study (0.95 kg/day) was used in strategy 9. Many pens of steers had higher recorded rates of ADG and so this additional scenario was evaluated in which a higher ADG (1.25 kg/day) was used.

13) Floodplain grazing cull cows in the 350 – 400 kg weight range, no relevant data was collected for this strategy in this study so data from a study that recorded the ADG of cull cows grazing floodplain pastures on Beatrice Hill Farm was used (McCosker 2018).

14) Feeding a silage-based feedlot ration to cull cows in the 350 – 400 kg weight range. No data was available for this strategy, so data provided by an experienced feedlot industry expert was used.

A summary of the outputs from the GM calculator are shown in Table 31. Under the assumed feed costs and cattle prices, many of the feeding strategies did not generate a positive margin from additional liveweight gain alone, where no increase in the sale price per kilogram was attributed to feeding. This highlights a fundamental challenge for beef producers in northern Australia, where achieving additional liveweight gain does not necessarily translate into improved profitability. The economic outcome depends on the relationship between the value of additional weight produced, the cost of achieving that gain and any additional commercial benefits realised.

The pellet-based feeding strategies demonstrated the importance of feed purchase price, freight and feed conversion efficiency. Despite achieving average daily gains of 0.57 kg/day for weaner pellets and 0.66 kg/day for shipper pellets, the respective margins were negative $127/head and $322/head. The commercial corn-based ration also produced a negative margin of $175/head despite achieving 0.79 kg/day. These results demonstrate that the additional liveweight produced was insufficient to recover the associated feeding costs at the assumed cattle prices. They also reinforce the importance of considering total delivered feed costs, particularly in northern Australia where freight can represent a substantial proportion of the cost of purchased supplements.

In contrast, grazing steers on dryland forage sorghum and irrigated improved pasture generated positive modelled margins of $90/head and $64/head respectively, despite relatively modest average daily gains of 0.30 and 0.39 kg/day. These results illustrate the potential economic advantage of lower-cost feed sources, where slower growth can generate a greater margin than more intensive feeding strategies due largely to the lower costs. However, these outcomes must be interpreted in the context of the capital investment, operating costs, utilisation rates, establishment failure risk and alternative land uses associated with producing forage. A positive margin from grazing a forage crop does not necessarily establish that developing or operating the production system is profitable at a whole-of-business level.

The silage-based steer rations provide a further illustration of the sensitivity of feeding economics to animal performance. At an ADG of 0.95 kg/day, the modelled margin was negative $27/head, whereas increasing ADG to 1.25 kg/day produced a positive margin of $14/head. The improvement in economic performance reflects the greater value of liveweight produced relative to feeding costs and the shorter period required to achieve the target gain. However, the relatively small positive margin in the higher-growth scenario leaves limited capacity to absorb unexpected costs, lower-than-anticipated animal performance or adverse cattle price movements.

The cull cow strategies demonstrated the importance of considering both liveweight gain and changes in market value associated with animal condition and weight. Floodplain grazing produced a positive modelled margin of $162/head, supported by an increase in the price received per kilogram as cows moved into a higher-value weight category under the assumed abattoir pricing schedule and feeding cull cows a silage-based feedlot ration produced a positive margin of $150/head. This highlights the potential value of targeting feeding interventions towards classes of cattle where changes in market specifications or price categories may provide an additional return beyond the value of liveweight gain alone. It should be noted that experienced feedlotters caution that feeding cull cows can quickly become unprofitable if they are fed too long. It is important to monitor them closely and ensure that they are sold before their rates of ADG slow and feed conversion becomes less efficient.

These results also emphasise the importance of considering the timing of feeding and sale. Where feeding enables cattle to reach market specifications earlier, it may provide additional benefits through improved market access, reduced time to turnoff or the release of grazing capacity. Conversely, where fed cattle return to grazing and experience subsequent compensatory growth, some of the liveweight advantage achieved through feeding may be reduced relative to un-fed cattle. These potential benefits and costs are not fully captured by a short-term margin calculated on additional liveweight gain alone.

The break-even cattle prices presented in Table 31, together with the sensitivity analyses, demonstrate how relatively small changes in animal performance, feed costs or cattle prices can alter the economic outcome. Break-even should therefore be considered a reference point rather than an investment target, as producers must also allow for commercial risk, opportunity costs and an acceptable return on capital and management.

Importantly, the economic contribution of a feeding intervention will vary according to the age, class and production stage of the animal and the circumstances of the individual enterprise. Feeding a young steer to achieve earlier turnoff, improving the condition of a cull cow to access a higher-value market, or improving breeder performance may each influence business profitability through different mechanisms. Consequently, the most profitable intervention is not necessarily the one that produces the highest ADG or the lowest cost of gain, but the one that delivers the greatest net benefit within the broader production system.

Table 31. Summary of the outputs from the gross margin (GM) calculator.

Feeding strategy	ADG (kg/day)	DOF (days)	Feed purchase price ($/kg)	Feed cost + freight ($/kg)	Total feed + other costs over feeding period ($/hd)	Intake (kg/hd/day)	Total Feed Costs ($/hd/day)	Cost of Gain ($/kg)	GM/head ($/head)	Break even sale price ($/kg)
1) "Weaner pellets" - steers	0.570	80	$0.920	$1.270	$309.49	2.82	$3.87	$6.88	-$127	$4.40
2) "Shipper" pellets - steers	0.660	69	$0.675	$0.825	$504.36	8.46	$7.31	$11.21	-$322	$5.01
3) Floodplain grazing steers after pellets	0.370	123	$1.05 conc.	$1.350	$201.38		$1.64	$4.48	-$19	$4.06
4) Floodplain grazing steers - no pre-feeding	0.420	107	na	na	$124.28	na	$1.16	$2.76	$55	$3.83
5) Floodplain grazing steers - ADG=0.6 kg/day	0.600	75	na	na	$107.76	na	$1.44	$2.39	$72	$3.77
6) Commercial corn-based ration - steers	0.790	57	$0.993	$1.193	$355.15	4.85	$6.23	$7.89	-$175	$4.55
7) Pivot irrigated pasture grazing - steers	0.390	115	na	Na	$137.78	8.33	na	Na	$64	$3.80
8) Dryland forage sorghum grazing - steers	0.300	115	na	Na	$89.53	8.33	$0.78	$1.99	$90	$3.72
9) Silage based feedlot ration - Low ADG - steers	0.950	48	$0.276	$0.276	$209.68	12.41	$4.37	$4.66	-$27	$4.09
10) Silage based feedlot ration - High ADG- steers	1.250	36	$0.276	$0.276	$166.12	12.4	$4.61	$3.69	$14	$3.96
11) "Weaner pellets" - maiden heifers	0.570	80	$0.920	$1.270	n/a	n/a	n/a	n/a	*	*
12) "Weaner pellets" - first calf heifers	0.570	80	$0.920	$1.270	n/a	n/a	n/a	n/a	*	*
13) Floodplain grazing-cows	0.517	97	na	$0.276	$145.630	10.1	na	na	$162	$2.09
14) Silage based feedlot ration - cull cows	1.500	34	$0.307	$0.307	$159.04	11.3	$4.61	$3.69	$150	$2.12

The assumptions used in Table 31 are:

- The steers fed are in the weight range 255-299 kg

- The maiden heifers fed are those with a PM Wt < 250 kg

-The first calf heifers fed are those with a PC Wt of < 430 kg

- The cull cows fed are in the weight range 350-450 kg

- The steer "buy price" and "sell price" (the cattle price used to value steers at the start and end of the feeding period) was $4:00/kg except where stated otherwise.

-The cull cow "buy price" was $1.97/kg LW (for cows with an average starting weight of 350 kg), and the "sell price" was $2.49/kg LW (for cows with an average slaughter weight of 400 kg after feeding).

- "Total feed and other costs" for the feeding strategies was the actual cost of implementing the feeding strategy and included the following things where relevant: the purchase price of the feed, freight, labour, equipment required for feeding, clearing and irrigation costs, and floodplain agistment costs ($4.75/week for steers and $5.50/week for cull cows).

- The economic analyses used representative commercial assumptions for each strategy while recognising that local conditions, feed quality, labour availability and management skill influence outcomes.

** GM and break-even price were not calculated for the heifer strategies as animals are not sold after feeding. Their feed costs are shown in this table, and were used in economic evaluation with Breedcow Dynama.*

When interpreting data from Table 31, it should be understood that the GM calculator used a cattle input price of $4.00/kg, and that the strategies may be profitable at higher cattle output prices. For example, Strategy 1 (Weaner pellets fed to steers) has a strongly negative margin per head (-$127) at a cattle input price of $4.00/kg, however, if the cattle output price exceeds the break even price of $4.40 after feeding, then the strategy could become profitable

Given the tight relationship between feed cost, ADG and the value of additional liveweight (i.e. from the increase in LW and changes in cattle sale price), sensitivity analysis is critical to interpreting the economic results. The economic summary (Table 31) describes performance under the observed treatment conditions, while the sensitivity tables shown in Tables 32-37, etc identify the combinations of feed cost and cattle output price at which each strategy breaks even for different feed purchase prices. Importantly, these tables also provide producers with a simple quick-reference tool to identify the range of conditions under which a feeding strategy may be economically viable, without requiring them to undertake detailed calculations themselves. This is particularly valuable where feed and cattle prices change rapidly, allowing producers to quickly assess whether current conditions warrant further investigation of a feeding opportunity. They are intended as a first-pass screening tool rather than a substitute for enterprise-specific analysis, helping producers identify which opportunities warrant more detailed assessment.

Break-even prices were used as an indicative reference point in the sensitivity analyses rather than prescribing a minimum acceptable profit margin. This approach recognises that individual producers have different risk appetites, financial circumstances, opportunities to secure forward pricing and expectations of return on investment. While break-even represents the point at which the modelled costs of a feeding strategy are recovered, it does not necessarily represent an economically attractive investment. Producers must consider the additional margin required to compensate for production and market risks, the opportunity cost of capital and alternative uses of available resources. Presenting break-even prices therefore provides a consistent basis for comparing feeding strategies while allowing individual producers to determine the level of profitability required to justify investment within their own business circumstances.

Both approaches provide producers with practical quick-reference tools to identify the range of conditions under which feeding may be economically viable, without requiring detailed calculations or economic modelling. This is particularly valuable where feed and cattle prices change rapidly, allowing producers to assess whether prevailing market conditions warrant further investigation of a feeding opportunity. The tables are intended as first-pass screening tools rather than substitutes for enterprise-specific economic analysis. They also allow the findings of the project to remain relevant as costs and prices change.

The results of the sensitivity analyses are shown in Tables 32-37 for feeding strategies for which the feed purchase price can easily be obtained, and Table 38 for varying floodplain agistment costs. They show the break-even cattle price required at different feed costs using the ADGs and intakes from this study.

1) "Weaner pellets" fed to 500 steers (weight range 255-299 kg) with an intake of 2.82 kg/day, and ADG of 0.57 kg/day fed for 80 days to gain 45 kg. Freight = $350/t, Cattle “buy price” = $4.00

Table 32. Sensitivity analysis - Weaner pellets fed to 255-299 kg steers.

Feed purchase cost ($/T)	Break even cattle sale price ($/kg)**
700	$4.24
750	$4.28
800	$4.31
850	$4.35
900	$4.38
920*	$4.40
950	$4.42
1000	$4.45
1050	$4.49

**The actual purchase cost in this study.*

*** Calculated at a constant input price of $4.00 $/kg*

For this feeding strategy to break even, a cattle output price of $4:40/kg is required which is a significant increase above the reference cattle input price used in the modelling of $4:00. Much higher cattle price would be required for the strategy to be profitable enough to justify changing the production system. Table 32 shows that large reductions in feed purchase price still require cattle

sale prices that are well above the reference cattle price of $4:00/kg to break even. This is largely due to the high price of the pellets, but it should be noted that these pellets are not designed for the purpose they were used for in this project (i.e. long term feeding).

2) "Shipper pellets" fed to 500 steers (weight range 255-299 kg) with an intake of 8.46 kg/day, and with an ADG of 0.66 kg/day fed for 69 days to gain 45 kg. Freight = $150/t, Cattle “buy price” = $4.00.

Table 33. Sensitivity analysis - Shipper pellets fed to 255-299 kg steers.

Feed purchase cost ($/T)	Break even cattle sale price ($/kg)**
550	$4.78
600	$4.87
650	$4.96
676*	$5.01
700	$5.05
750	$5.14
800	$5.24
850	$5.33

**The actual purchase cost in this study.*

*** Calculated at a constant input price of $4.00 $/kg*

Table 33 shows that very high cattle sale prices would be required to break-even when using this strategy, even at feed purchase prices that are much lower than the current price. This is largely because of the high intake required for this strategy.

3) Commercial corn-based ration fed to 500 steers (weight range 255-299kg) with an intake of 4.85 kg/day, and with an ADG of 0.79 kg/day fed for 57 days to gain 45 kg. Freight = $200/t, Cattle “buy price” = $4.00.

Table 34. Sensitivity analysis - Commercial corn-based ration fed to 255-299 kg steers

Feed purchase cost ($/T)	Break even cattle sale price ($/kg)**
800	$4.38
850	$4.42
900	$4.47
950	$4.51
993*	$4.55
1050	$4.60
1100	$4.64
1150	$4.68

**The actual purchase cost in this study.*

** *Calculated at a constant input price of $4.00 $/kg*

Table 34 shows that high cattle sale prices would be required to break-even, even at feed purchase prices that are much lower than the current price.

4) Silage based feedlot ration fed to 500 steers (weight range 255-299 kg) with an intake of 12.41 kg/day, and with an ADG of 0.95 kg/day fed for 48 days to gain 45 kg. Cattle “buy price” = $4.00.

Table 35. Sensitivity analysis - Silage based feedlot ration fed to 255-299 kg steers with an ADG of 0.95 kg/day.

Feed purchase cost ($/T)	Break even cattle sale price ($/kg)**
200	$3.94
250	$4.04
276*	$4.09
300	$4.13
350	$4.22
400	$4.32
450	$4.41
500	$4.50

**The actual purchase cost in this study.*

** *Calculated at a constant input price of $4.00 $/kg*

Table 35 shows that at this rate of ADG the cost of the silage based feedlot ration would have to be below $250/t to break even at the current cattle price of $4/kg.

6) Silage based feedlot ration fed to 500 steers (weight range 255-299kg) with an intake of 12.41 kg/day, and with an ADG of 1.25 kg/day fed for 36 days to gain 45 kg. Cattle “buy price” = $4.00.

Table 36. Sensitivity analysis - Silage based feedlot ration fed to 255-299 kg steers with an ADG of 1.25 kg/day.

Feed purchase cost ($/T)	Break even cattle sale price ($/kg)**
200	$3.85
250	$3.92
276*	$3.96
300	$3.99
350	$4.06
400	$4.13
450	$4.20
500	$4.27

**The actual purchase cost in this study.*

** *Calculated at a constant input price of $4.00 $/kg*

Table 35 indicates that this strategy does slightly better than breaking even at the actual current feed cost ($276/t) and cattle price ($4/kg).

7) Silage based feedlot ration fed to 500 cull cows with an ADG of 1.50 kg/day fed for 34 days to gain 51 kg (from 350 kg - to 401 kg), which increases the sale price received by $0.52/kg LW. Cow "buy price = $1.97" (cow value = $690 for a 350kg cow), cow "sell price" = $2.49/kg (cow value = $996 for a 400kg cow).

Table 37. Sensitivity analysis - Silage based feedlot ration fed to 350-400 kg cull cows with an ADG of 1.5 kg/day.

Ration cost ($/T)	Break even cattle sale price ($/kg)
200	$2.01
250	$2.06
307*	$2.12
350	$2.16
400	$2.21
450	$2.25
500	$2.30

**The actual ration cost in this study.*

Table 37 shows that this strategy is quite profitable as, even at much higher ration costs, the break-even price is well below the current cattle price of $4/kg.

Table 38. Sensitivity analysis – Floodplain grazing of 255-299 kg steers with an ADG of 0.60 kg/day and no pre-feeding with pellets.

Agistment price ($/head/week)	Break even cattle sale price ($/kg)
4.00	$3.75
4.75*	$3.77
5.50	$3.80
6.00	$3.82

**The actual agistment cost price in this study.*

Table 38 shows that large increases in agistment cost have relatively little effect on the break-even sale price, and that the break-even sale price at this rate of ADG is well below the current cattle price of $4/kg.

These tables provide producers with a simple quick-reference resource to identify the range of conditions under which a feeding strategy may be economically viable, without requiring them to undertake detailed calculations themselves. This is particularly valuable where feed and cattle prices change rapidly, as they allow producers to quickly assess whether current conditions warrant further investigation of a feeding opportunity. They are intended as a first-pass screening

tool to help producers identify which opportunities may warrant more detailed assessment, and they are not a substitute for enterprise-specific analysis. The sensitivity analyses provide information that can be used to evaluate strategies as costs and prices change.

The break-even price is used as an indicative threshold for profitability, rather than a recommended trading price. The profit margin required above the break-even price will vary between businesses according to their appetite for risk, confidence in achieving the assumed ADG, exposure to feed and cattle price changes, ability to secure feed and forward pricing, access to working capital, and the consequences of an adverse outcome. Producers should therefore apply an appropriate margin of safety above the calculated break-even price when assessing whether a feeding opportunity is sufficiently attractive to proceed with adoption. There is no single appropriate target margin above break-even that applies in all situations, and the required margin of safety should increase as uncertainty in animal performance, feed costs and sale price increases.

GM per head and the break-even price are simplistic indications of whether a strategy is profitable under a defined set of conditions (cattle price, ADG etc.), and they do not capture any flow of benefits or costs to the business. Therefore, a more detailed full property economic analysis has been undertaken using a herd modelling approach to assess the strategies more fully without compromising the privacy of any individual producers.

Economic assessment of strategic investments

Strategies that result in a change to capital investment or herd structure require assessment of the effects on whole of business profitability through time. Regional economic models were therefore developed to assess these strategies over a longer investment period and account for the annualised cost of capital investment. This enabled the economic performance of longer-term development strategies to be considered alongside shorter-term feeding opportunities, while recognising differences in capital requirements, operating costs and the timing of financial returns.

Desk-top analyses were undertaken to model the whole-of-herd impacts on the herd structure, productivity and profitability of a typical cattle property in the Katherine region using the Breedcow Dynama software suite of programs (Holmes et al. 2017) and the methodology of Bowen and Chudleigh (2021). The Dynama parameters used for a representative herd in the Katherine region and the outputs from the Dynama modelling are shown in Appendix 1. The outputs are shown in Table 39.

Table 39. Outputs of economic analysis using the Katherine representative herd.

Strategy	NPV of change	Annualised NPV	Peak deficit (with interest)
Weaner pellets fed to 150-199kg steers (N=500), with no increase in $/kg received	-$868,298	-$112,449	-$1,414,366
Weaner pellets fed to 150-199kg steers (N=500), with an increase of $0.40/kg in the price received*	-$429,183	-$55,581	-$699,094
Weaner pellets fed to maiden heifers with a PM Wt of <250kg (n=253)	-$345,485	-$44,742**	-$562,759
Weaner pellets fed to 1st calf heifers with a PC Wt of <430 kg (n=1059)	-$2,490,600	-$322,544	-$4,056,925
Floodplain grazing 150-199kg steers (N=500), with an ADG of 0.4 kg/day and no increase in $/kg	-$445,975	-$57,756	-$726,446
Floodplain grazing 150-199kg steers (N=500), with an ADG of 0.6 kg/day and no increase in $/kg	-$388,241	-$50,279	-$632,404
Floodplain grazing 150-199kg steers (N=500), with an ADG of 0.6 kg/day and a $0.40/kg increase in cattle price received after floodplain grazing.	$42,702	$5,530	na

**In some years the live export price received for cattle in November can be $0.40 higher that the price in the middle of the year (although this effect is not consistent).*

***The reason that the annualised NPV appears less negative for the maiden heifer feeding strategy compared to feeding steers is that less animals were fed.*

The strongly negative NPVs reported for the pellet-feeding scenarios in Table 39 demonstrate that the additional production benefits, under the assumptions modelled, were insufficient to offset the costs of implementing these strategies within the representative breeding enterprise. This is largely due to the high cost of the pellets, however, it should be noted that the pellets were not designed for the purpose in which they were used in this trial i.e. long-term feeding. The substantial peak deficits also highlight the potential cashflow and financing implications of introducing feeding strategies, even where the objective is to improve longer-term herd productivity. Together, these indicators reinforce the importance of assessing feeding interventions within the whole-business context rather than relying solely on animal performance or short-term gross margins. It is important to re-iterate that producers would likely be implementing feeding strategies to capture price changes as well as liveweight increase (e.g. the scenario with a $0.40/kg increase in cattle price after floodplain grazing in Table 39) and this analysis is not suggesting collaborating producers were implementing unprofitable strategies.

A contributing factor to steer feeding strategies with positive GMs having negative annualised NPV is that in the economic modelling, the feeding and early sale of steers frees up pasture which is used by an expanded breeding herd with a 55% weaning rate. The modelled breeder herd has a lower GM per AE after interest than steer production, and so the effect of expanding the breeder herd is to reduce the profitability of the whole property compared to the property without the

feeding strategy. Therefore, the break-even GM analysis for feeding steers can produce a positive result and, at the same time, reduce the overall profitability of the beef business.

The negative annualised NPV of most of the feeding strategies evaluated highlights how important it is for producers to consider all the economic impacts of feeding strategies before taking steps to implement them. There is also a need for northern producers to gain skills in more intensive cattle feeding systems and to share knowledge on how best to increase profit and decrease risk when implementing feeding strategies. These results also highlight why it is important to ensure the existing business model has been optimised before introducing more risk through feeding strategies. For example, Bowen et al. (2020) demonstrated that correcting a P deficiency in the Katherine region resulted in a large increase in annualised NPV (>AU$500 000) and had an internal rate of return of 172%. This analysis was done using a similar methodology and a very similar representative herd model.

It should be noted that some feeding strategies may create value that is not easily captured. Strategic benefits may include improved drought preparedness, greater marketing flexibility, improved utilisation of seasonal feed resources, reduced mustering frequency or labour costs, increased carrying capacity, improved breeder performance or access to higher-value markets. Strategies can also have a positive effect on property valuation. The analyses undertaken for this study have focussed on operating profit not allowed for any returns from capital gains or some of these other potential benefits. Where property managers feel that potential for such value creation arises from feeding exercises, such factors should be included in the investment analysis undertaken at their property or business enterprise level.

Collectively, these findings support a more targeted approach to intensification in northern beef enterprises. Feeding strategies should be evaluated against clearly defined production and market objectives, with consideration given to their direct costs, effects on herd productivity, capital requirements and whole-of-business profitability.
The overarching message is that when introducing feeding strategies there is an imperative to identify and monitor the critical production and economic KPIs, particularly animal growth rates, feed intake, cost of gain and market prices, so that producers can recognise when actual performance deviates from the assumptions underpinning profitability and make timely management adjustments before losses accumulate.
The implications for future research, producer decision-support and investment priorities are addressed in the recommendations section of this report.

3.4 Potential for carbon credits

An example of how lifetime emissions can be reduced through feeding strategies is shown in Table 40. It shows a representation of a steer from birth to a target sale weight of 300 kg under three different scenarios in which the feeding strategy used at VRRS (Ridley Northern Weaner pellets) was fed in either Year 1, Year 2, or not at all. The figures in Table 40 were obtained by inputting data recorded at VRRS into an emissions calculator (Primary Industries Climate Challenges Centre 2026). The hypothetical calf is born in November and weaned in the following year at 175 kg. It has an annual LWG of 107 kg grazing native pasture in the first post weaning year and 117 kg in the second post weaning year. If the animal was fed, it had a growth rate of 0.433 kg/day during the feeding period. Compensatory gain of 5kg was allowed for in the “Feeding in year 1” strategy. The weights shown each month in Table 40 are for the first day of that month in the modelling.

Table 40. Example of growth paths used in calculation of lifetime CO_2 equivalent amounts for a representative steer with three different growth paths.

Post wean year	Month	Season	Event	Weight (kg) - No feed	Weight (kg) - Feed Yr1	Weight (kg) - Feed Yr2
	Nov	Wet	Born	25	25	25
	Dec	Wet		50	50	50
	Jan	Wet		75	75	75
	Feb	Wet		100	100	100
	Mar	Dry		125	125	125
	Apr	Dry		150	150	150
	May	Dry	Weaned	175	175	175
1	Jun	Dry		175	175	175
1	Jul	Dry		175	175	175
1	Aug	Dry		175	175	175
1	Sep	Wet	Feeding Yr1	175	175	175
1	Oct	Wet	Feeding Yr1	175	188	175
1	Nov	Wet	Feeding Yr1	175	201	175
1	Dec	Wet		175	214	175
1	Jan	Wet		196	234	196
1	Feb	Wet		217	254	217
1	Mar	Dry		238	274	238
1	Apr	Dry		259	294	259
1	May	Dry		280	314	280
2	Jun	Dry		282		282
2	Jul	Dry	Feeding Yr2	284		284
2	Aug	Dry	Feeding Yr2	286		296
2	Sep	Wet	Feeding Yr2	288		309
2	Oct	Wet		290		
2	Nov	Wet		292		
2	Dec	Wet		294		
2	Jan	Wet		315		
2	Feb	Wet		336		
2	Mar	Wet		357		
2	Apr	Wet		378		
2	May	Dry		399		

When the growth paths from Table 40 are used in the emissions calculator, it estimates that the lifetime CO_2 equivalent emissions are 3.8 tonnes for an un-fed animal, 2. 2 tonnes for an animal

fed in the first post weaning year and 2.89 tonnes for an animal fed in the second post weaning year. The differences come from the younger ages at which the animal can be turned off.

Using these figures, compared to a steer that just grazes native pasture and does not get fed pellets, the same steer that gets fed in the first post weaning year would have 1.6 t less CO_2 emissions and a steer fed in the second post weaning year would have 0.91 less CO_2 emissions. At a carbon credit price of $40/t, a property that sells 1,000 steers per year could potentially get $64,000 worth of carbon credits per year from using the feeding in the first post weaning year strategy.

Note that the total CO_2 equivalent amounts shown here are indicative for demonstration purposes only, as there are many variables that can influence this (e.g. geographical area, pasture type, supplementation, property inputs etc.). Also that this is a hypothetical example calculated using the previous methodology.

3.5. Virtual fencing - Results and Discussion

3.5.1 Audio cues and pulse frequencies during the training and trial period

Audio cues and pulse frequencies decreased from the training period to the trial period across all sites, which was expected as animals were conditioned to the virtual fencing neckbands. Data was obtained for a one-week period within the training period and a random week within the trial period the following, to show the effectiveness of animals learning the virtual boundary cues. The average number of pulses received per day per animal during the random week within the trial period was zero across all properties (Table 41). This result indicates that the animals rarely challenged the virtual fence once training had been completed.

Table 41. The average number of audio cues and pulses received per animal per day across the training and trial periods at each of the properties.

Location	Kidman Springs		Manbulloo Station		Larrakeyah Station	
Period	Training	Trial	Training	Trial	Training	Trial
Audio cues received	2.6	0.1	2.2	0.2	5.5	0.9
Pulses received	0.7	0	0.7	0	1.4	0

The frequency of the audio cues increased with smaller paddock size (e.g. on the pivot area at Larrakeyah station) as animals have more restricted movement than in larger paddocks (Table 41). Overall, the observed reduction in pulse frequency in the trial period across all sites suggests that the training period was effective in teaching the animals to associate the audio cue with the virtual fence boundary (Table 41)

3.5.2 Performance of eShepherd virtual fencing neckbands

The eShepherd neckbands (VF collars) worked well at all sites. All 100 deployed at Manbulloo worked for the entire trial period (Table 42). At Kidman Springs, all neckbands worked well. There was one animal that escaped the virtual fenced area and returned to its home range early in the trial, and this neckband was turned off remotely due to the animal not being within the trial area. This was a deliberate decision and not a fault of the neckband. At Larrakeyah all neckbands that remained on animals worked well. Sixteen neckbands fell off animals due to being fitted too loose (an error from an inexperienced technician fitting them on smaller heifers, rather than a flaw in the neckband), and these neckbands were subsequently turned off and deactivated once they had fallen off. The sampling interval setting on the neckbands was set to provide a geolocation update every 10 minutes, when good connectivity to the tower could be achieved. This was achieved mostly at Manbulloo with an average sampling internal of 11.8 minutes (Table 42). Slight increases in this sampling interval were seen at Kidman Springs and Larrakeyah, as these locations had fewer towers and further distances between towers and neckbands (Table 43).

Table 42. Summary of working neckbands and sampling interval for all 3 properties.

Site	Number of working devices	Average sampling interval per day in minutes (range in brackets)
Manbulloo Station	100	11.8 (10.3 - 19.6)
Kidman Springs	44	19.7 (11.7 - 48.3)
Larrakeyah Station	84	24.3 (14.4 - 404.4)

Table 43. Summary of towers, and distances to towers for all 3 trial properties.

Site	Number of towers	Average read distance to tower (m)	Maximum read distance to tower (m)
Manbulloo Station	4	529.9	2,100.93
Kidman Springs	2	2,770.4	6,204.7
Larrakeyah Station	1	1,695.5	2,471.9

VF performance - Manbulloo Station

All 100 deployed eShepherd neckbands were functional for the full deployment period at Manbulloo Station, with no days where data collection was absent (Figure 7). Occasional increases in the average daily sampling interval above 30 minutes were observed in 20% of animals, however the majority of animals maintained average daily sampling intervals below 20 minutes throughout the trial.

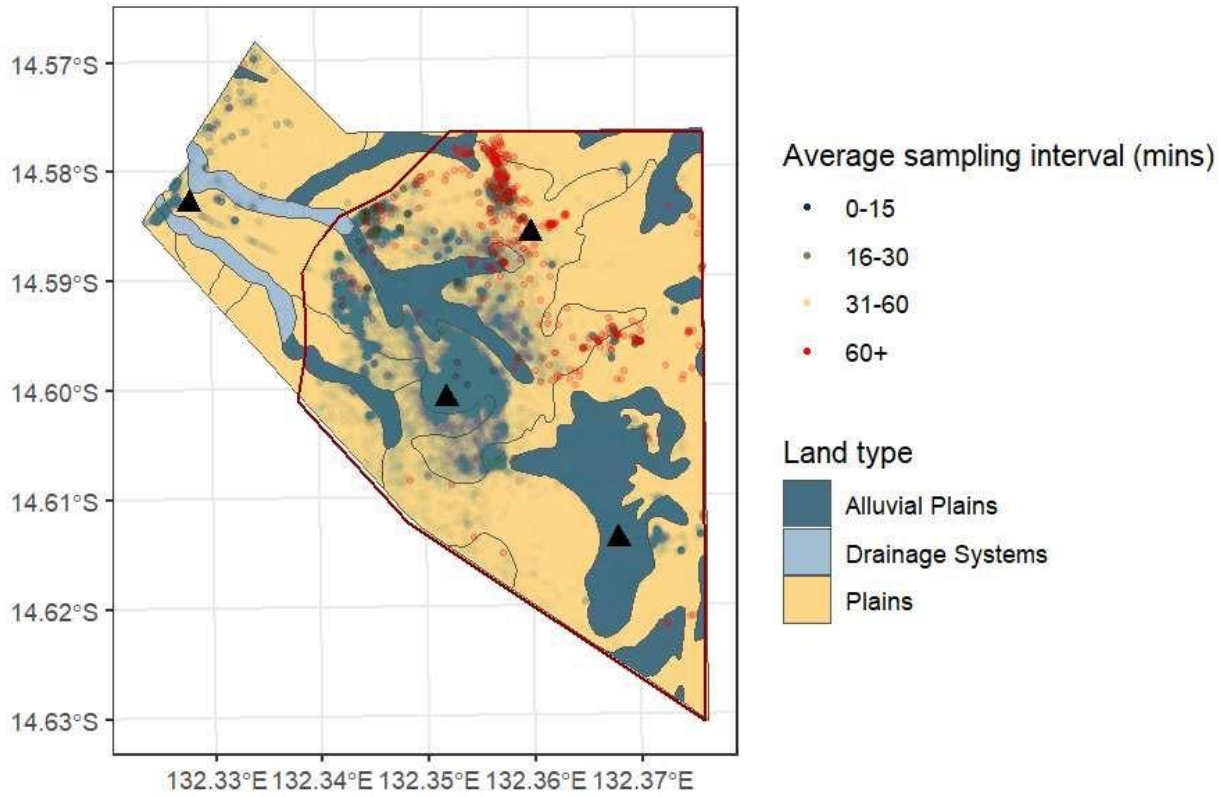


Figure 7. The average sampling interval (mins) between data points.

Network tower locations are denoted by black triangles. The dark red polygon denotes the area where the animals were virtually fenced in.

VF performance - Kidman Springs (VRRS)

At Kidman Springs, 98% of the 45 deployed eShepherd neckbands remained functional throughout the trial period. Thirty-nine neckbands experienced at least one day of non-functionality, however, all neckbands resumed normal functioning following these periods.

In the days preceding and following periods of neckband malfunction, the average sampling interval frequently increased, suggesting a gradual degradation in connectivity prior to the cessation of functionality. This may indicate that the neckbands were progressively moving beyond optimal communication range of the network towers.

Despite these intermittent disruptions, overall performance remained high, with the average sampling interval maintained below 20 minutes for on average 93.7% of each animal's deployment period (Figure 8).

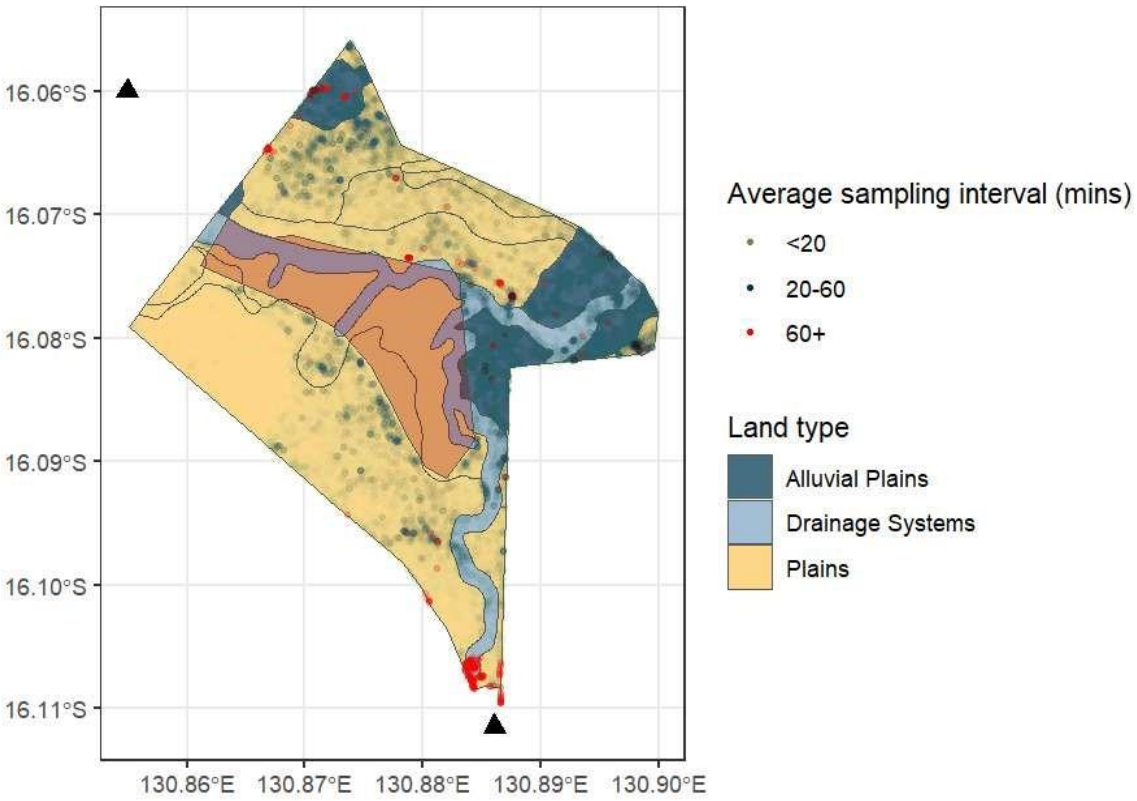


Figure 8. The average sampling interval (mins) between data points.

Network tower locations are denoted by black triangles. The excluded area is highlighted in an orange polygon.

VF performance - Larrakeyah Station

One hundred eShepherd neckbands were deployed at Larrakeyah Station but 16 fell off the animals and so were deactivated. All remaining 84 neckbands successfully recorded data during the trial period. Four neckbands had periods where the sampling interval exceeded 60 minutes (Figure 9). Three of these neckbands had multiple days with a sampling interval greater than 60 minutes, while the remaining neckbands experienced a single day of poor sampling, after which sampling intervals returned to below 60 minutes.

An additional four devices did not capture data over the entire deployment period – two neckbands captured data for 11 days out of the 19 days in the trial, and the remaining two captured data for five of the 19 days.

Overall, the devices performed well. Seventy-five animals maintained average daily sampling intervals below 30 minutes for the entirety of the deployment period, while the average proportion of each animal's deployment period with sampling intervals below 30 minutes was 98.2% (Figure 9).

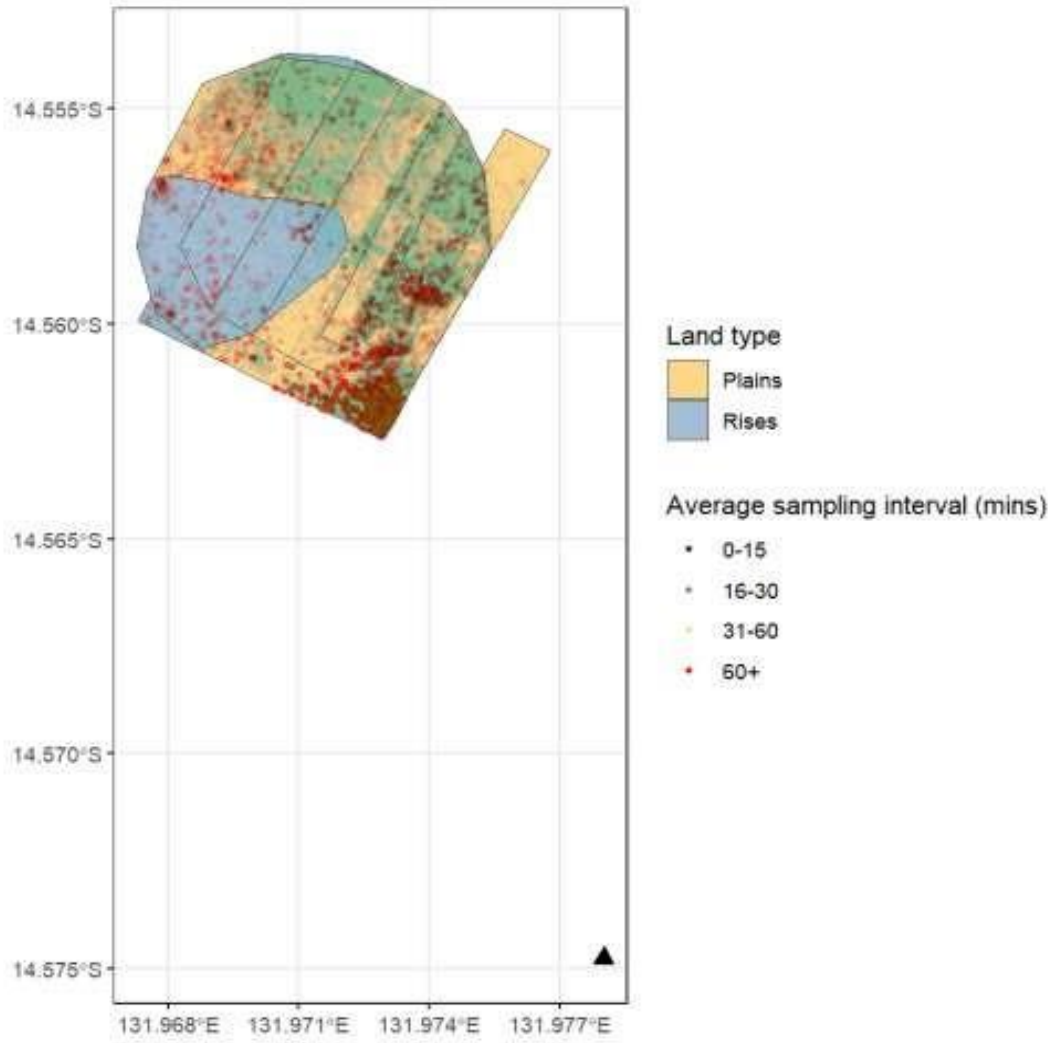


Figure 9. The average sampling interval (mins) between data points.

Network tower locations are denoted by black triangles.

3.5.3 Breaches of the virtual fences during the trial period

Manbulloo Station – breaches of VF

Across the deployment period at Manbulloo, five animals breached the virtual fence on six separate occasions (Figure 10). Two of the animals had not returned to the fenced area before the conclusion of the trial, while two returned within several hours and one animal returned after one day. These animals did not breach the virtual fence again during the deployment period.

During each fence breach, the animals received audio cues and pulses from the neckbands but continued beyond the virtual fence. This suggests that the audio cues and pulses were insufficient to deter the animals under the conditions at the time. One animal breached the fence to access the old watering point, indicating a clear motivation for crossing (Figure 10). In contrast, the remaining breach events accessed random locations within the north-west quadrant of the paddock, with no obvious spatial pattern or identifiable attractant.

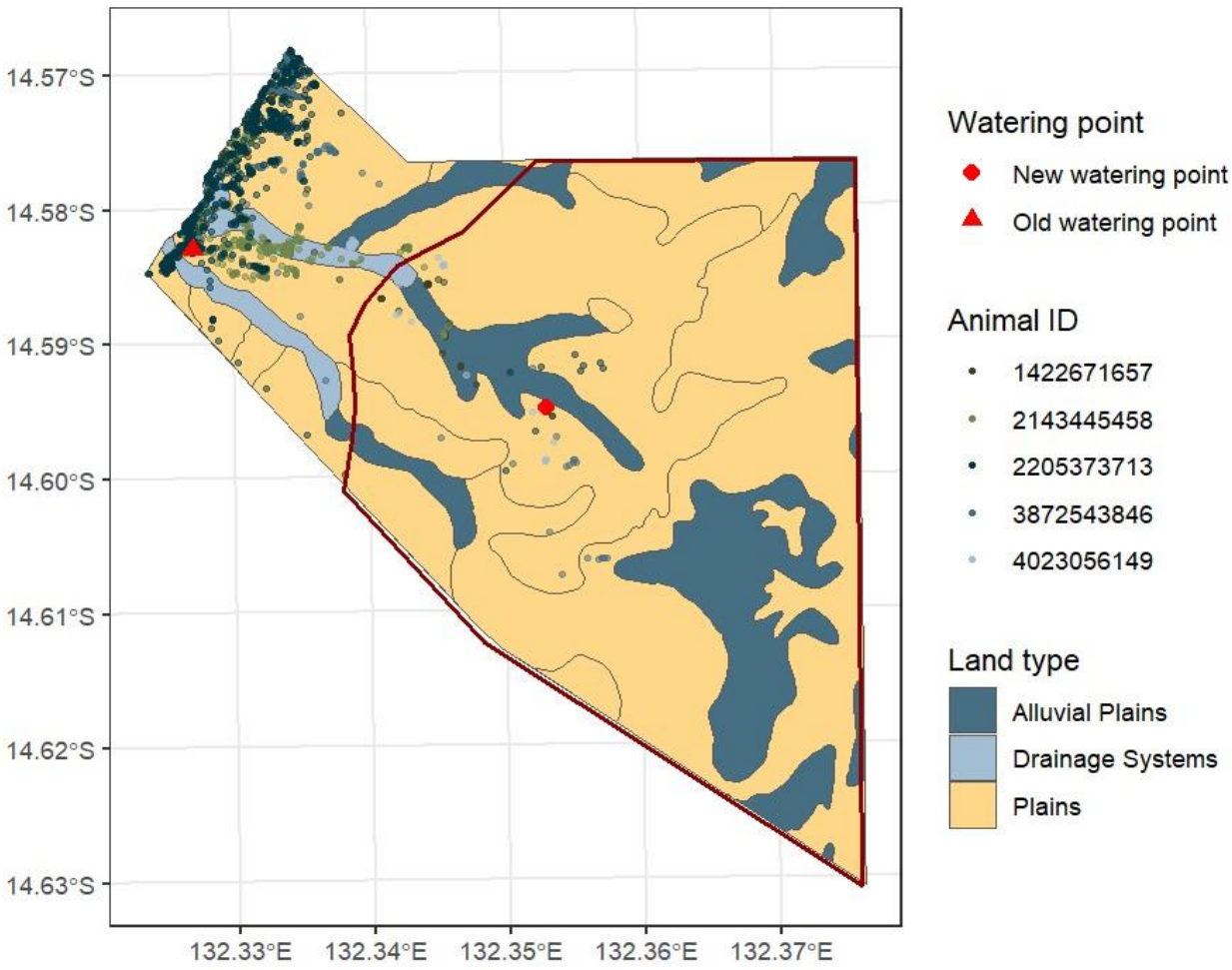


Figure 10. Land types and locations of the animals that breached the virtual boundary during the trial period at Manbulloo.

Kidman Springs – breaches of VF

A virtual fence was set up to exclude animals from a “scald” area in the centre of the paddock that usually gets overgrazed each year (Figure 11). No animals entered the excluded scald area for the duration of the trial period. One animal, however, escaped the virtual paddock on 14/7/25 and jumped a physical fence into another paddock and did not return during the trial period (Figure 11). Sixteen animals escaped the trial paddock during the trial where weaners from another paddock had got into the virtual paddock and their presence lured out collared cows into an area they were virtually excluded from. This was an event that occurred within a short period of time and once it was apparent that weaners were involved in the virtual boundary, it was moved to accommodate cows and allow them to move with the weaners into another part of the paddock. This was a positive learning experience for the research team and showed that when mixed with other animals that do not have virtual boundaries, it may be difficult to effectively control animals virtually in such circumstances.

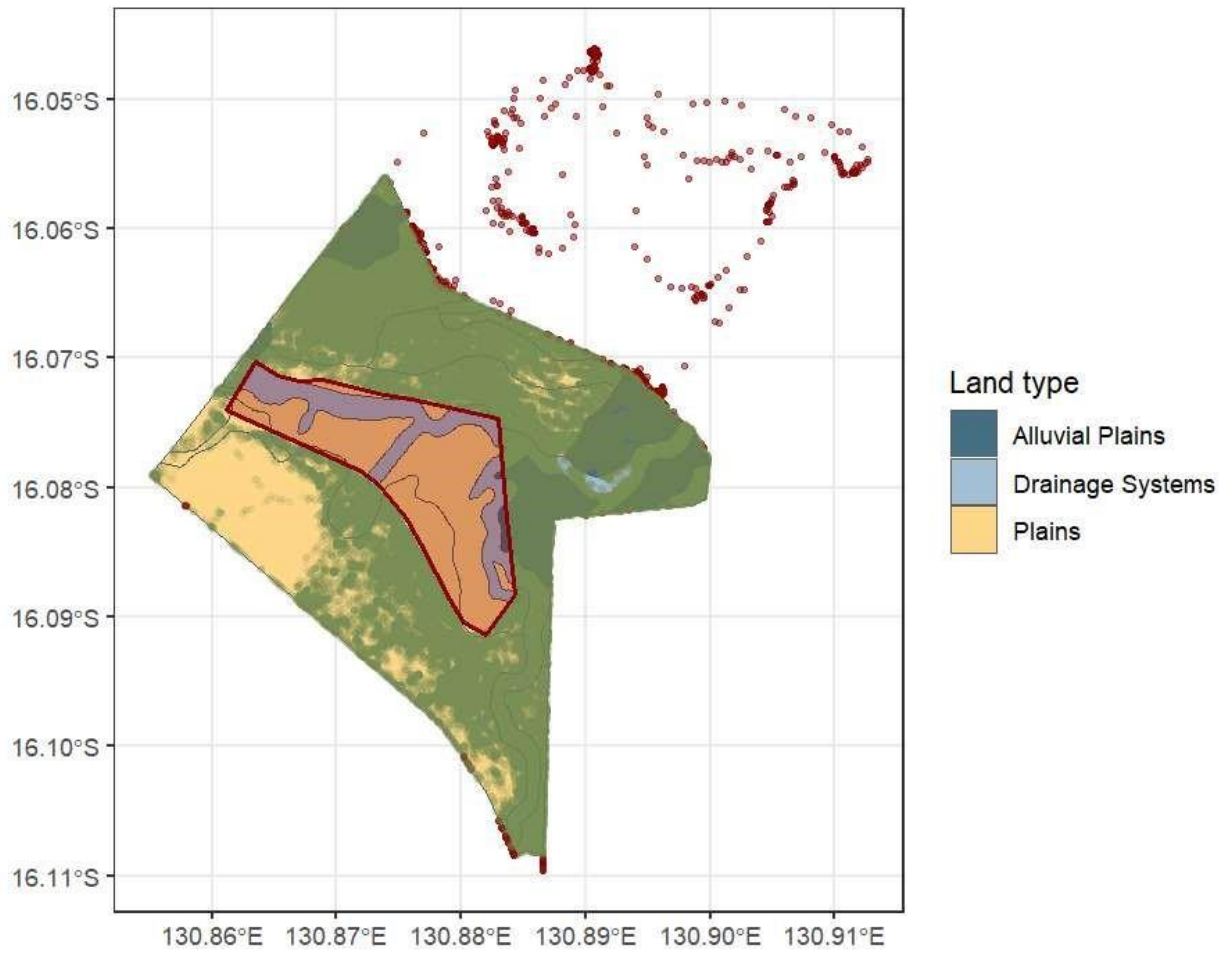


Figure 11. The VRRS trial paddock and GPS locations of the escaped animal.

The exclusion zone in centre of paddock is shown in a red polygon in Figure 11. The red dots outside the paddock show that this animal did not return to the trial paddock.

Larrakeyah Station – breaches of VF

Two fence breach events occurred across virtual fences during the trial period at Larrakeyah Station. A single incident involved one animal which received eight audio cues and five pulses before briefly crossing the virtual fence and immediately returning to the fenced area.

Virtual boundary breaches were difficult to quantify in the small and intensive trial scenario on the pivot area at Larrakeyah. When a virtual boundary was changed, animals received the new paddock boundaries at different times depending on their proximity and connectivity to the tower. This made analysing data to identify fence breaches difficult as not all animals had the same paddock area at the same time (Figure 12). There were also 4 animals at Larrakeyah which were not in the Strip grazing trial, however, a number of these animals were in the pivot paddock during the Strip grazing trial event (after having breached physical fences to enter) so this was also a consideration when assessing VF breaches.

Difficulties with identifying fence breaches were also attributed to the association of audio and pulse frequency with each geolocation interval contained in the data output available from eShepherd. The data included the total number of audio and pulse events within the timeframe between consecutive geolocation updates, however only one GPS location is given per update. Therefore, some geolocations contained with the datapoint may not represent exactly where the audio or pulse was given, especially if multiple were received within the interval between each geolocation.

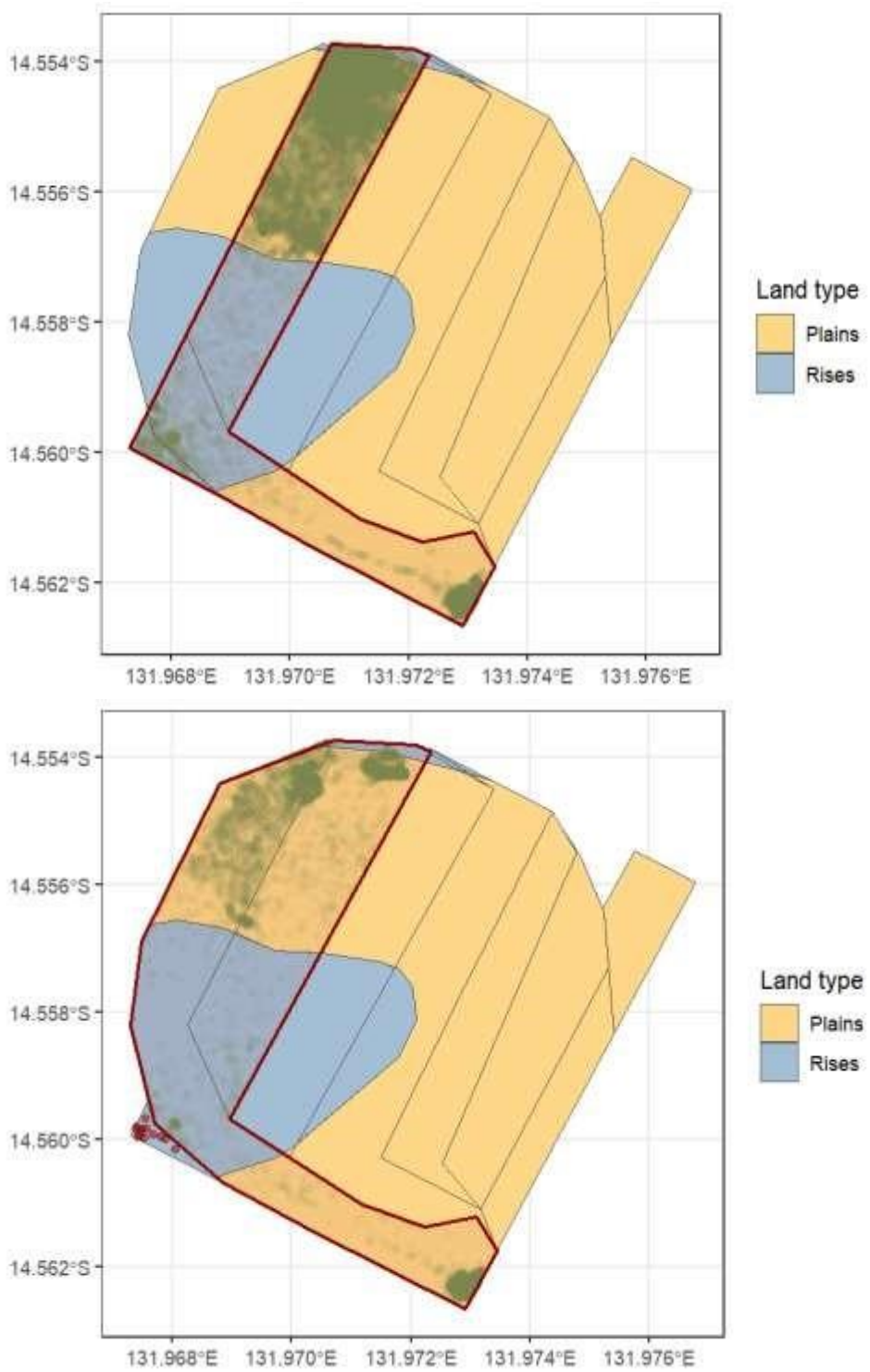


Figure 12. Example of a virtual paddock breach event, where areas overlapped in the pivot area.

The top panel in Figure 12 shows where virtual boundary was set, and bottom panel shows where virtual boundary was moved to, with red dots indicating breach events, though this was likely attributed to the neckbands not receiving the new virtual paddock boundaries yet.

3.5.4 Changes in spatial utilisation following water point exclusion at Manbulloo Station

A virtual fence was set up around a new water point in the paddock at Manbulloo, to try to get the cows to utilise this water point and not return to their old water point. If this was successful it would create more even grazing of the paddock, as the area around the old water point was becoming overgrazed while there were other areas in the paddock (further from the old water point) that appeared to be un-grazed.

During the trial period, the VF collared animals were successfully contained within the virtual fence, with only two animals breaching the exclusion zone to access the original watering point (Figure 13). Grazing activity was centred around the new watering point, with animals remaining an average of 3,253 ± 810m from this water source.

Following the removal of the virtual fence, the animals rapidly resumed use of the original watering point (Figure 14), indicating a strong preference for the original water source. Most animals consistently utilised the watering point throughout the post-trial period, while visits to the new watering point became relatively infrequent and sporadic. Some animals did continue to utilise the area around the new watering point, with an average distance of 2307 ± 1014m from the new watering point and 1614 ± 1647m from the original watering point during the post-trial period. On average, animals spent 59 ± 27.0% of their time closer to the original watering point than the new watering point.

These findings suggest that virtual fencing can effectively redirect animals to a newly established watering point while the exclusion is in place, however, once access to the original watering point was restored, most animals rapidly reverted to using it as their primary water source. Despite this, continued use of the area surrounding the new watering point suggests that the animals did not completely abandon the grazing patterns established during the exclusion period. This indicates that temporary virtual fencing could be used to influence subsequent grazing distribution, although longer exclusion periods or permanent decommissioning of the original watering point may be required to achieve a lasting shift in watering behaviour.

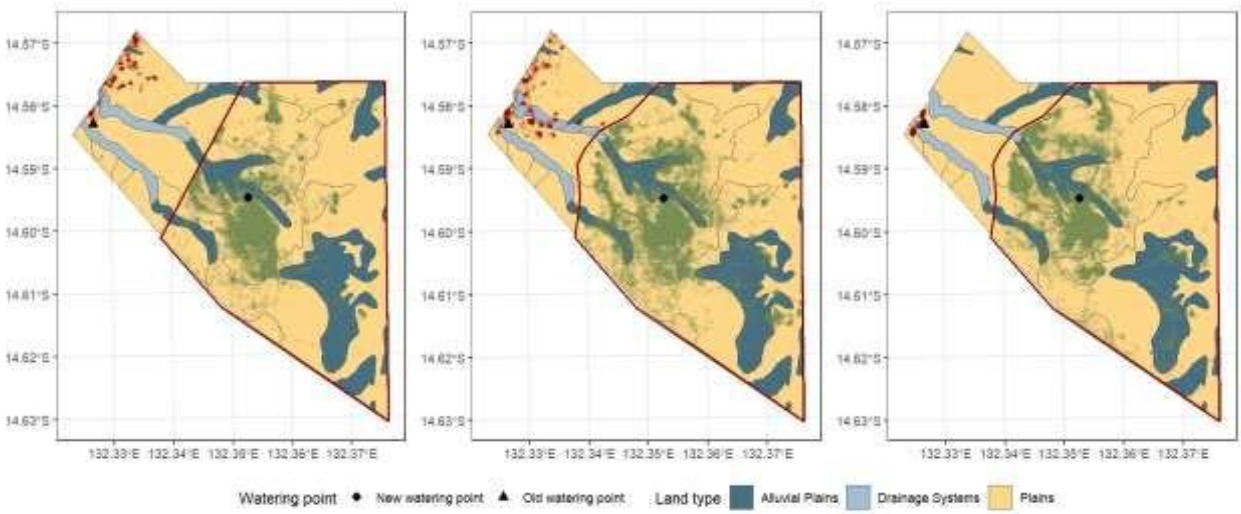


Figure 13. Geolocations of animals at Manbulloo during first three weeks of the trial period.

The red polygon in Figure 13 shows the virtual boundary around the new water point (black diamond). The green dots show the locations of animals within the virtual boundary and red dots show animals outside the virtual boundary. Each image of the paddock in Figures 13 and 14 shows the geolocations of animals over a period of one week.

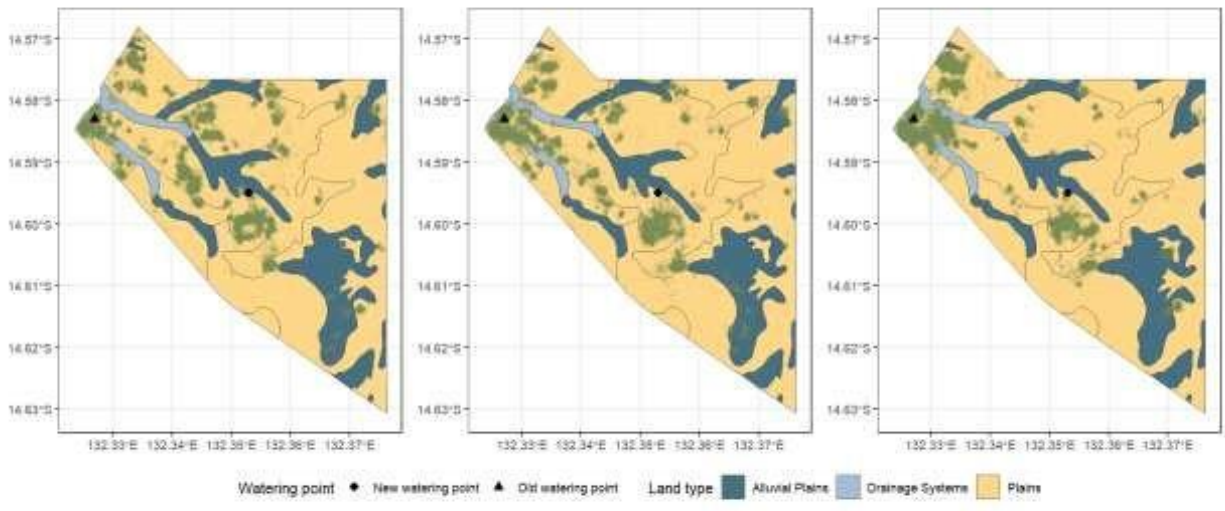


Figure 14. Geolocations of animals at Manbulloo during three periods of 7 days, once the virtual boundary had been removed.

3.5.5 Exclusion of animals from a scald area at Kidman Springs

The excluded scald area had historically been a preferred grazing location and was subject to chronic overgrazing. The excluded scald zone comprised a relatively high proportion of drainage systems (30.9%) compared to the remainder of the paddock (9.3%) (Figure 11). Despite this, animals did not compensate by increasing their use of drainage systems elsewhere in the paddock, accounting for 9.6% of animals' locations, with an odds ratio of 0.87 (an odds ration quantifies the strength of the association between two events), indicating that they were used slightly less than expected. Animals instead preferentially selected Alluvial Plains land types (Figure 11), which represented only 14.6% of the accessible paddock but accounted for 29.6% of animals' locations (Table 44). The odds ratio for this land type was 3.00, suggesting that they were used substantially more than expected (Table 4). These findings suggest that having been excluded from a historically preferred grazing area, animals redistributed their grazing to other areas of the paddock, allowing the degraded scald area to be protected, without simply transferring grazing pressure to similar land types.

Table 44. Land type proportion of Gutta Percha paddock at Kidman Springs, subsequent time spent in each land type by animals and odds ratio of grazing each land type during a 3 month period from June to September 2025.

	Proportion of land type in excluded scald area (%)	Proportion of land type in remainder of paddock (%)	Proportion of time spent in each land type (%)	Odds ratio
Alluvial Plains	1.4	14.6	29.6	3.00
Drainage Systems	30.9	9.3	9.6	0.87
Plains	67.7	76.3	60.8	1.00

3.5.6 Facilitation of strip grazing at Larrakeyah Station

At this site the aim was to see if strip grazing of irrigated pasture under a pivot could be implemented using virtual fencing rather than physical fencing. The virtual fence successfully facilitated strip grazing at Larrakeyah Station by restricting animals to designated grazing strips (Figures 15 and 16). Following each fence movement, animals readily utilised the newly available forage rather than remaining in previously grazed areas for prolonged periods of time.

Due to the layout of the strip grazing and the limitations in making paddock changes with the eShepherd system, when a new area (strip of the pivot) was opened for grazing, the virtual boundary would be re-drawn to include the new area but the old area also had to be included as animals were still grazing in it. The old area could not be excluded from the new virtual strip until all the animals had moved into the new strip. This was done through monitoring movements after a new strip had been opened up to graze (which could be done remotely on the Gallagher eShepherd App), however, timelines for closing of the previously grazed strip varied according to when animals all moved into the new grazing area (Figure 16).

By the conclusion of the trial, animals had sequentially grazed the designated area, demonstrating that virtual fencing can effectively facilitate controlled strip grazing without the need for temporary physical fencing.

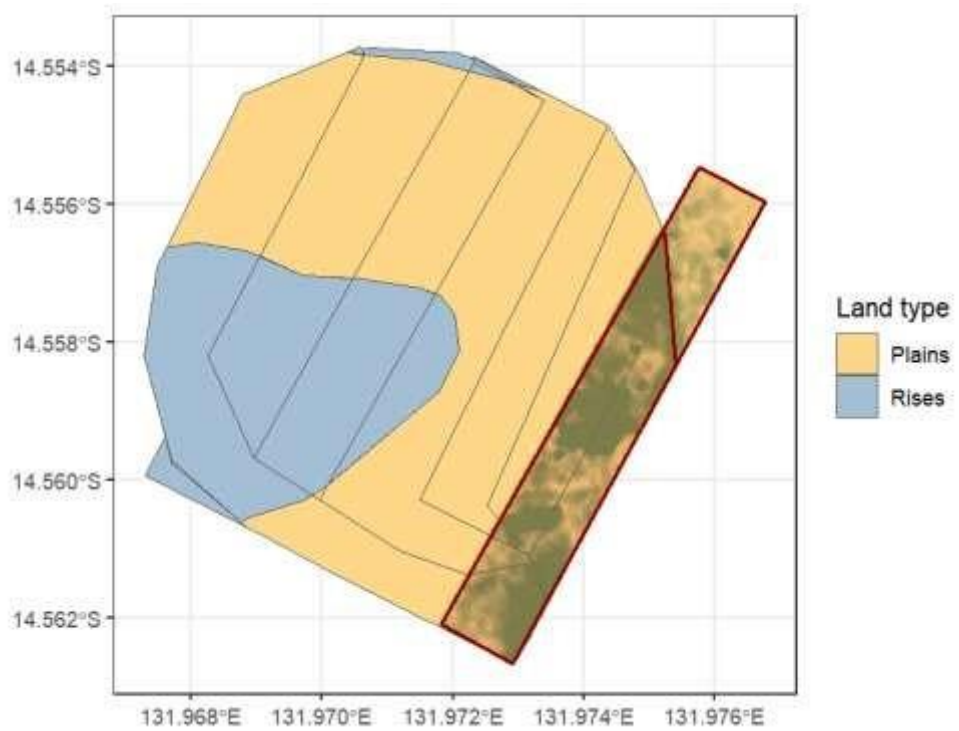


Figure 15. Strip 1 at Larakeyah during the first strip graze of the trial. Animals locations shown in green over land type on the pivot.

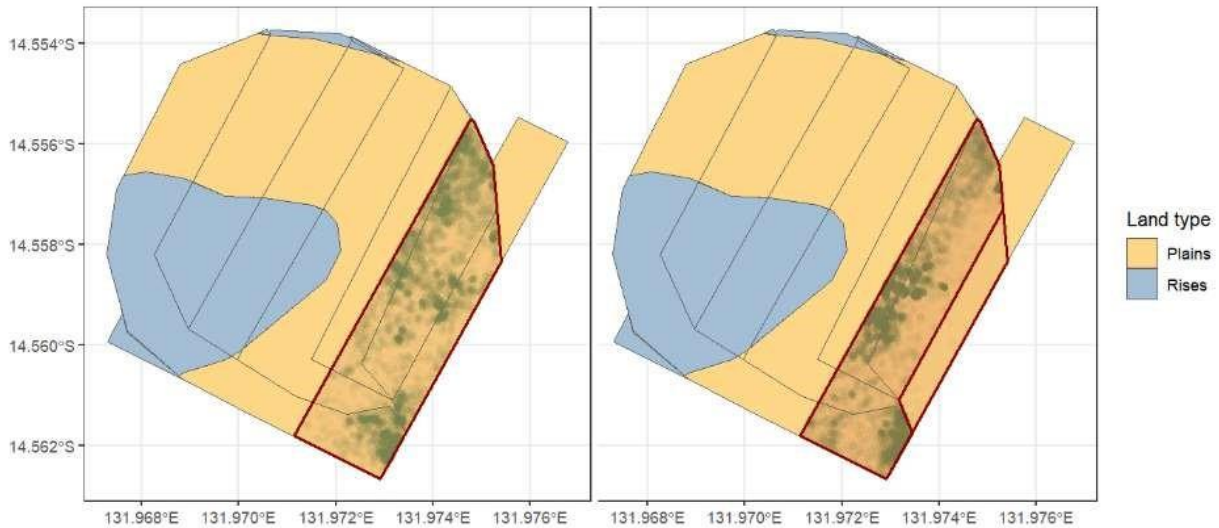


Figure 16. A strip transition showing how “back fencing” was done during the trial period.

After a larger area was opened to animals, the back of the previous strip was excluded (the second image of the pivot area in Figure 16) to avoid further trampling and enable recovery of the previously grazed strip. Green dots signify locations of animals within the virtual boundary.

3.5.7 General Discussion - VF

Results from these VF trials demonstrate the practical viability of this technology across a range of production systems in northern Australia. High levels of compliance with virtual boundaries were observed across all trial sites, indicating that VF can effectively contain animals under diverse environmental and management conditions. These findings highlight the versatility of VF as a management tool capable of supporting multiple production and grazing management objectives.

The Manbulloo trial demonstrated the capacity of VF to establish animals at an unfamiliar water point within a paddock where animals had previously shown a strong preference for an existing water source. This has important implications for extensive grazing systems in northern Australia, where the installation of additional watering infrastructure is commonly used to improve grazing distribution but may often not achieve the desired utilisation of surrounding pasture. Virtual fencing provides a practical mechanism to encourage animals to use newly developed water points, allowing previously underutilised areas of the landscape to be grazed while reducing land condition decline around established watering locations. Improved grazing distribution has the potential to increase forage utilisation, reduce overgrazing, and improve overall paddock productivity. Greater flexibility in moving animals throughout the landscape may also help maintain diet quality during the dry season by improving access to ungrazed pasture, and reducing dry season declines in liveweight gain that are characteristic of northern Australian beef production systems.

The Kidman Springs trial highlighted the potential for VF to exclude animals from a scalded (overgrazed) area while maintaining productive use of the surrounding paddock. The scald within ‘Gutta Percha’ paddock had historically attracted cattle and was overgrazed, contributing to ongoing erosion and poor land condition. Throughout the trial, no collared animals entered the exclusion zone, demonstrating the effectiveness of VF in protecting highly preferred areas without the need for conventional fencing. These findings have broad applications for grazing management, including excluding animals from erosion prone areas, degraded landscapes, riverbanks, weed infested areas, and undesirable terrain such as gullies or swamps. From a production perspective, VF also allowed the paddock to remain in use while protecting the degraded area. Rather than destocking the entire paddock, 45 animals were able to be grazed in the productive parts of the paddock, demonstrating how VF can simultaneously achieve landscape exclusion objectives and maintain livestock productivity.

The Larrakeyah trial demonstrated the application of VF within an intensive rotational grazing system, where precise and frequent adjustments to virtual boundaries were used to implement strip grazing under a centre pivot irrigation system. Animals remained highly compliant with the virtual boundaries despite the small grazing areas and the presence of high value forage outside the virtual boundaries. Controlled strip grazing reduces selective grazing and minimises forage losses through trampling by limiting the area available for grazing at any one time. This promotes more uniform pasture utilisation and provides a more consistent forage supply throughout the grazing period. The successful implementation of VF under these conditions demonstrates that the technology is suitable not only for extensive rangeland systems but also for intensive production where more precise grazing control is required.

A major strength of this study was the evaluation of VF across multiple production systems and management objectives, including grazing distribution, environmental exclusion, and intensive strip

grazing. Assessing the technology under contrasting conditions demonstrates its flexibility and highlights the broad range of applications that VF may offer northern Australian cattle properties. Beyond virtual fencing, the technology also provides continuous monitoring of animal location and movement, addressing one of the major challenges associated with managing livestock in extensive grazing systems. Access to near real-time spatial information has the potential to improve livestock management, reduce labour requirements, and support more informed management decisions.

Several limitations should be considered when interpreting these results. From an analytical perspective, the collar data recorded only a single GPS position for each logging interval, while the number of audio and pulses represented the cumulative events occurring within that interval. Consequently, it was not possible to determine the precise location at which individual audio or pulse events occurred. Although this limitation does not affect the operational performance of the VF system, it restricts the resolution at which animal interactions with the virtual boundary can be analysed. A further limitation was the varied delivery of updated virtual paddocks to individual neckbands. Following a VP adjustment, some animals received the new VP within minutes, whereas others experienced delays of several hours. As a result, animals that had already received the updated boundary could appear to breach the virtual paddock before other animals had transitioned to the new boundary, without receiving any audio or electrical stimuli because their neckbands had already recognised the updated location. This issue was particularly evident during the Larrakeyah strip-grazing trial, where animals frequently occupied areas immediately adjacent to the virtual boundary. Although this affected interpretation of individual breach events, it reflects a data synchronisation issue rather than a limitation of the virtual fencing concept itself. Future software developments that delay activation of VP changes until all collars have received the updated virtual paddock may reduce these challenges. This functionality has already been incorporated into the cellular version of the eShepherd system.

An important consideration for the commercial adoption of VF is the proportion of animals within a herd that are fitted with neckbands. Observations from the Kidman Springs trial indicated that non-collared animals could influence the movement of collared animals and occasionally contribute to virtual boundary breaches due to herding behaviour. Similar effects have been reported in sheep, where decreasing the proportion of collared animals reduced overall compliance with virtual boundaries (Marini *et al.,* 2020). Although the animals in this trial maintained adequate compliance despite the presence of non-collared animals, further research around the minimum proportion of collared animals required to maintain effective containment in extensive environments is recommended. Determining the relationship between the proportion of a herd fitted with neckbands and containment effectiveness should be a priority for future research, given the potential economic benefits of reducing the number of collars required for large commercial properties.

Overall, these findings demonstrate that virtual fencing has considerable potential to improve both productivity and grazing management in extensive beef production systems. One of the greatest constraints to production in northern Australia is the highly variable utilisation of pasture resources, with animals often concentrating around preferred water points and overgrazing these areas while large areas of available forage remain underutilised. By enabling precise control of animal distribution without the need for additional physical fencing, virtual fencing provides producers with a practical tool to better match grazing pressure with forage availability across the landscape. Improved grazing distribution has the potential to increase pasture utilisation, maintain higher diet quality for longer periods, and reduce the distance animals travel to access feed and water. Collectively, these outcomes may contribute to improved liveweight gain, particularly during the dry season when declining pasture quantity and quality often limit animal performance. Furthermore, the ability to protect sensitive areas while continuing to utilise productive portions of paddocks

offers opportunities to simultaneously improve environmental outcomes and enterprise productivity. As the technology continues to develop and become cheaper, virtual fencing has the potential to become an important component of precision livestock management in northern Australian grazing systems, supporting both sustainable land management and improved production efficiency.

3.6 Allicin (garlic) and Sulphur supplement trials -

3.6.1 Supplement intake

At DDRF both dry season supplement blocks (Olssons NT Uraphos + 40% urea) and wet season supplement blocks (Olssons Superphos12) were provided to all the trial paddocks from 24/9/25. The two + Fly Treatment paddocks were also given the Allicin + Sulphur blocks. The dry season blocks were removed on 8/12/25 and not fed again for the rest of the trial, while the wet season blocks continued to be provided for the rest of the trial. The intake of the different types of supplement blocks at DDRF is shown in Table 45. During the “dry season” (24/9/25 to 8/12/25) the average intake of the supplement blocks in the treatment groups (two paddocks per group) was:

Control: Dry season blocks = 13 g/head/day, Wet season blocks = 12 g/head/day.

+ Fly Treatment: Dry season blocks = 15 g/head/day, Wet season blocks = 7 g/head/day, Allicin blocks = 9 g/head/day.

During the “wet season” (8/12/25 to 6/4/26) the average intake of the supplement blocks was:

Control: Wet season blocks = 32 g/head/day.

+ Fly Treatment: Wet season blocks = 24 g/head/day, Allicin blocks = 27 g/head/day.

The intake of the Allicin + Sulphur blocks by the + Fly Treatment groups was below the level recommended by the manufacturer (30 – 50 g/head/day).

Table 45. Supplement blocks intake by the treatment groups at DDRF.

Period	Treatment	Wet season block (kg/head/day)	Dry Season block (kg/head/day)	Allicin block (kg/head/day)
Dry season (24/9 - 8/12)	Treatment 1	0.006	0.020	0.006
Dry season (24/9 - 8/12)	Treatment 2	0.008	0.010	0.013
Dry season (24/9 - 8/12)	Control 1	0.016	0.020	
Dry season (24/9 - 8/12)	Control 2	0.017	0.010	
Dry season (24/9 - 8/12)	Treatment average	0.007	0.015	0.009
Dry season (24/9 - 8/12)	Control average	0.012	0.013	
Wet season (8/12 - 6/4)	Treatment 1	0.025		0.028
Wet season (8/12 - 6/4)	Treatment 2	0.024		0.027
Wet season (8/12 - 6/4)	Control 1	0.045		
Wet season (8/12 - 6/4)	Control 2	0.041		
Wet season (8/12 - 6/4)	Treatment average	0.024		0.027
Wet season (8/12 - 6/4)	Control average	0.032		

At BHF the dry season blocks were put out initially on 25/09/2025 but it began raining soon after that and they were removed on 13/10/2025 before the cattle had started eating them. The wet season blocks were given to the treatment groups from 13/10/2025 to 22/04/206 and the supplement intake during this period is summarised in Table 46.

Table 46. Supplement block intake by the treatment groups at BHF.

Treatment	Wet season block (kg/head/day)	Allicin block (kg/head/day)
Control 1	0.036	
Control 2	0.028	
Treatment 1	0.030	0.029
Treatment 2	0.027	0.024
Control average	0.032	
Treatment average	0.029	0.027

At both sites, the intake of the Allicin + Sulphur blocks by the + Fly Treatment groups was below the level recommended by the manufacturer (30 – 50 g/head/day).

3.6.2 Effect on buffalo fly numbers on animals

Buffalo fly burdens were quite low at the start of the trials at both sites in the late dry season (October), with total fly counts being about 100 flies per animal in October at both sites (Figures 17 and 18). Both sites then had a trend of increasing fly burden in the early wet season to around 400 flies per animal at DDRF in February and 800 flies per animal at BHF in February. A fly count in March 2026 was not possible at DDRF due to flooding, and a fly count was not conducted at BHF in January.

There were no significant differences in mean fly counts between the treatments at any of the observation dates throughout the trials at either site. The fly treatment did not appear to reduce the number of flies present on + fly treatment groups in comparison to the control (no fly treatment) groups.

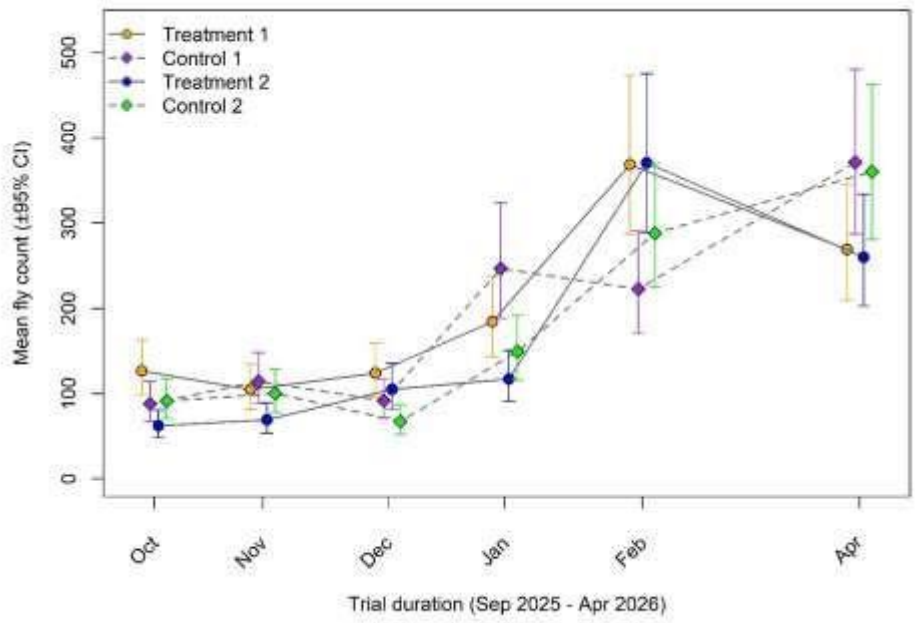


Figure 17. The mean total count of buffalo flies per animal (with 95% confidence limits) for each treatment group at DDRF from 30/9/25 to 9/4/26.

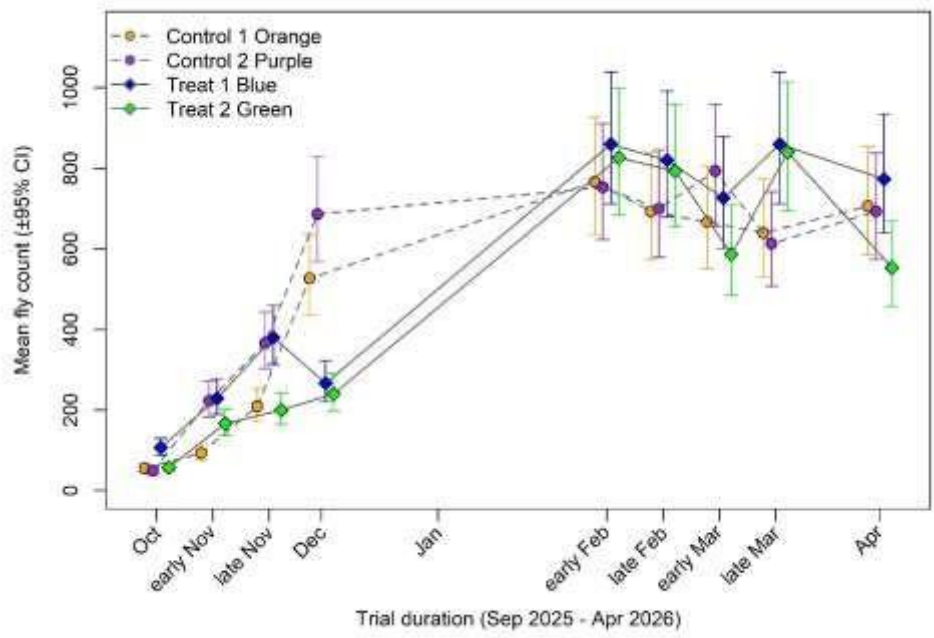


Figure 18. The mean total count of buffalo flies per animal (with 95% confidence limits) for each treatment group at BHF from 24/10/25 to 10/4/26.

3.6.3 Effect on skin lesions

There was no difference between treatments in the mean number of lesions per animal at the start of the trial at either site. The proportion of animals with skin lesions at both sites increased over the trial period and by February about 95% of animals had lesions in all groups at both sites, and this remained the case until the end of the trial. This is consistent with the findings of Johnson *et al.* (1986) who reported the presence of buffalo fly associated lesions on over 95% of cattle in northern areas of Australia.

At BHF the mean number of skin lesions per animal at the start of the trial in September was between 5.1 and 7.6 (no difference between treatments) and this increased to between 14.0 to 18.3 for three of the treatment groups by April 2026. The other treatment group (one of the + fly treatment groups) had a significantly lower mean lesion number (8.2) in April (Figure 19).

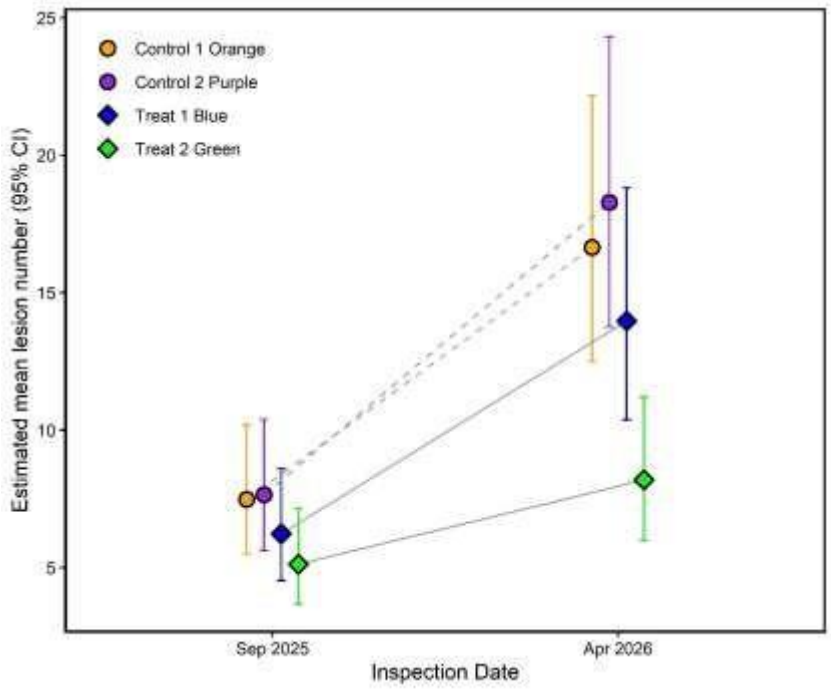


Figure 19. The mean total skin lesion number per animal at the start and end of the BHF trial.

At DDRF the mean number of skin lesions per animal for the treatments at the start of the trial in September was between 4.6 and 6.2 and there were no significant differences between treatments. Mean lesion number of the treatments increased to between 9.0 and 15.6 in April 2026. There were some significant differences between treatment groups in April, but they were not consistent. One of the + fly control groups had the lowest mean lesion number in April (9.0) while the other + fly control group had the highest mean lesion number (15.6).

The total lesion area (estimated by multiplying the number of lesions by the size of lesions) of animals increased over the duration of the trial in all treatments (Figures 20 and 21). At the start of the trial in September at DDRF, on average animals had <5 cm^2 covered by lesions and this increased to around 20 cm^2. At BHF average lesion area increased from <10 cm^2 to around 20 cm^2 over the same time frame. At the final assessment in April, one of the + fly treatment groups had a significantly lower total lesion area than the other treatment groups at DDRF, but there were no significant differences between any of the other treatment groups at either site (Figures 20 and 21).

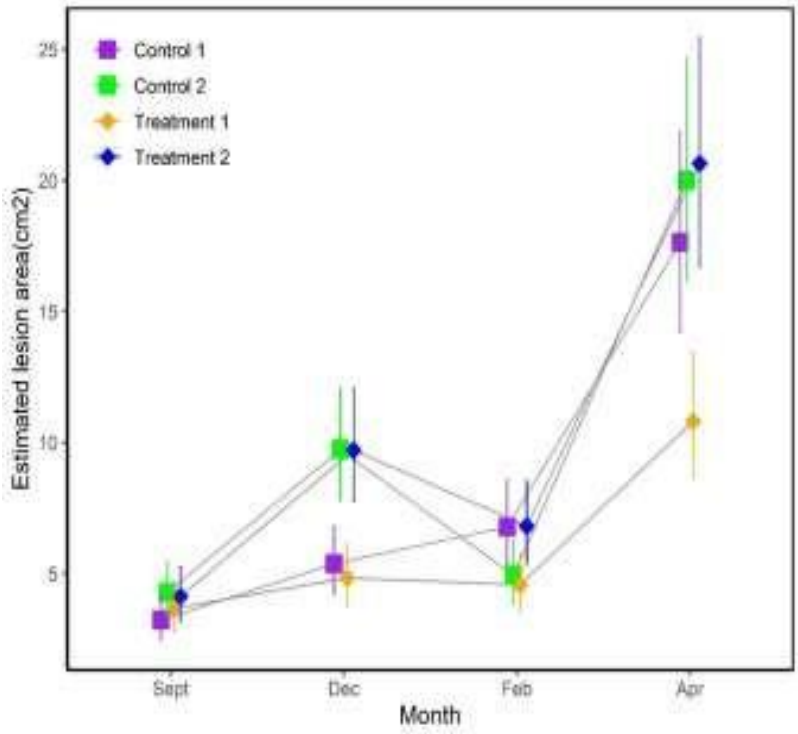


Figure 20. Mean total lesion areas of the four treatment groups at DDRF.

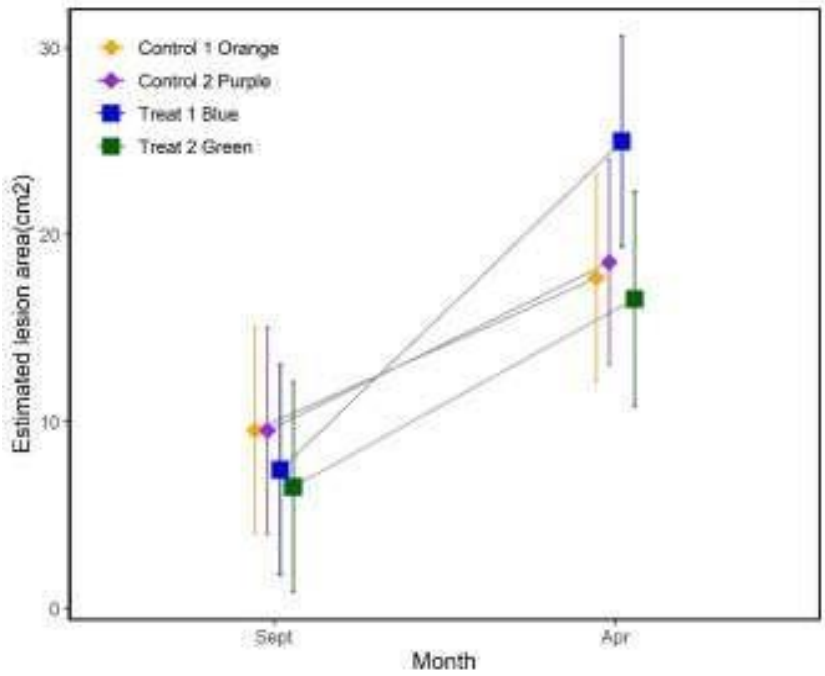


Figure 21. Mean total lesion areas of the four treatment groups at BHF.

3.6.4 Effect on liveweight gain

The average LWs of each of the treatment groups at DDRF on each of the weighing dates are shown in Table 47. The average increase in LW from September to April over all groups was 104 kg (ADG = 0.523). There were no significant differences in mean LW between the treatment and control groups on any of the weighing dates (Figure 22).

Table 47. Mean liveweight, liveweight gain and average daily gain of the treatment groups in the DDRF lick block trial.

Date	Treatment 1	Control 1	Treatment 2	Control 2
24/9/2025	155.0	155.4	154.9	154.0
2/12/2025	196.5	195.4	196.6	196.1
11/2/2026	233.7	232.8	235.7	235.7
10/4/2026	254.9	255.6	260.4	262.5
Liveweight gain (kg): Sep-Apr	100.0	100.1	105.5	108.5
Average daily gain (kg/day)	0.505	0.506	0.533	0.548

The e-mean ADGs for each treatment are shown in brackets in the legend of Figure 22.

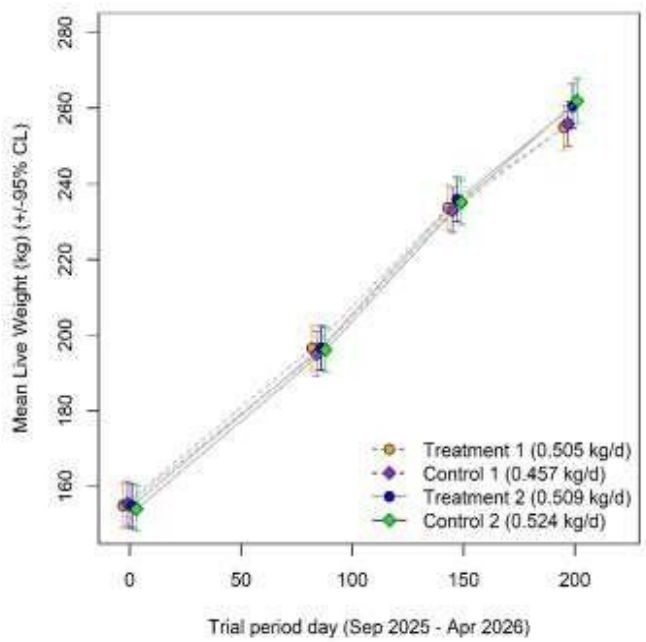


Figure 22. The mean live weight (with 95% confidence limits) for treatment groups from 24/09/25 to 10/04/26 at DDRF.

The average LWs of each of the treatment groups at BHF on each of the weighing dates are shown in Table 48. The average increase in LW from September to April over all groups was 109 kg (ADG = 0.524). Control group 2 had significantly lower LW and ADG than the other groups at the end of the trial in April, but there were no significant differences in mean LW between any of the other groups (Figure 23). The e-mean ADGs for each treatment are shown in brackets in the legend of Figure 23.

Table 48. Mean liveweight, liveweight gain and average daily gain of the treatment groups throughout the DDRF lick block trial

Date	Treatment 1	Control 1	Treatment 2	Control 2
25/09/2025	188.9	189.1	188.3	188.0
22/04/2026	299.5	313.1	277.0	304.2
Liveweight gain (kg): Sep-Apr	110.5	124.0	88.7	116.2
Average daily gain (kg/day)	0.529	0.593	0.425	0.556

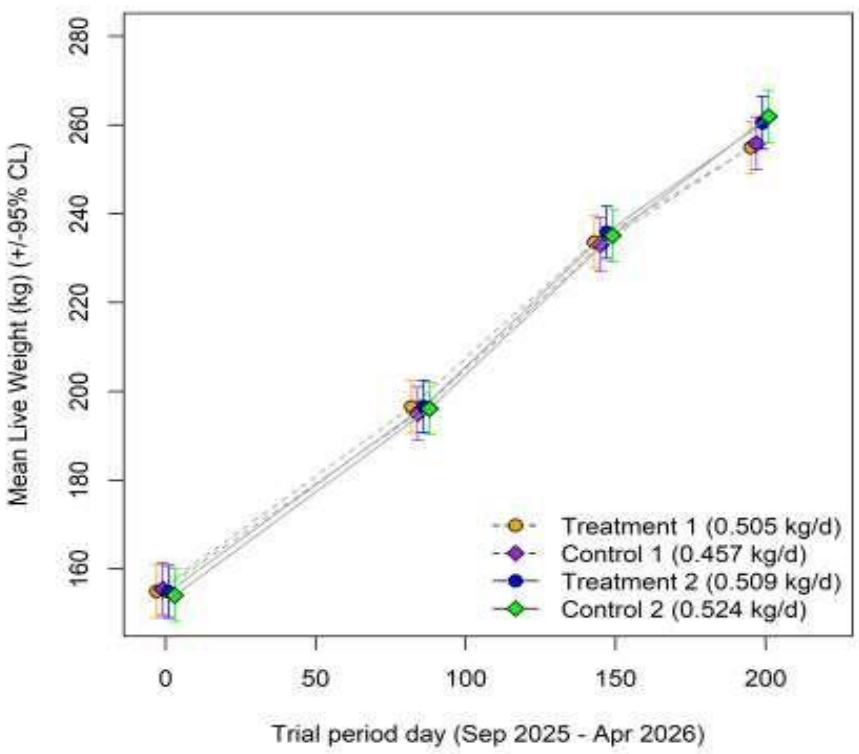


Figure 23. The mean live weight (with 95% confidence limits) for treatment groups from 25/09/25 to 22/04/26 at BHF.

3.6.5 Summary of results - Allicin (garlic) and Sulphur supplement trials

There was no consistent treatment effect of the Allicin + Sulphur blocks on LWG, fly burden or lesion scores at either site in this trial. This may have been because the intake of the supplement blocks was below the level recommended level by the manufacturer, but it is not known whether there would have been an effect if intake was higher. There are anecdotal reports from producers that the Allicin + Sulphur blocks repel buffalo flies (e.g. https://www.olssonsblocks.com.au/_files/ugd/1b9c87_4c14955d31eb456481f6f1c26ac82162.pdf) but this trial did not find such an effect.

Since buffalo fly burden was not affected by treatment, it is not surprising that lesion score and LWG were also not affected. By the end of the trial 95% of animals in all treatments had skin lesions and while one of the groups receiving the Allicin + Sulphur blocks at BHF had significantly less lesions than the other groups at the end of the trial, supplement treatment did not have a consistent effect on the mean number of lesions or total lesion area on animals.

4. Strategic recommendations

Priority recommendations for sector development from the project are:

1. Improve producer access to practical economic decision-support tools

- Develop and extend simple, producer-friendly tools to assess when supplementary feeding or intensification is likely to be profitable.
- Incorporate feed costs, expected ADG, cattle prices, freight, seasonal conditions and market opportunities.
- Use sensitivity analysis to help producers understand the range of conditions under which a feeding strategy may be viable.
- Develop a practical “Should I feed?” decision framework, encouraging producers to assess economic returns before committing resources. Figure 24 below is provided as an example.

2. Prioritise producer-led research into improving whole-of-business profitability

- Expand research beyond individual animal performance and cost of gain to understand the impacts of feeding strategies on whole-of-business profitability.
- Investigate how the age, class and stage of production of an animal influence its contribution to profitability within different northern beef enterprises, and identify where interventions can deliver the greatest economic benefit.
- Evaluate the economic implications of reducing age at turnoff, changing herd structure, increasing turnoff numbers and releasing grazing capacity.
- Better quantify compensatory growth (in various situations) and its implications for the profitability of feeding strategies.
- Integrate production, economic and financial modelling into future research design so that commercial viability is assessed alongside biological performance.

3. Reduce the financial risk associated with intensification and infrastructure investment

- Develop regionally relevant economic models for investments in irrigated and improved pastures, fodder production, feeding infrastructure and associated equipment.
- Assess capital requirements, utilisation rates, annualised costs, cashflow and return on investment.
- Investigate opportunities for shared infrastructure, equipment and services to improve utilisation and reduce individual business exposure.
- Encourage staged investment and small-scale commercial testing before substantial capital is committed.

4. Strengthen producer capability and practical knowledge exchange

- Extend the project's findings workshops and accessible decision-support resources.
- Case studies with collaborating properties would be a useful way to draw out some of these potential other benefits. "It's not the what—it's the how."
    - Questions to explore would include:
    - Why they chose that strategy.

    - What assumptions proved wrong.
    - What surprised them.
    - What they'd measure differently next time.
    - Under what conditions they'd do it again and when they wouldn't.
- Build producer capability in feed budgeting, interpreting growth responses, understanding cost of gain and assessing financial risk.
- Support producer-led learning networks that bring together producers, researchers, advisers and commercial partners.
- Encourage and facilitate the sharing of both successful and unsuccessful feeding experiences to reduce the cost of learning across the industry.

5. Better align feeding and intensification strategies with market opportunities

- Improve understanding of how seasonal price movements, market specifications and supply-chain requirements influence the value of additional liveweight gain.
- Investigate where feeding can economically improve market access, bring forward turnoff or increase the consistency of supply.
- Consider the benefits of earlier sale against the opportunity cost of additional feeding, alternative grazing strategies and potential compensatory growth.
- Strengthen collaboration between producers and supply-chain participants to identify commercially viable opportunities for targeted feeding.

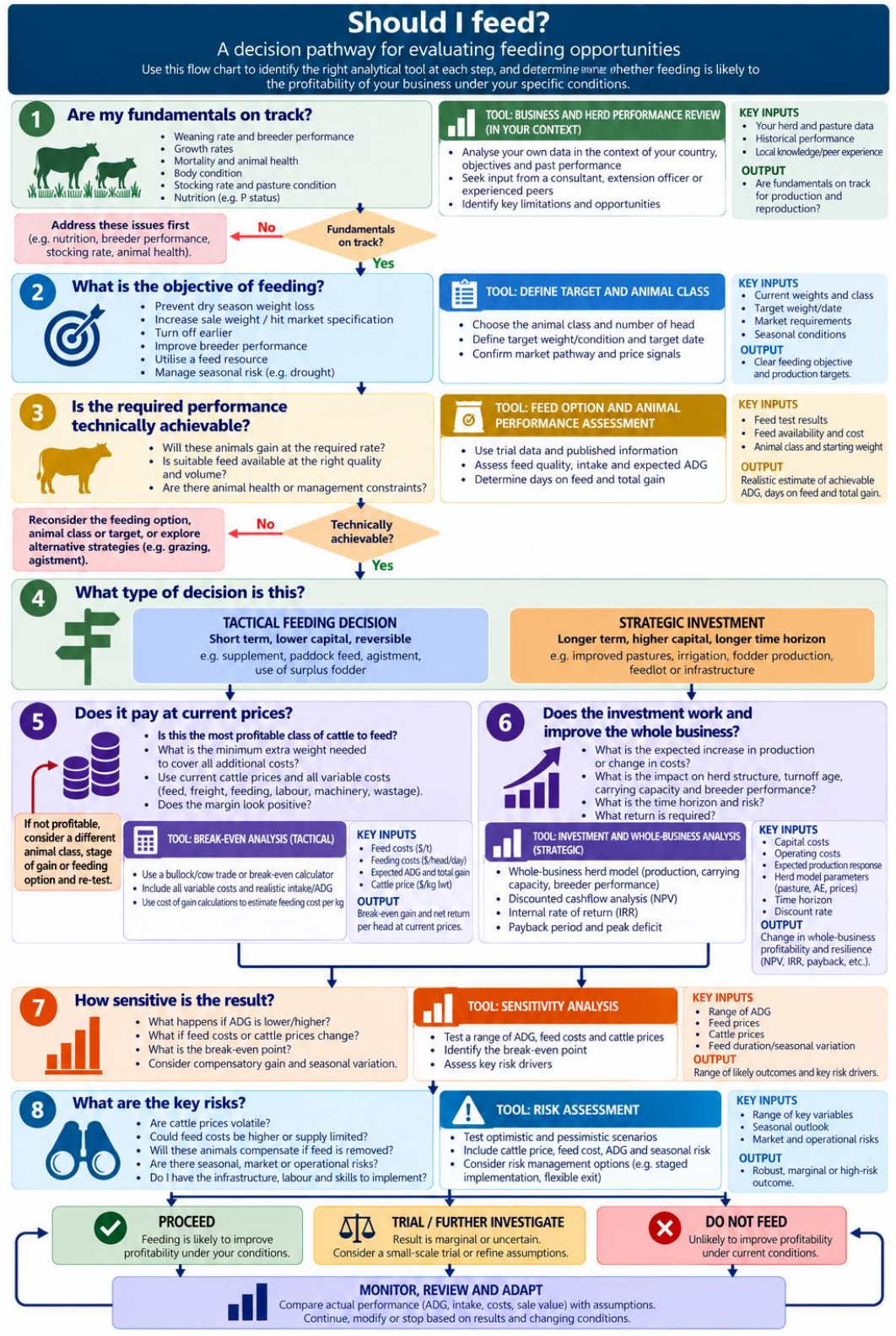


Figure 24. Feeding decision tree flowchart.

5. References

Bortolussi G, McIvor JG, Hodgkinson JJ, Coffey SG and Holmes CR (2005) The northern Australian beef industry, a snapshot. 2. Breeding herd performance and management. *Australian Journal of Experimental Agriculture,* 45:1075-1091.

Hijmans RJ, Phillips S, Leathwick J, Elith J (2024) dismo: Species Distribution Modelling. R package version 1.3-15.

Johnston DJ, Barwick SA, Corbet NJ, Fordyce G, Holroyd RG, Williams PM and Burrow HM (2009) Genetics of heifer puberty in two tropical beef genotypes in northern Australia and associations with heifer- and steer-production traits. Anim. Prod. Sci. 49:399-412.

Marini D, Kearton T, Ouzman J, Llewellyn R, Belson S, Lee C. (2020). "Social influence on the effectiveness of virtual fencing in sheep." *Applied Animal Behaviour Science,* 231, 105088.

Primary Industries Climate Challenges Centre (2026) University of Melbourne, (SB-GAF) Sheep & Beef GHG Accounting Framework- (SB-GAF) Monthly V2.5 AIA EAP API versions 1.1.0., 1.2.0, 1.3.0 and 2.0.0, https://piccc.org.au/resources/Tools viewed 22/7/26

Schatz TJ, and Hearnden MN (2017) The effect of weight and age on pregnancy rates in Brahman heifers in northern Australia. Animal Production Science. 57, 2091–2095 http://dx.doi.org/10.1071/AN16212

Zinn RA, Barreras A, Owens FN, Plascencia A (2008) Performance by feedlot steers and heifers: Daily gain, mature body weight, dry matter intake, and dietary energetics. Journal of Animal Science. 86, 2680–2689 https://doi.org/10.2527/jas.2007-0561

Appendices

Appendix 1 - Economic analysis – Calculator details

Table 49. Summary of inputs used and gross margins (GM) generated from Breedcow Dynama in whole-of-herd modelling of herds using the reference herd for the Katherine region and some of the modelled feeding strategies.

Parameter	Reference herd	Steer - pellets	Maiden Heifer-pellets	1st Calf Heifer-pellets	Floodplain agistment ADG = 0.4
Total adult equivalents (AE)	7840	7840	7840	7840	7840
Total cattle carried	9157	9000	9153	9151	8984
Weaner heifers retained	1373	1433	1369	1368	1431
Total females mated	4988	5206	4974	4970	5196
Total females mated and kept	4133	4313	4121	4118	4305
Total calves weaned	2747	2866	2767	2773	2861
Weaners/total cows mated (%)	55	55	56	56	55
Wnrs/cows mated and retained (%)	66	66	67	67	66
Annual female death rate (%)	3	3	3	3	3
Female sales/total sales (%)	47	47	47	47	47
Total cows and heifers sold	1168	1219	1179	1182	1217
Maximum cow culling age (years)	12	12	12	12	12
Heifer joining age (years)	2	2	2	2	2
Two yr old heifer sales (%)	38	38	38	38	38
Total steers and breeders sold	1310	1383	1319	1322	1381
Max bullock turnoff age (years)	2	2	2	2	2
Average female price (A$)	1213	1169	1206	1204	1213
Average steer/bullock price (A$)	1235	1147	1235	1235	1162
Capital value of herd (A$)	9643064	9313284	9633639	9631141	9394472
Imputed interest on herd val.	482153	465664	481682	481557	469724
Net cattle sales (A$)	3034263	3011689	3050619	3054954	3080359
Direct costs, excluding bulls (A$)	431494	586050	489553	655007	491884
Bull replacement cost (A$)	129049	134675	128683	128586	134439
Gross margin for herd (A$)	2473720	2290964	2432383	2271362	2454036
GM after imputed interest (A$)	1991567	1825300	1950701	1789805	1984312
GM per adult equivalent (A$)	316	292	310	290	313
GM/AE after interest (A$)	254	233	249	228	253

Appendix 2 - Sulphur and Garlic supplement trial information

Table 50. Monthly rainfall (mm) recorded at DDRF (Douglas River weather station).

Sourced: https://www.bom.gov.au/climate/averages/tables/cw_014901.shtml)

Month	Mean rainfall (mm)
October 2025	108.6
November 2025	225.2
December 2025	156.2
January 2026	393.6
February 2026	422.2
March 2026	799.2
April 2026	54.8

Table 51. Monthly rainfall (mm) recorded at Middle Point weather station (near BHF).

(Sourced: https://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=-39745032&p_stn_num=014041)

Month	Mean rainfall (mm)
October 2025	43.0
November 2025	659.0
December 2025	294.2
January 2026	418.2
February 2026	247.4
March 2026	452.0
April 2026	118.0

Table 52. Typical Analysis of Olsson's Allicin + Sulphur Lick Blocks.

(sourced: https://www.olssonsblocks.com.au/blocks/allicin-plus-sulphur).

Molasses	4%
Salt (NaCl)	Max. 80%
Sulphur (S)	12%
Allicin	0.3%

Recommended Intake: Cattle 30-50g per head per day.

Table 53. Typical Analysis of Olsson's NT Uraphos + 40% Urea supplement blocks.

(sourced: https://www.olssonsblocks.com.au/blocks/nt-uraphos-40-percent-urea)

Urea	40%
Total Protein Equivalent	114.68%
Molasses Energy Equivalent	22.46%
Salt (NaCl)	36%
Zeolite	8%
Calcium (Ca)	2%
Phosphorus (P)	2%
Magnesium (Mg)	0.28%
Iron (Fe)	1000mg/kg

Recommended Intake: Cattle 90-150g per head per day

Table 54. Typical Analysis of Olsson's Superphos 12% supplement blocks

(sourced: https://www.olssonsblocks.com.au/blocks/superphos-12-percent)

Phosphorus (P)	12%
MCP	53%
Molasses	5%
Salt (NaCl)	33%
Calcium (Ca)	13%
Copper (Cu)	1250mg/kg
Cobalt (Co)	15mg/kg
Zinc (Zn)	320mg/kg
Selenium (Se)	26mg/kg
Live Probiotics (DFMs)	10^9cfu/ml 0.5%

Recommended Intake: Cattle 50-100g per head per day

Table 55. Example of buffalo fly lesion scoring system (one side of the animal).

Tag ID	Treatment Group	Number of lesions							Size of largest lesion if >5cm preset (cm)	Total lesion area (cm)	Number of Active Lesions	Number of lesions per body region						No. Body regions
		0.5 cm	1 cm	2 cm	3 cm	4 cm	5 cm	>5 cm				Face	Neck	Hump	Back	Dew lap	Under side	
22992	Control 1		3							3			3					1
22994	Treat 1		5							5		1	2	2				3
23621	Control 1				1					3				1				1
46789	Treat 2	4								2	1		4					1
46793	Treat 1	3		9						19.5		1	2	4	5			4

Appendix 3 – Photos

Photo 1. Cattle in the pellet feeding trial at VRRS.

Photo 2. Cattle in the pellet feeding trial at KRS.

Photo 3. Cattle eating pellets at KRS.

Photo 4. The feeding paddock at LaBelle station.

Photo 5. The feeding complex at Maryfield station.

Photo 6. Cattle grazing a forage sorghum cultivation on the Sturt Plateau.

Photo 7. The feeding complex at Legune station.

Photo 8. The traditional owners inspecting the feeding trial at Hodgson Downs station.