Final report

Weaner to Yearling Production Pays Off

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Abstract

Monaro beef systems traditionally target weaner production with all steer weaners sold before their first winter. This PDS gathers real farm data from 10 different monitor paddocks representing a range of locations, soil types and crop/pasture types to validate model outputs and the decision to retain steers to heavier weights and to demonstrate the achievable winter steer growth rates for a range of forage crops and pastures.

For each paddock, herbage mass and quality was measured at the start of periods of grazing by steers as well as herbage mass at the end. Steers were weighed into and out of the monitor paddock in order to calculate steer growth rates. These data were used as inputs to the GrazFeed model to validate the prediction of liveweight gain by the model. Other data provided by the cooperating farmers included any additional grazing the paddocks sustained as well as costs of pasture / crop establishment and management of retained stock. These data were used to determine the profitability of the higher productivity forages as compared to the average farm profit.

All but one system tested maintained steer growth rate above 1 kg/h/d during the winter period and most forage systems tested gave an increase in whole farm profit of between 7% and 14% representing $25,000 to $50,000 greater profit across a 1000ha farm.

Executive summary

Background

Traditional beef systems on the Monaro target weaner production with all steer weaners sold before their first winter. Recent price trends have enticed producers to consider retaining these steers to greater weights by retaining them over their first winter into their second spring. Previous system modelling suggested that retaining steers past weaning was a profitable strategy and especially if a specialist high quality forage could be grown to ensure growth rates are maintained over winter. This PDS seeks to validate the decision to retain steers to heavier weights and demonstrate the achievable winter steer growth rates for a range of forage crops and pastures in order to give Monaro producers the confidence to retain their steer weaners through the winter and then grow them on to heavier weights

Objectives

- On six properties, validate the farm system modelling which showed retaining steers through their first winter is more profitable than the common practice of selling as weaners in autumn.
- For each of the six properties, validate farm metrics such as dry matter production, feed quality, steer growth rate, area of specialist crop/pasture and soil fertility.
- Conduct a cost benefit analysis of retaining steers over winter on specialist crop and pasture compared to the traditional base weaner selling system.
- Deliver educational and training activities to increase producer confidence, knowledge and skills to adopt the system. Targets of 65% of these businesses will learn new knowledge and skills resulting in 35% adopting (or intention to adopt) new finishing practices on-farm.

Methodology

Ten indicative paddocks were chosen on 6 farms run by 4 cooperating (core) farmers representing a range of potential crops and specialist pastures. Over the winters of 2019 and 2021 steer weaners were retained and grazed on these paddocks with steer liveweight gain being measured along with entry and exit herbage mass and green herbage feed quality. All pasture and livestock costs were recorded and a partial budget conducted to determine the relative profitability of these paddocks compared with baseline pasture as determined by farm benchmarking. As the cooperating farmers were already committed to retaining steers to grow them over winter, steers were only grazed on higher producing pastures and crops grazing on lower quality baseline pastures such as native pastures would have compromised the performance of retained steers and so was not economically feasible for the cooperators.

Results/key findings

- In every demonstration paddock over both years steers were able to maintain significant weight gain during winter grazing. Economic analysis indicated that the establishment of these crops or pastures increased profit in every case and with the replacement of 7% of baseline pastures with these higher performing crops and pasture could lift average farm profit between 4 and 24%. Overall the additional profit across a 1000ha farm ranged between $12,000 and $100,000 but the majority of monitor paddocks gave an improvement in whole farm profit of between $25,000 and $50,000. In practice farmers are likely to adopt

more than one of the tested crops/pastures according to their agronomic suitability so extra farm profit is likely to be somewhere in the middle of the range.

- Weight gains over the measured periods were mostly in excess of 1 kg/hd/d and ranged from a low of 0.5 kg/h/d on a waterlogged winter wheat paddock in 2021 which became heavily pugged during the grazing period through to a high of 1.6kg/h/d on a winter wheat paddock in 2019. Obviously, the growing conditions were the major factors impacting these extremes as both were the same crop type.
- It is clear that as long as the choice of specialist pasture or crop was agronomically suited to the location and conditions then retaining steers over the winter is profitable. However due to the provision of additional grazing throughout the year and their establishment costs being amortised over a longer time frame, high quality perennial pastures ranked among the most profitable options while annual crops were more subject to the vagaries of the seasonal conditions. It is likely that both crops and pastures will play a role with crops helping to manage weeds before sowing longer term specialist pasture.
- Extension and communication activities were completed in line with original plan and included field day presentations, newsletter articles and website updates. From pre and post project surveys 100% of core producers said their knowledge, skills and confidence increased and this similarly 100% for observer producers. Ninety percent of core producers and 75% of observer producers are expected to implement finishing weaners / steers on crop in the future.
- Monitoring and evaluation was completed in line with the original plan.

Benefits to industry

Since in every case the addition of these crops and pastures to the farm showed an improvement in farm profits, Monaro farmers should now have the confidence to take this option to retain the steer portion of their drop except in the poorest of seasonal conditions.

Future research and recommendations

Based on the very high digestibility levels measured in these specialist crops and pastures it is suggested that adding an additional digestibility class to the Green component of GrazFeed would enhance its utility for helping to manage these high productivity systems.

PDS key data summary table

Aim

Can high quality forage crop and perennial pasture systems be utilised to meet target weights for finishing steers on the Monaro and increase overall farm profit relative to the traditional base selling enterprise system.

	Comments		Unit
Production efficiency benefit (impact) Animal production efficiency - kg LWT/ha; kg LWT/DSE, AE or LSU Pasture productivity – kg DM/ha Stocking rate – DSE, AE or LSU/ha Reproductive efficiency – marking %, weaning % Mortality rate (%)	*The crops and pastures used allowed weight gains in steers that would otherwise have been sold* *In some cases there is also extra DSE carried relative to the baseline capacity of 8 DSE/ha while in others baseline grazing is foregone*	46 to 409 -6.5 to 7.1	Kg Lwt/ha dse/ha Insert unit
Reduction in expenditure Reduction in labour i.e. DSE/FTE, LSU/FTE, AE/FTE; Reduction in other expenditure	This strategy does not reduce expenditure there are no savings.	0	
Increase in income	Total increase in income from value of steer liveweight gain plus change in baseline carrying capacity valued at $53.20/dse	$470 - $1150	/ha
Additional costs (to achieve benefits)	Additional costs of both the annualised cost of the crop or pasture as well as additional costs associated with retaining the steers to older age and higher weights	$192 - $660	/ha
Net $ benefit (impact)	Averaged across the farm based on the specialist crop or pasture making up 7% of the farm area.	**$12 - $100**	**/ha**
Number of core participants engaged in project		4	
Number of observer participants engaged in project		10	
Core group no. ha		19200	
Observer group no. ha		33400	
Core group no. sheep		55400	hd sheep
Observer group no. sheep		75400	hd sheep
Core group no. cattle		6668	hd cattle
Observer group no. cattle		6550	hd cattle

% who said knowledge, skill & confidence had increased – core	*E.g. Finish weaners / steers on crop*	100%	
% who said knowledge, skill & confidence had increased – observer	*E.g. Finish weaners / steers on crop*	100%	
% practice change adoption – core	*E.g. Finish weaners / steers on crop*	90%	
% practice change adoption – observers	*E.g. Finish weaners / steers on crop*	75%	
% of total ha managed that the benefit applies to	*E.g. % of total ha, fodder crop is grown on*	75%	
Key impact data			
Net $ benefit /ha (impacted ha)	**$161 - $958/ha**		
Net $ benefit /ha (total ha managed)	**$12 - $100/ha**		

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1 Background

Historically young steers are sold from the breeding enterprise on the Monaro as weaners before their first winter. This has meant that the winter grazing demand is significantly reduced. With an ongoing lift in the sale price of finished and feeder steers in recent years MFS members were interested in retaining weaners through their first winter in order to take advantage of spring feed and to sell these animals either as finished slaughter animals or at the higher weights required for entry to feedlots.

In a manner similar to the lamb finishing options explored in previous MFS PDS projects GrassGro modelling was first completed to explore the feasibility of maintaining sufficient weight gain over winter to meet MSA standards and also as to what trade-off there might be in the whole farm system in terms of reduced breeding cow numbers required to offset the extra winter grazing pressure. This modelling showed that the strategy of retaining steers gave better profits in most years. These profits were highest when specialist forage (oats) was included in the system so this PDS was developed in order to ground truth the modelling results as to the likely steer growth rates that might be achieved on a range of specialist forages and pastures.

It was intended that demonstration of the ability to maintain steer growth rates throughout winter would lead to greater confidence in Monaro graziers to adopt the strategy of retaining steers through their first winter.

Due to poor Autumn/Winter seasonal conditions in 2018 and 2020 this work has been drawn out with demonstrations being completed over 2 better winter seasons (2019, 2021) with a year's gap in between.

2 Objectives

Project objectives:

By December 2021, in the Monaro region of Southern NSW:

1. Seven (7) producer demonstration sites will validate / ground truth the modelling projections demonstrating the relative profitability of the following (7) finishing pasture systems in beef enterprises;

   (a) Improved grass pasture (phalaris and rye grass based) – 2 sites
   (b) Wheat (with pellet supplements) – 1 site
   (c)Oats / Cereals – 3 sites
   (d) Control / baseline (permanent pasture) – already documented in Grassgro® modelling paper – 1 site
   100% Achieved – further outlined in report

2. Validate on-farm the following metrics for each of the six (6) demonstration systems;

   (a) Dry Matter Production (kg DM/ha/year)

   Achieved by proxy. Accumulated DM has been measured before grazing and at the closure of the measured grazing period. This gives some idea of pasture productivity but also the summing of all dse's carried over and above the steer finishing give a further picture of the overall productive capacity of the pasture. As direct measures of production were only ever

intended to be carried out over the winter period of grazing with steers it is impossible to give an accurate number for annual DM production.

(b) Feed quality (DMD, ME etc)
100% Achieved. Feed quality measures including DMD, ME and CP were taken prior to the grazing period in every case
(c) Steer live-weight gains (g/hd/day)
100% Achieved. Steer weights were measured at the entry and exit dates as a minimum and also in between for extended grazing periods steer liveweight gains are reported in the body of the report.
(d) Percentage (%) of farm area (ha) required for finishing steers to target weights. **Not possible to be achieved.** Due to the way each paddock was grazed some paddocks had a very large proportion of the grazing from animals other than steers. It was too complex and fraught with error to try an extrapolate from the data collected just how many hectares of the farm would need to be dedicated to the particular system to finish all steers present in the farm system. This is further confounded on the real farms by a variable mix of sheep and cattle enterprises and the fact that the real life strategy might include a mix of several of the options tried. It was decided that the original modelling work would give a fairer indication of the area of specialist fodder needed.
(e) Soil fertility recorded (phosphorus, sulphur, PBI, K, Ca, Na, Mg, Al, CEC, EC, pH) - **Achieved**

3. Conduct a cost benefit analysis to determine the overall profitability of each system in context of whole farm profit compared to the traditional base weaner selling system. Key performance indicators to include;

   (a) income ($/DSE) and income/HA
   (b) enterprise expenses ($/DSE) and per HA
   (c) gross margin ($/DSE) and per HA
   (d) net profit ($/DSE)
   100% Achieved – further outlined in report

4. Demonstrate the value of EID cattle tags to monitor performance of the treatment groups.

   100% Achieved – further outlined in report

5. Collate five years of comparative analysis data for Monaro beef enterprises for11 farm businesses participating in the MFS benchmarking group. (These 11 businesses include 4 of the core farm businesses hosting sites).

   100% Achieved – further outlined in report

6. Deliver a series of educational, training and information activities to upskill 71 core farm businesses to increase confidence, awareness and capacity to adopt and integrate steer finishing systems into their farm enterprise. Estimated 65% of these businesses will learn new knowledge and skills resulting in 35% adopting (or intention to adopt) new finishing practices on-farm.

   100% Achieved – further outlined in report

3 Demonstration Site Design

3.1 Methodology

3.1.1 Paddock Descriptions

A range of different paddocks were chosen across a range of host properties to represent the types of pastures and crops available to graze steers over winter. These are listed in detail below.

2019 Paddocks

a) Winter Wheat ("Undowah" –Bibbenluke – John Murdoch)

The monitor paddock was on a basalt soil being 10ha in size and sown to winter wheat in January 2019. The paddock had a south easterly aspect (36.798°S,149.286°E)

b) Ryegrass/Lucerne ("Undowah" –Bibbenluke – John Murdoch)

The monitor paddock was grazed in rotation with the winter wheat and was also 10ha in size. The paddock was again basaltic in origin with heavy black cracking clay. The paddock was sown in September 2018. The paddock had a southerly aspect and was located at 36.805°S,149.284°E.

c) Winter Wheat (Mila – John Murdoch)

This paddock was on acidic granite based soil and the paddock had an easterly aspect and was located at 37.056°S,149.188°E.

d) Grazing Oats ("Lowanna", Cathcart – Michael Shannon)

This paddock was on a reclaimed wetland (Dragon Swamp) with heavy clay soil and 16ha in size. The paddock was sown in Autumn 2019. The paddock has a south easterly aspect and located at 36.815°S,149.385°E.

e) Grazing Canola ("Lowanna", Cathcart – Michael Shannon)

The monitor paddock was on basalt soil, just 9.3ha in size. The paddock had a slight westerly aspect and was located at 36.809°S,149.362°E

f) Verdua Rye Grass (Jillamatong – Murray Jackson)

The granite soil paddock was 14ha and was sown in September 2018. The paddock had a predominantly westerly aspect and was located at 36.654°S,149.260°E.

2021 Paddocks

g) Winter Wheat ("Winton" –Ando – John Murdoch)

This 19ha paddock on basalt soil was grown specifically for steer finishing over winter. The paddock has a south easterly aspect and was located at 36.713°S,149.188°E

h) Tall Fescue /Lucerne ("Winton" –Ando – John Murdoch)

This paddock is also on Basalt and was grazed following on from the winter wheat paddock on this property. It is 15ha in size and located at 36.715°S,147.195°E

i) 1st Year Mona Ryegrass (Kydra – Richard Taylor)

This paddock has a sown area of 34ha and around 50ha in total with a general south westerly aspect and interspersed with patches of timber and granite boulders. The paddock was sown in January 2021 and is located at 36.444°S,149.404°E.

j) 2nd Year Mona Ryegrass (Kydra – Richard Taylor)

The paddock was sown in February of 2020 and is again a rough paddock interspersed with timber and boulders with a south westerly aspect. The sown area was 29 ha in size but the total paddock is approximately 30ha in total. The paddock is located at 36.452°S,149.392E

k) Winter Wheat ("Lowanna" Cathcart – Michael Shannon)

This is a 15.5ha paddock with approximately 20 ha sown to winter wheat. The paddock is heavy textured clay soil on the valley floor of a drained swampy area. The paddock is located at 36.825°S,149.386E

3.1.2 Pasture Measurements

For each forage type a cohort of weaned steers was grazed for a period during winter and the herbage mass and quality of the forage was assessed upon entry of the steers into the paddock and residual herbage mass assessed at exit. A median quadrat sampling techniques was used taking 10 quadrat cuts per paddock but in so doing make a total of 50 visual assessments. Cuts were taken along a representative transect in each paddock and the same transect used for both entry and exit cuts. At the same time a toe point sampling of green herbage to ground level was taken along the transect to form a representative sample for testing ruminant feed value.

3.1.3 Animal Measurements

All steers were weighed upon entry to the paddock and again on exit in order to calculate weight gain achieved during the grazing period when pasture measurements were taken. To avoid curfew issue as near as possible the steers experienced the same time off feed before each weighing. If steers were to spend more than 3 weeks on a paddock then if feasible interim weights were taken. In some cases there was more than one group of steers grazed paddocks throughout the winter season and where possible their weight gain was also monitored to add to the richness of the data. On extra grazings where weights were not measured the number and type of animals present was recorded so that the grazing could be valued in the economic analysis.

3.1.4 Modelling

In order to assess the potential reliability of the initial GrassGro modelling each individual grazing period was modelled using GrazFeed in order to give some level of validation of the animal component of the modelling. The initial and final biomass numbers were used along with weight and mature size parameters for each steer cohort and their expected daily weight gain compared with their measured weight gain.

3.2 Economic analysis

The economic value of the specific forage crop or specialist pasture was determined by taking a partial budget approach.

Firstly the steer weight gain was valued at the 3 year median price and any change in price across the winter grazing period was also applied to the steer liveweights at the commencement of the period.
Secondly any extra grazing in addition to the measured steers was tallied in DSE terms and compared to the expected farm baseline carrying capacity which was taken to be 8 DSE/ha based on the 2019 MFS Farm benchmarking data. Any difference between the extra grazing achieved and this 8 DSE baseline was valued at the average Monaro farm gross margin of $53.20/DSE again as determined by the benchmarking data. A **total net value of grazing** over the baseline pasture was determined as the sum of

a) the value of steer liveweight gain
b) the increase or decrease in steer base weight value and
c) the value of other surplus or forgone grazing relative to the 8 DSE baseline.

Based on the assumption of a zero change in the farm overheads annual profit from this steer finishing paddock was determined as the total net value of grazing minus

a) the amortised cost of establishing the crop or pasture based on the expected grazing life (amortised at 3% pa).
b) Direct costs associated with a delay in sale past weaner age. (Commission, saleyard dues etc at 5% of steer value gained. Freight on extra weight at $0.05 per kg of extra weight sold, husbandry costs estimated at $0.10 per kg of extra weight sold. Cost of maintenance P fertilizer at $5 for each surplus DSE carried over the baseline of 8 DSE)

3.3 Extension and communication

Results of the project have been presented at two field days, in multiple newsletters and media articles, as well as being published on the MFS website which is accessible to the public.

3.4 Monitoring and evaluation

The monitoring and evaluation (M&E) process used for data collection was done in compliance with the project objectives and undertaken by Doug Alcock – GrazProphet. All data sets and results are stored on MFS OneDrive as well as on the MFS computer.

4 Results

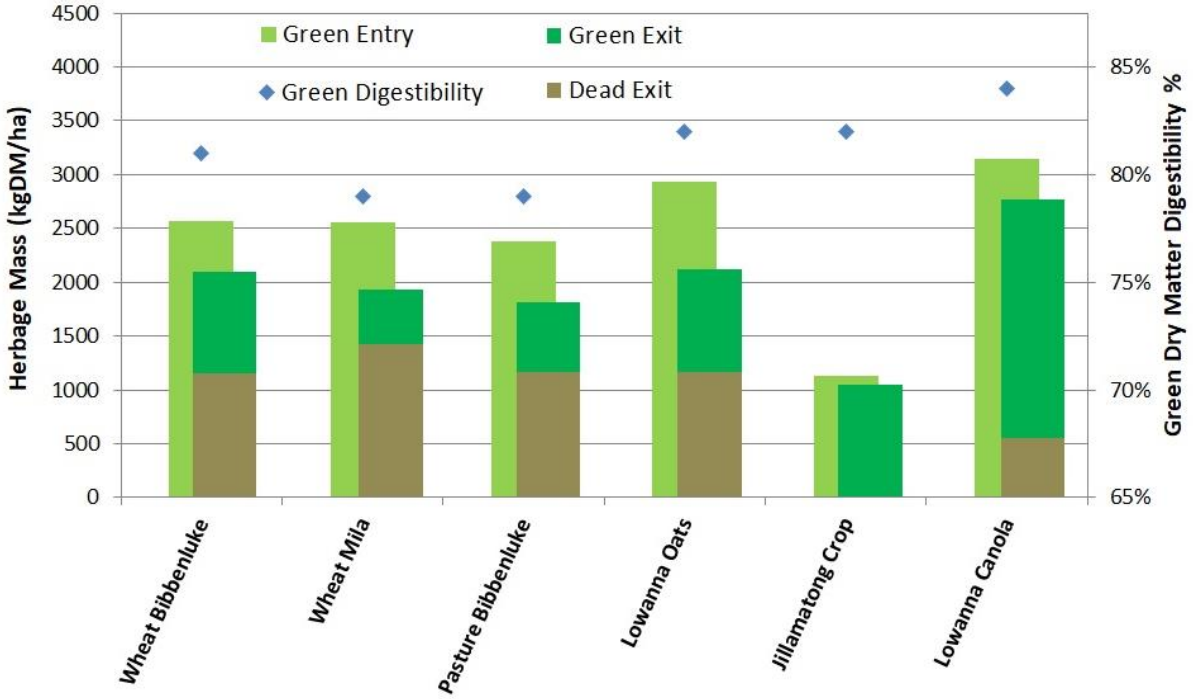
4.1 Demonstration site results

4.1.1 First year results (2019)

Herbage mass and Quality

The herbage mass was assessed upon entry and exit of the steers from each paddock. At the time of entry the feed quality was also tested. With the exception of the Jillamatong site there was a considerable transfer of green into the dead pool which is assumed to have been due to trampling and in some cases the impact of rust.

Figure 1. Herbage availability and quality at the start and the herbage mass at the end of the grazing period for each monitor paddock in 2019.

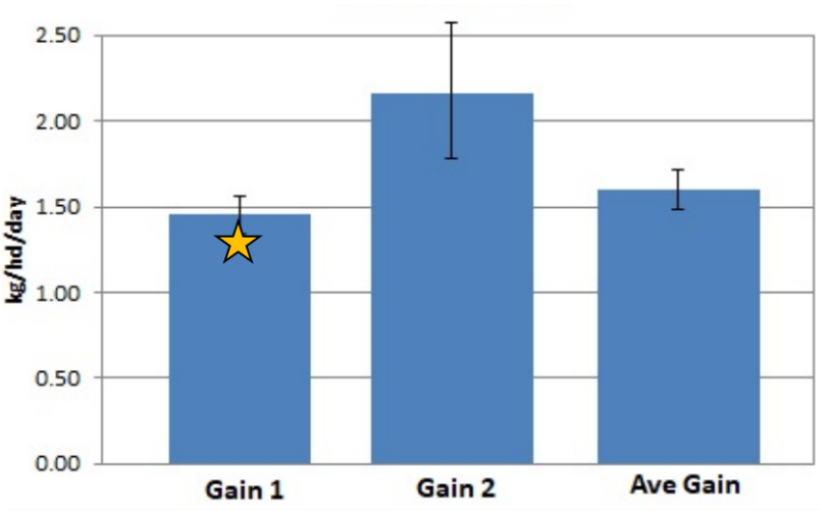


Animal Performance

Paddock a) Wheat Bibbenluke

Steers grazed this paddock on two occasions during the Autumn/Winter of 2019. Steers began the trial at around 300kg liveweight and the first grazing was from the 12th of April to the 10th of May. The second grazing was from the 10th of June to the 17th of June. On average the steers gained 1.6 kg/h/d across the entire 35 days of grazing. As feed quality information was available and the green feed sampled on the 10th of April was 81% DMD and 25% CP. This herbage data was used in the GrazFeed model to determine the expected animal performance relative to the observed performance for the first grazing period. In this case the expected performance was withing the range of the 95% confidence interval of the measured data which should give confidence that conclusions from modelled data should be reasonably accurate.

Figure 2. Animal performance on Winter Wheat at Bibbenluke in 2019

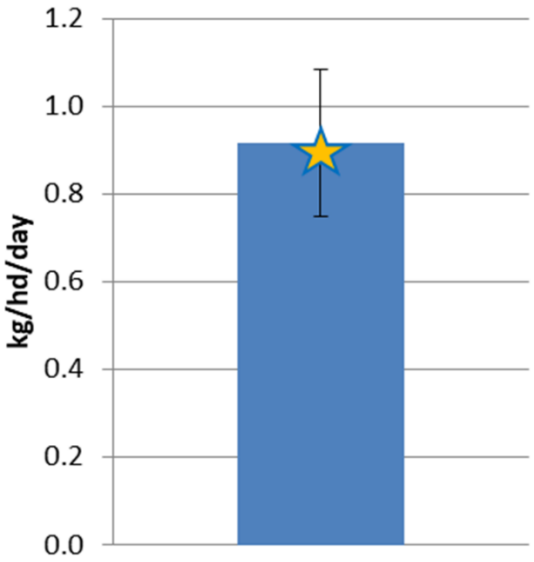


Paddock b) Pasture Bibbenluke

Steers grazed this paddock in rotation with the winter wheat at Bibbenluke. Steers grazed this paddock between the 10th of May and the 10th of June.

On average the steers gained 0.9kg/h/d across the month of grazing and this lower growth rate reflected the lower feed quality compared with the winter wheat. GrazFeed modelling using feed availability and quality gave a prediction of steer growth rate right on the observed average.

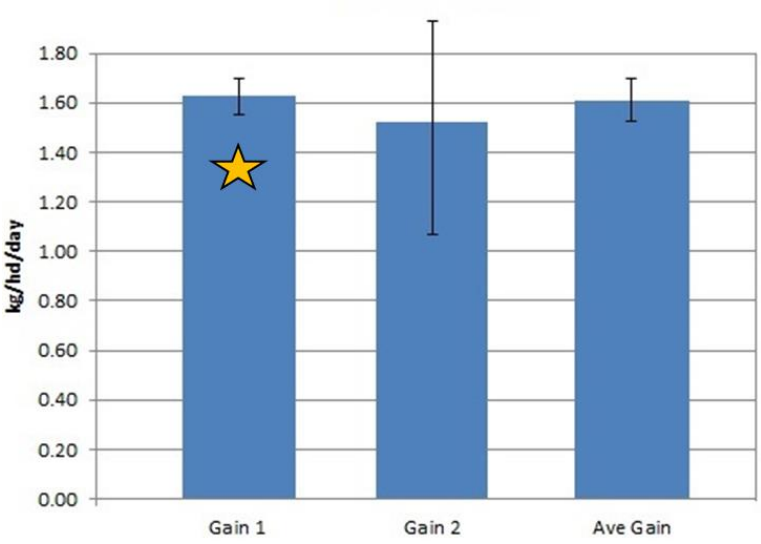
Figure 3. Animal performance on Fescue / Lucerne Pasture at Bibbenluke in 2019



Paddock c) Winter Wheat Mila

Steers grazed this paddock in a rotation with a second paddock. Grazing occurred between the 1st of May and the 31st of May and then again for a brief period from the 18th of June to the 23rd of June. Steers entered the paddock at 278 kg Live weight.

Figure 4. Animal Performance on Winter Wheat at Mila 2019

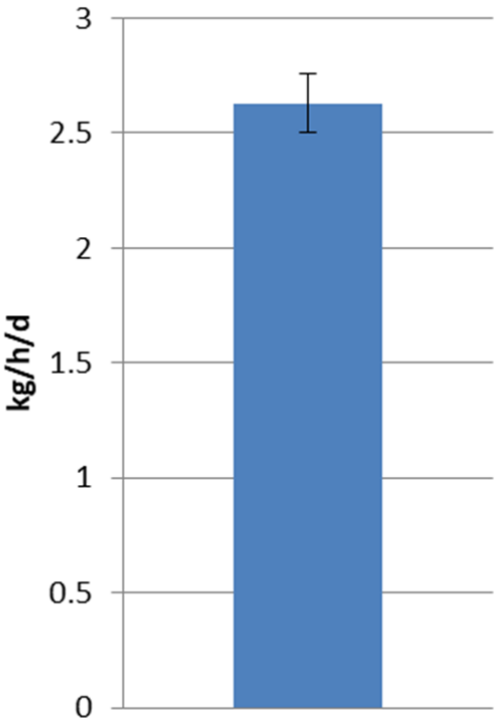


On average the steers gained 1.6kg/h/d across 35 days of grazing. The expected gain based on the GrazFeed model was only 1.3 kg/h/d which was below the span of the 95% confidence limits of the measured data. Overall, the error was small and could be the result of errors in a number of inputs. Firstly, the expected mature liveweight (Standard reference weight) may have been underestimated. Secondly the biomass sampling transect may not have been fully representative of the paddock. Thirdly the steers may have had some setback in the period before entering the paddock and they may have exhibited some compensatory gain which was not captured by the model.

Paddock d) Lowanna Grazing Oats

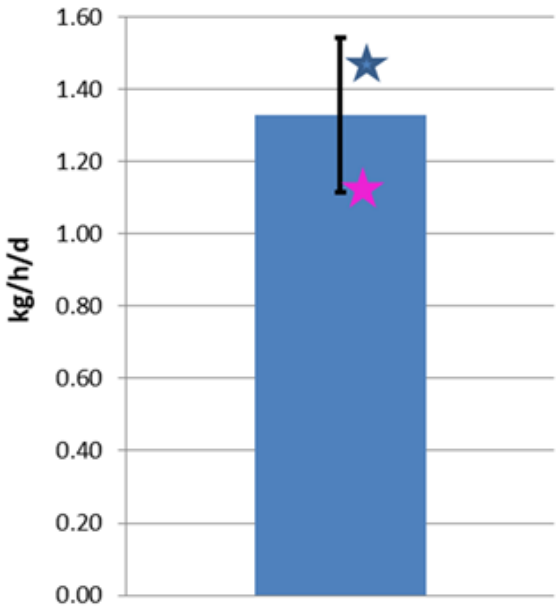
Unfortunately, due to farm decisions there were no steers available to graze this crop at the initial grazing, so it was grazed by mature cows which had been traded to profit from weight gain. For unknown reasons the cows put on weight at a much higher rate than might reasonably be expected. Given that these animals had been trucked in they had probably been off feed and water for an extended period meaning the curfew conditions for the subsequent weighing would have been significantly different. Modelling of this scenario was not possible as feed quality was not observed for this grazing.

Figure 5. Performance of cows on grazing oats at Lowanna 2019.



The paddock was grazed a second time with mixed sex young cattle between the 17th and the 30th of July with animals weighing 183 kg LWt on average. GrazFeed modelling suggested that the weight gains observed over this two-week period were as expected and they are shown as a blue star for the steer portion and a pink star for the heifer portion with both estimates lying within the 95% confidence interval for the average daily gain of the entire cohort.

Figure 6. Performance of young cattle on grazing oats at Lowanna 2019.



Paddock e) Lowanna Canola

This paddock was grazed by two main cohorts. The first cohort of 24 steers entered the paddock on the 17th of June at around 300kg liveweight and exited the paddock on the 30th of July. Weight gain averaged 1.16 kg/h/d and the combination of herbage characteristics when used in GrazFeed gave an expected weight gain of 1.28 kg/h/d which was within the 95% confidence limits of the observed measurements.

The second cohort was a group of 32 young mixed sex cattle averaging 240kg live weight which entered the paddock on the 27th of September and exited on the 18th of November. The average daily gain of the entire group over this period was 1.37 kg/h/d and this reflected the predicted liveweight gain from GrazFeed. Again the heifer and steer portions were modelled separately and the outputs represented by the pink and blue stars respectively. If the average position of the two model outputs falls within the 95% confidence limits of the measured mixed cohort again giving confidence on the ability to predict the outcome of the finishing system using GrazFeed.

Figure 7. Performance of Steers on Canola at "Lowanna" in 2019

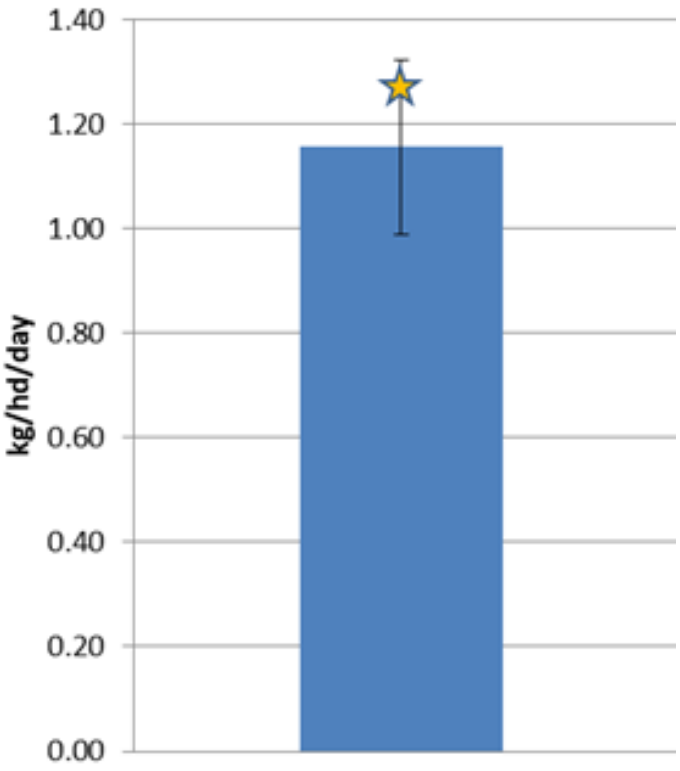
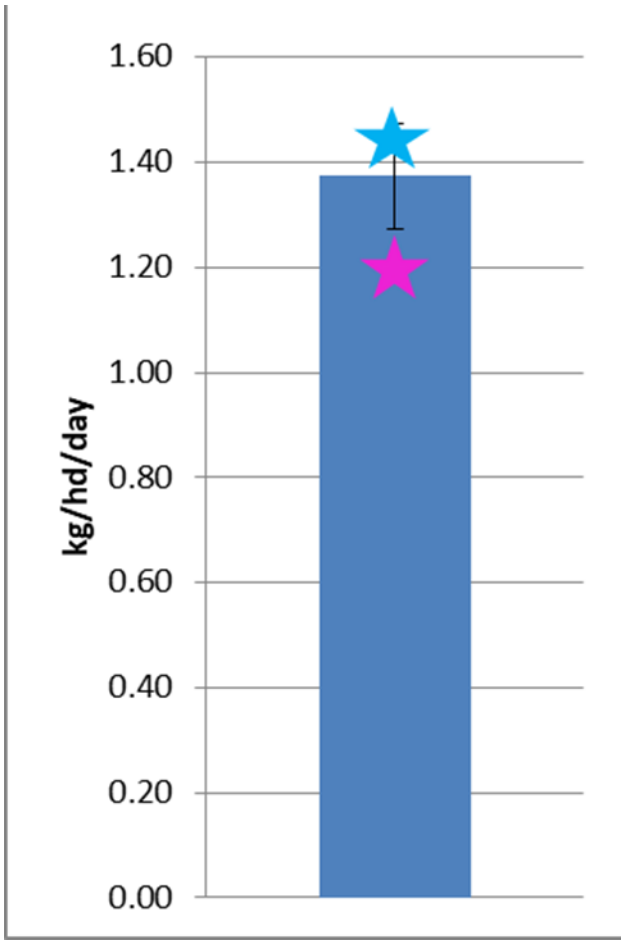


Plate 1. Steers on Canola at Lowanna.

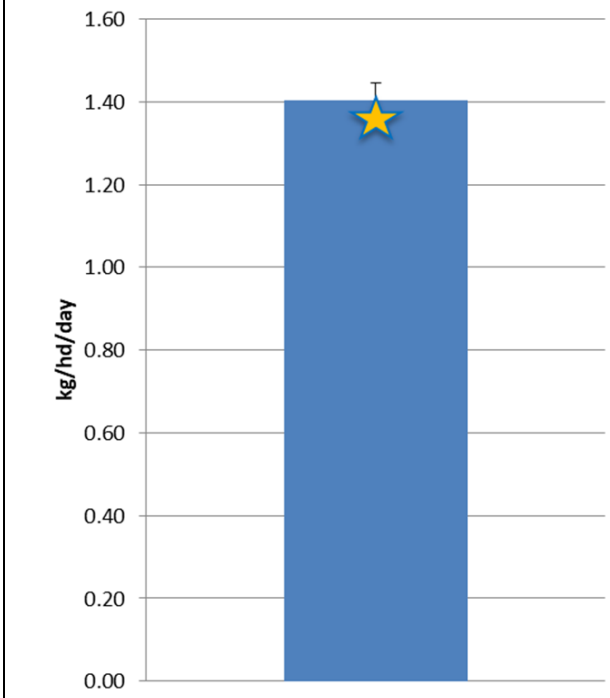
Figure 8. Performance of mixed sex young cattle on Canola at "Lowanna" in 2019.



Paddock f) Jillamatong Ryegrass

This paddock was grazed over an extended period from the 15th of May to the 12th of August. The cohort was of 32 steers averaging 204kg liveweight on entry. Even though the biomass level at just over 1000kgDM/ha seems low the plant density was low and the average height was tall and exceeded 20cm. This meant animal intake was not being limited and weight gains were good especially given the feed quality was high. Across the whole period the measured gain was 1.4 kg/h/d and the expected gain based on GrazFeed was within the 95% confidence interval once pasture height was properly accounted for. The herbage mass at exit was not substantially different to that at the entry date suggesting average pasture growth across the full grazing period was approaching 20kg/ha/d.

Figure 9. Performance of steers on Ryegrass at "Jillamatong" in 2019.

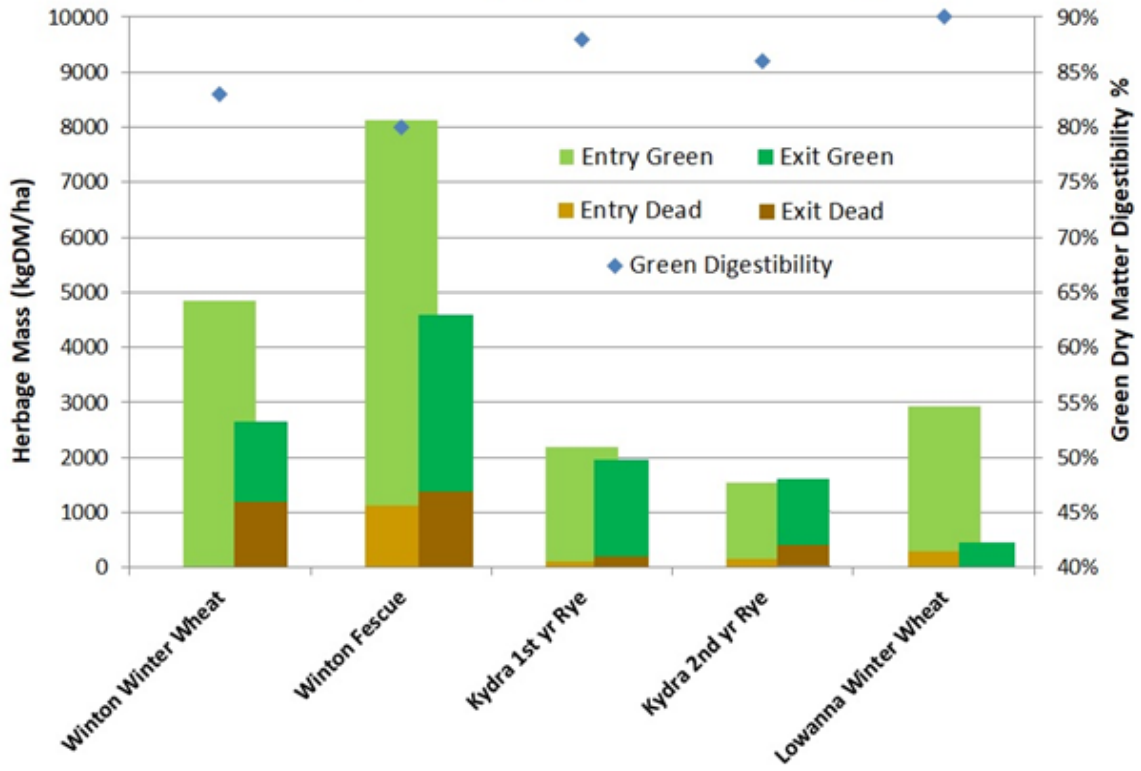
ADG of steers between 15th May and 12th Aug.	Jillamatong Ryegrass 15th May
	

4.1.2 Second Years Results (2021)

Herbage mass and Quality

The herbage mass was assessed upon entry and exit of the steers from each paddock. At the time of entry, the feed quality was also tested.

Figure 10. Herbage availability and quality at the start and the herbage mass at the end of the grazing period for each paddock in 2021



Animal Performance

Paddock g) Winton Winter Wheat

Steers grazed this paddock over a single 71-day period from the 19th of April until the 29th of June 2021. Steers began the trial at averaging 297kg liveweight and an interim liveweight was taken on the 11th of May. On average the steers gained 1.27 kg/h/d over the entire grazing period. GrazFeed predicted weight gain based on entry herbage mass and quality was just over 1.3 kg/h/d which was slightly higher than the upper end of the 95% confidence interval for the measured data. Dry matter percentage was low at this time with just 17% dry matter and with digestibility being very high at 83% it is possible a lack of effective fibre may have limited the digestive performance of the steers especially as they adjusted to the feed in the early stages of grazing.

Figure 11. Performance of steers on winter wheat at "Winton"in 2021

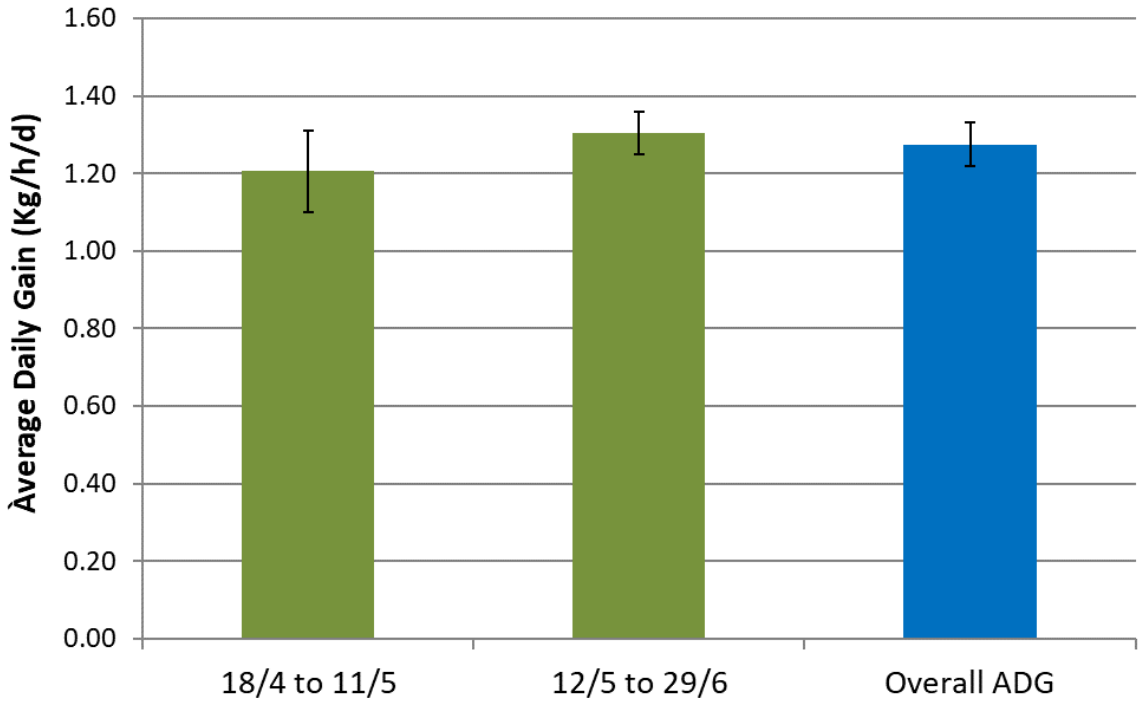


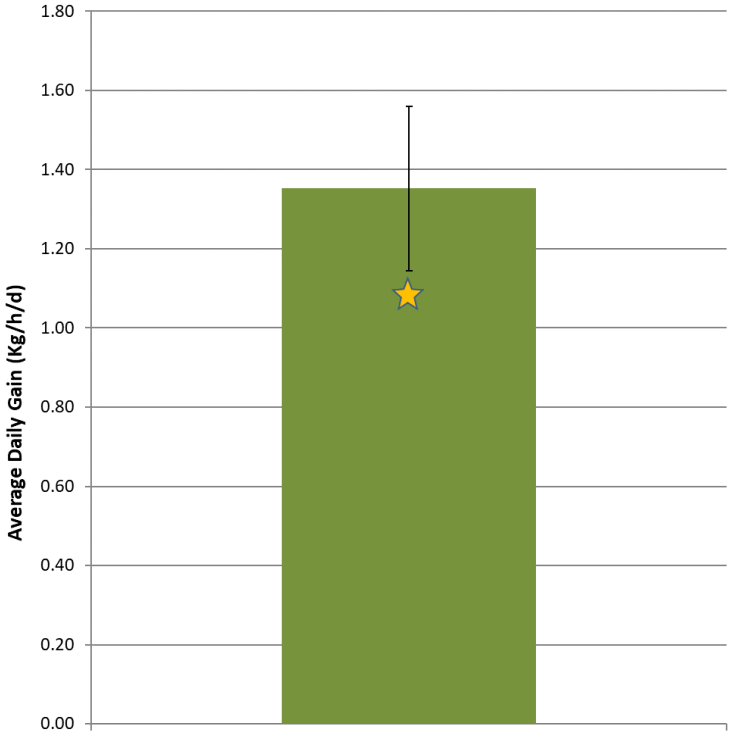
Plate 2. Winton winter wheat crop on the 18th of April 2021

Plate 3. Steers grazing Winton Wheat paddock on the 29th of June 2021.

Paddock h) Winton Fescue

Steers were moved directly from the winter wheat on to this Fescue / Lucerne pasture at "Winton". Steers grazed this paddock between the 29th of June and the 15th of August. Being winter the contribution from the Lucerne component was very low and herbage was dominated by tall fescue.

Figure 12. Animal performance on Fescue / Lucerne Pasture at Winton in 2021



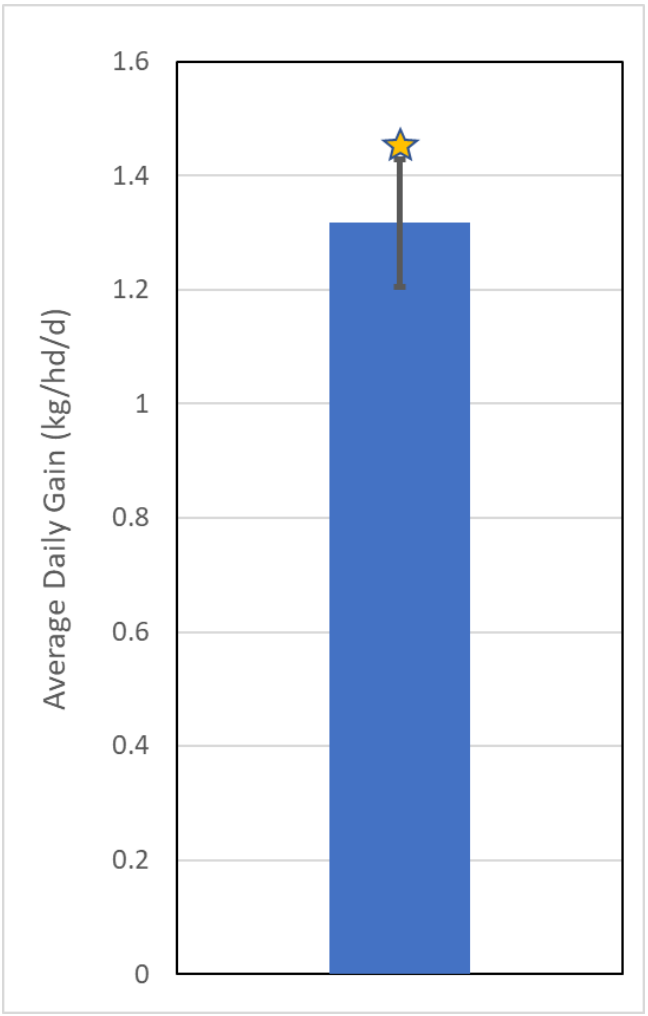
On average the steers continued to gain at 135 kg/h/d across the 47 days of grazing. GrazFeed modelling projected a steer growth rate just under the observed range. This difference is largely due to the highest digestibility pool in GrazFeed being 80% which limits the animals' diet to 80% DMD. As the measured green digestibility is right on 80% animals would be selecting a diet higher than 80% which would account for the underestimate of growth rate in GrazFeed.

Paddock i) Kydra 1st year Ryegrass

Conditions in this paddock were quite wet and rainfall was ongoing throughout the grazing period

Steers grazed this paddock between the 15th of June and the 22nd of July and entered the paddock at 429 kg Live weight.

Figure 13. Animal Performance on 1st year Ryegrass at Kydra in 2021



On average the steers gained 1.32kg/h/d across 35 days of grazing. Due to the very high digestibility of the green herbage the pasture was modelled predominantly as an 87% digestibility roughage supplement to offset the problem that the maximum digestibility of pasture allowed in GrazFeed is only 80% digestible. This supplement was offered ad lib against a background pasture of 500kgDM/ha and 80% digestible to ensure that there was some energy use for grazing accounted for. Using this method, the expected gain based on the GrazFeed model at 1.43kg/h/d was right at the top end of the 95% confidence limits of the observed average of 1.32 kg/h/d. Overall this error is small and the methodology used was imperfect.

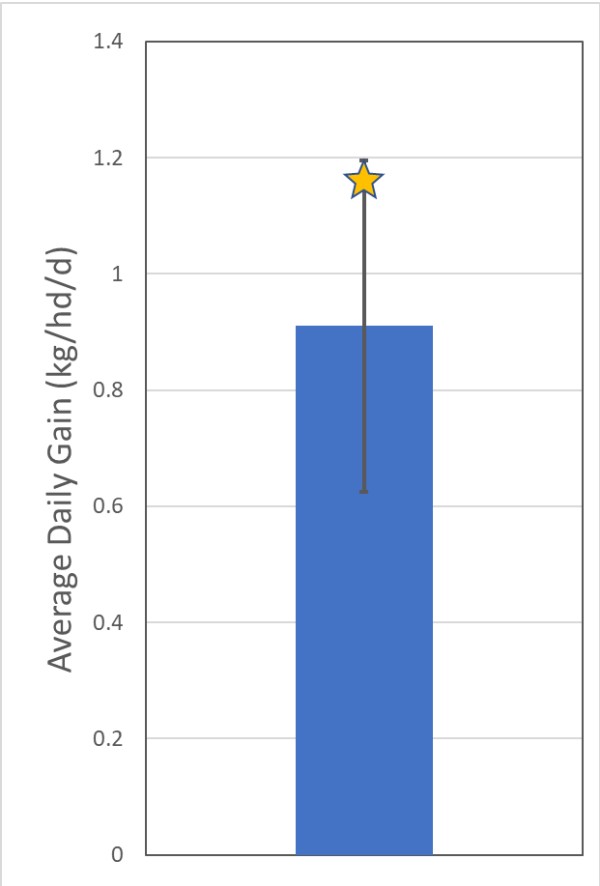
Paddock j) Kydra 2nd yr Ryegrass

Grazing of this paddock occurred in parallel to the 1st year Ryegrass at this location with entry and exit dates being 16th of Jun and the 20th of July.

Steer entry weights were about 10kg lighter at 418kg and over the 34 days of grazing they gained an average of 0.91kg/h/d. This will be because of a combination of lower herbage mass and also slightly

lower digestibility. GrazFeed runs were done in a similar manner to the 1st yr Ryegrass and the model overestimated the growth rate in a similar fashion with the estimate right at the upper end of the 95% confidence limits of the measured gain. This paddock was also a difficult paddock to sample effectively as it was much more broken up by outcrops of boulders necessitating the use of a split transect to ensure better coverage of the paddock.

Figure 14. Performance of Steers on 2nd year Ryegrass at Kydra in 2021.

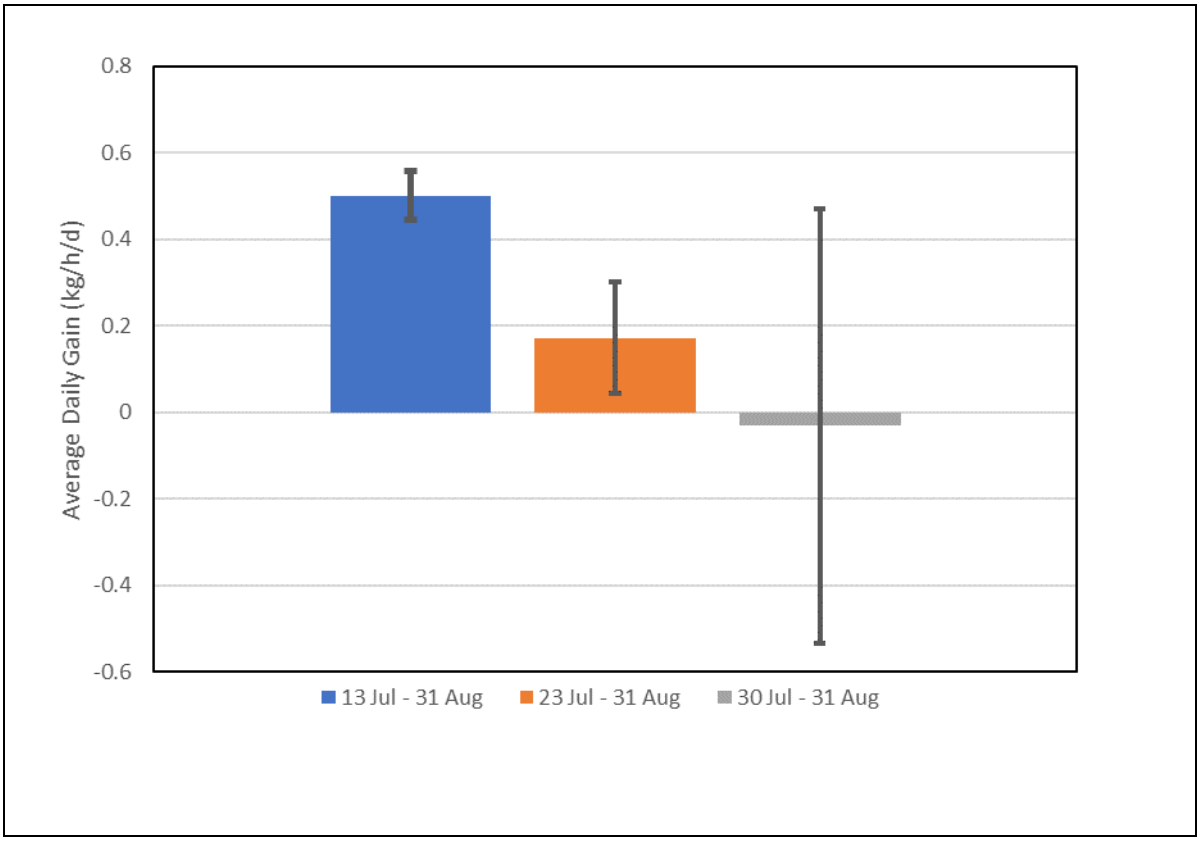


Paddock k) "Lowanna" winter wheat

This property is right on the edge of the eastern escarpment of the Monaro region and receives a larger amount of rain on average, but this year there has been abnormally wet conditions and the paddock monitored was subject to considerable waterlogging and hence pugging during the grazing period.

This paddock had a single grazing with steers. 97 steers entered the paddock on the 14th of July at around 300kg liveweight. On the 23rd of July a further 17 steers averaging 322kg entered the paddock and then finally 4 more steers averaging 285kg entered the paddock on the 30th of July. All steers remained in the paddock until the 31st of August. Weight gain of the initial cohort averaged 0.5kg/h/d which is considerably lower than would be expected for the herbage availability and quality at the grazing entry date. The second cohort averaged just 0.17 kg/h/d and the final 4 steers did not gain weight over their month of grazing.

Figure 15. Weight gain of three cohorts of steers with different date of entry onto winter wheat at "Lowanna" in 2021



When modelled in GrazFeed as a supplement It would be expected that while ever the herbage was available to graze the steers should have been able to grow in excess of 2kg/h/d. The paddock however was just 20ha and the number of steers ultimately grazing the paddock tallied 118 or almost 6 steer per ha. Initial intake of DM would be expected to approach 10kg/h/d so DM would have been consumed at around 60kg/ha/d plus there would have been at least 50% wastage due to soiling and pugging under that high stock density and with such wet soil. This brings the amount of dry matter leaving the paddock to at least 90kg/ha/d and with waterlogged soils the additional growth of herbage might be expected to be very low to negligible. The reality of the feed budget for such a high stocking density has meant that the grazing period has been too long in this paddock for the size of the mob.

Looking at each cohort individually since the third cohort did not gain weight over the final month of grazing then it is reasonable to assume that the other steers would have performed similarly over this period. Based on that assumption the second cohort must have grown at 0.96kg/h/d in the last week of July in order to average 0.17kg/h/d over the full grazing period.

Using similar logic then the first group of 97 steers would have grown at 1.78kg/h/d for the first 10 days before the entry of the second cohort in order that their average gain reach 0.5kg/h/d over the entire grazing period. This level of initial growth is much more in line with the GrazFeed expectations based on the entry herbage mass and quality.

Overall, the poor performance of the steers over this grazing period is more to do with a high stocking rate diminishing herbage availability and quality rather than a poor performance of the crop per se.

Plate 4. Herbage at the commencement and the end of grazing at Lowanna in 2021

4.2 Economic analysis

4.2.1 First Year Economics

Table 1. Whole of Paddock steer performance 2019

	Bibbenluke		Mila	Cathcart		Jillamatong
	Wheat	Rye/Luc	Wheat	Oats	Canola	Ryegrass
Kg/h/day	1.42	0.96	1.61	1.33	1.24	1.4
Total kg Gain	2405	652	2988	1244	4090	3994
Gain kg/ha	241	65	270	77	409	285

Each paddock had widely varying performance in terms of total steer weight gain per ha not so much because of differences in overall productivity as the fact that each had a variable amount of grazing for other purposes. For this reason the economic analysis has accounted for the amount of other grazing and given this a value based on the average farm gross margin/dse.

The following overall economic output of the paddock for the year was accounted for using the following factors as inputs and was calculated in the manner of a partial budget.

Table 2. Economic input assumptions for 2019.

Steer weight gain	Valued at 3 yr median for yearling feeder steers (294 c/kg lwt)
Increase in value of existing weight	Existing weight value increased by 15c/kg lwt
Variable Costs	One drench, One vaccination $5/hd (average 10c /kg lwt gained)
Transaction Costs	Transaction costs (5% of value gained)
	Freight ($0.05 per kg gained)
Fertiliser	Extra P at 1 kg/DSE extra grazing above 8 dse/ha
Amortised cost of establishment	Real costs as provided by cooperating farmers plus allowances for machinery costs where they weren't provided.
Value of extra grazing	valued at $53.20/dse (Aggregate Consulting 2019 benchmarking data)

As such the profit is calculated in the manner of a partial budget as the additional profit over and above the return expected from baseline pasture carrying 8 dse/ha.

Individual System economic Calculations

Table 3. Profit calculation for Winter Wheat at Bibbenluke in 2019

Benefits

Lwt Gain	241 kg/ha
Value	$708/ha
Existing weight	$157/ha
Other Grazing	3.76 DSE/ha
Base Line	8 DSE/ha
Extra / Forgone	4.24 DSE/ha
Value	$226/ha
NET	$639/ha

Costs

Cost to Establish	$405/ha
Commission	$35.40
Freight	$12.05
Husbandry	$24.10
Total Cost	**$476.55**

Profit = $162/ha/yr

Table 4. Profit calculation for pasture at Bibbenluke in 2019

Benefits

Lwt Gain	65 kg/ha
Value	$191/ha
Existing weight	$39/ha
Other Grazing	17.68 DSE/ha
Base Line	8 DSE/ha
Extra / Forgone	9.68 DSE/ha
Value	$515/ha
NET	$745/ha

Costs

Pasture Costs	
4 month fallow (2.64 dse)	*$147*
Cost to Establish	*$354/ha*
Amortised (4yr)	**$135/ha/yr**
Steer Finishing Costs	
Commission	$11.50
Freight	$3.25
Husbandry	$6.50
Extra Fertiliser Cost	$48.40
Total Extra Cost	**$204 /ha/yr**

Profit = $541/ha/yr

Table 5. Profit calculation for Wheat at Mila in 2019

Benefits

Lwt Gain	270 kg/ha
Value	$794/ha
Existing weight	$193/ha
Other Grazing	7.1 DSE/ha
Base Line	8 DSE/ha
Extra / Forgone	0.9 DSE/ha
Value	$47.88/ha
NET	$939/ha

Costs

Crop Costs	
Establishment Cost	**$314/ha/yr**
Steer Finishing Costs	
Commission	$50
Freight	$13.50
Husbandry	$27
Total Extra Cost	**$405 /ha/yr**

Profit = $533/ha/yr

Table 6. Profit calculation for grazing oats at Lowanna in 2019

Benefits

Lwt Gain	77 kg/ha
Value	$226/ha
Existing weight	$10/ha
Other Grazing	12.4 DSE/ha
Base Line	8 DSE/ha
Extra / Forgone	4.4 DSE/ha
Value	$234/ha
NET	$470/ha

Costs

Crop Costs	
Establishment Cost	**$314/ha/yr**
Steer Finishing Costs	
Commission	$50
Freight	$13.50
Husbandry	$27
Total Extra Cost	**$405 /ha/yr**

Profit = $540/ha/yr

Table 7. Profit calculation for grazing canola at Lowanna in 2019

Benefits

Lwt Gain	409 kg/ha
Value	$1202/ha
Existing weight	$199/ha
Other Grazing	1.44 DSE/ha
Base Line	8 DSE/ha
Extra / Forgone	6.54 DSE/ha
Value	$350/ha
NET	$1051/ha

Costs

Crop Costs	
Establishment Cost	$318/ha/yr
Fallow (3m in 2018)	**$106**
Steer Finishing Costs	
Commission	$70
Freight	$20
Husbandry	$41
Supplements	$105
Total Extra Cost	**$660 /ha/yr**

Profit = $391/ha/yr

Table 8. Profit calculation for short term Ryegrass at Jillamatong in 2019

Benefits

Lwt Gain	285 kg/ha
Value	$838/ha
Existing weight	$70/ha
Other Grazing	5.3 DSE/ha
Base Line	8 DSE/ha
Extra / Forgone	2.7 DSE/ha
Value	$144/ha
NET	$764/ha

Costs

Crop Costs	
Establishment Cost	$366/ha/yr
Steer Finishing Costs	
Commission	$45
Freight	$14
Husbandry	$29
Total Extra Cost	**$454 /ha/yr**

Profit = $310/ha/yr

Finally, the contribution to the whole farm profit was calculated under the assumption that the specialist crop or pasture represented 7% of the farm area as suggested by the initial GrassGro modelling.

Table 9. Overall Economic Summary 2019

	Wheat		Perennial Pasture	Canola	Oats	Tetraploid Rye
Liveweight Gain (Kg Lwt/ha)	241	270	65	409	77	285
Net Other Grazing (DSE/ha)	4.24	0.9	9.7	6.54	4.4	2.7
Net Value ($/ha)	639	939	745	1051	470	764
Extra Costs ($/ha)	477	405	204	660	405	454
Net Profit 2019 ($/ha)	**162**	**533**	**541**	**391**	**540**	**310**
Increase in Farm Gross Margin ($/ha)	12	38	39	28	39	22

All systems studied in 2019 returned a profit relative to the assumed whole farm baseline. Since the demonstration sites were in different locations with variable past history and subject to different rainfall and temperature regimes it is not possible to use this data to draw a conclusion as to which pasture or crop system gives the best results. Rather these results should give Monaro farmers the confidence that as long as the crop or specialist pasture sown is agronomically suited to their location if it is used to retain and grow steers over winter it will generate considerably increased profits compared to their baseline pasture.

4.2.2 Second Year Economics

Table 10. Whole of Paddock steer performance 2021

	Winton		Cathcart	Kydra Ryegrass	
	Wheat	Fes/Luc	Wheat	1st yr	2nd Yr
Kg/h/day	1.27	1.35	0.5	1.32	0.91
Total kg Gain	5138	3559	2925	1243.8	1330
Gain kg/ha	270	237	125	261	46

Again the paddocks had varying performance in terms of total steer weight gain per ha. Both paddocks at Winton were remarkably similar in steer performance and the first year Mona ryegrass at Kydra also fell in this range. Performance at Cathcart was severely hampered by waterlogging due to the very wet conditions and the second year ryegrass numbers are more hampered by there being a single measured cohort despite the fact there were several other cohorts of steers grazed. This has in part been accounted for through the calculation of DSE's carried but steer weight gain is likely to have been undervalued when it is valued at the baseline benchmark of $53.20 per DSE.

The following overall economic output of each paddock for the year was accounted for using the same inputs as for 2019 except the 3 year median steer price has risen and the difference in price of weaner steers at the start of winter relative to feeder steers in spring has risen also.

Table 11. Economic input assumptions for 2021.

Steer weight gain	Valued at 3 yr median for yearling feeder steers (390 c/kg lwt)
Increase in value of existing weight	Existing weight value increased by 19c/kg lwt
Variable Costs	One drench, One vaccination $5/hd (average 10c /kg lwt gained)
Transaction Costs	Transaction costs (5% of value gained)
	Freight ($0.05 per kg gained)
Fertiliser	Extra P at 1 kg/DSE extra grazing above 8 dse/ha
Amortised cost of establishment	Real costs as provided by cooperating farmers plus allowances for machinery costs where they weren't provided.
Value of extra grazing	valued at $53.20/dse (Aggregate Consulting 2019 benchmarking data)

Individual System economic Calculations 2021

Table 12. Profit calculation for Winter Wheat at Winton in 2021

Benefits

Lwt Gain	**270 kg/ha**
Value	$1053/ha
Existing weight	$88/ha
Other Grazing	*5.3 DSE/ha*
Base Line	*8 DSE/ha*
Forgone DSE	*2.7 DSE/ha*
Forgone DSE value	$144/ha
NET $ Gain	**$997/ha**

Costs

Crop Costs	
Fallow in 2020 (3 DSE)	**$159/ha**
Establishment Cost	**$223/ha**
Total	**$382/ha**
Steer Finishing Costs	
Commission	$60.95
Freight	$13.50
Husbandry	$27.00
Total Extra Cost	**$483 /ha**

Profit = $514/ha/yr

Table 12. Profit calculation for Fescue/Lucerne pasture at Winton in 2021

Benefits

Lwt Gain	237 kg/ha
Value	$924/ha
Existing weight	$58/ha
Other Grazing	*11.2 DSE/ha*
Base Line	*8 DSE/ha*
Extra DSE	3.2 DSE/ha
Extra DSE value	$168/ha
NET $ Gain	**$1150/ha**

Costs

Pasture Costs	
Cost to Establish	*$410/ha*
Amortised (5yr)	**$92/ha/yr**
Steer Finishing Costs	
Commission	$49.10
Freight	$11.85
Husbandry	$23.70
Extra Fertiliser Cost	$15.80
Total Extra Cost	**$192/ha/yr**

Profit = $958/ha/yr

Table 13. Profit calculation for 1st Year Mona Ryegrass pasture at Kydra in 2021

Benefits

Lwt Gain	261 kg/ha
Value	$1018/ha
Existing weight	$104/ha
Other Grazing	*3.7 DSE/ha*
Base Line	*8 DSE/ha*
Forgone DSE	*4.3 DSE/ha*
Forgone DSE value	$228.76/ha
NET $ Gain	**$893/ha**

Costs

Pasture Costs	
Cost to establish	*$272/ha*
Amortised (2yr)	**$144/ha/yr**
In crop (Pesticide, N, Gib)	**$169/ha/yr**
Steer Finishing Costs	
Commission	$56
Freight	$13
Husbandry	$27
Total Extra Cost	**$409 /ha/yr**

Profit = $484/ha/yr

Table 14. Profit calculation for 2nd Year Mona Ryegrass pasture at Kydra in 2021

Benefits

Lwt Gain	45 kg/ha
Value	$175/ha
Existing weight	$66/ha
Other Grazing	*15.1 DSE/ha*
Base Line	*8 DSE/ha*
Extra DSE	*7.1 DSE/ha*
Extra DSE value	$378/ha
NET $ Gain	**$619/ha**

Costs

Pasture Costs	
Cost to establish	*$272/ha*
Amortised (2yr)	**$144/ha/yr**
In crop (Pesticide, N, Gib)	**$134/ha**
Steer Finishing Costs	
Commission	$12/ha
Freight	$2.25/ha
Husbandry	$4.50/ha
Extra Fertiliser Cost	$35.5/ha
Total Extra Cost	**$332 /ha**

Profit = $287/ha/yr

Table 15. Profit calculation for Winter Wheat at Lowanna in 2021

Benefits

Lwt Gain	125 kg/ha
Value	$488/ha
Existing weight	$89/ha
Other Grazing	9.8 DSE/ha
Base Line	8 DSE/ha
Extra DSE	1.8 DSE/ha
Value	$96/ha
NET $ Gain	**$673/ha**

Costs

Crop Costs	
Fallow in 2020 (3 DSE)	**$159/ha**
Establishment Cost	**$289/ha**
Total	**$448/ha**
Steer Finishing Costs	
Commission	$28.85
Freight	$6.25
Husbandry	$12.50
Total Extra Cost	**$496 /ha**

Profit = $177/ha

The contribution to the whole farm profit was again calculated using the assumption that the specialist crop or pasture would constitute 7% of the farm area. As shown in table 16. all systems studied in 2021 again returned a profit relative to the assumed whole farm baseline with farm profit increasing by $14/ha to $100/ha.

Table 16. Overall Economic Summary 2021

	Wheat		Fescue/Luc	Tetraploid Rye	
				1st Yr	2nd Yr
Steer Gain (Kg Lwt/ha)	270	125	237	261	45
Net Other Grazing (DSE/ha)	2.7	1.8	3.2	4.3	7.1
Net Value ($/ha)	997	673	1150	893	619
Extra Costs ($/ha)	483	491	192	409	332
Net Profit 2021 ($/ha)	**514**	**177**	**958**	**484**	**287**
Increase in Farm Profit ($/ha)	51	14	100	47	26

Even in the case of the Cathcart wheat which was severely waterlogged and pugged the performance was higher than the assumed baseline pasture. In that paddock in 2021 the baseline pasture would also have been affected by waterlogging and baseline performance would have also been reduced. It should be noted that a large portion of the extra DSE run on the 2nd year Ryegrass at Kydra were actually extra cohorts of steers for which no weight gains were measured so the economic performance of this paddock is likely to have been considerably underestimated. Again, these results should boost confidence in the strategy of retaining steers over winter on specialist pastures and crops.

4.3 Extension and communication

Throughout the two years of data capture for this PDS project, educational and information activities were delivered approximately twice a year to update members on the information and provide a platform for discussion of results, interpretation and producer exchange and interaction. The following communication / education activities were delivered;

- **5th December 2019** - Steer Finishing Presentation – Year 1 Results – 50 attendees
- **6th December 2021** - Steer Finishing Presentation – Final Results – 70 attendees

Communication activities around these field days included regular newsletter articles, a website page, local newspaper articles, radio interviews and case studies.

Results from our post project observer survey indicated 90% of respondent's indicated that this project has increased their confidence, knowledge and skills in finishing lambs and 75% plan to implement changes as a result of the data presented. These changes include using EID tag and recording software, as well as weighing weaners on and off finishing systems and increasing the number of weaners to be finished.

4.4 Monitoring and evaluation

Monitoring and evaluation was undertaken throughout the entire project and all data was recorded and stored on the MFS computer and MFS One Drive account. The project was put on hold after the first year due to drought conditions, but resumed the year after allowing competition of the project with 2 different site hosts.

All Core and observer producers surveyed said their knowledge, confidence and skills had increased during the project.

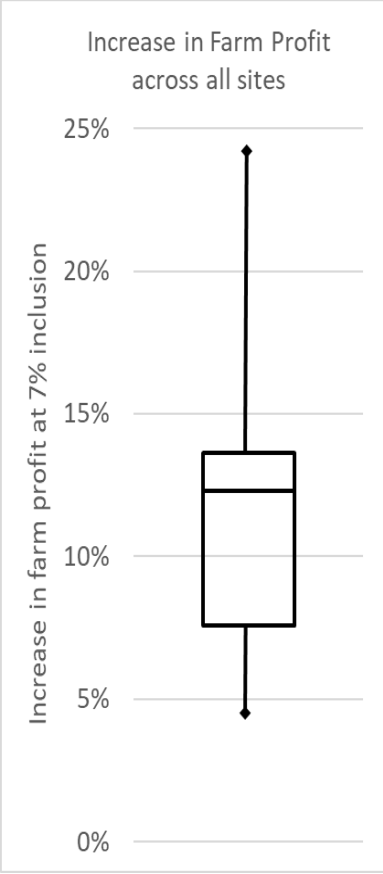
From post project surveys, ninety percent of core producers are expected to implement finishing weaners / steers on crop in the future. Observers were very satisfied with the presentation of final results at the field day and as a result of project, 75% of producers intend to implement key outcomes with 25% requiring further information.

Feedback from the Steering Committee noted that the project was valuable and results have helped inform future practice.

5 Conclusion

The original GrassGro modelling indicated that retaining steer weaners over their first winter would be profitable compared with selling prior to winter as weaners in most years. This work also highlighted that the rainfall total over the March-April was a useful guide to identify those years with a greater risk of a poor result with a total below 50mm being suggested as an indicator.

Figure 16. Increase in farm profit across all sites



In this PDS which commenced in 2018 delays in delivery were sought in both 2018 and again in 2020 on the basis of seasonal conditions and cooperating farmers deciding not to retain weaner steers through winter. The April – May rainfall totals in these two years were 25mm and 34mm respectively which not only was below the suggested 50mm threshold but ranked both these years in the worst 10% of the past 50 years for this metric. 2019 and 2021 by contrast had 94.2mm and 97.5mm in March -April placing them around the 6th decile (just on the average) making them ideal years to test the profitability from retaining steers.

Overall, the inclusion of a specialist pasture or crop at 7% of the farm area for retaining steer weaners and maintaining their weight gain over winter added considerably to the whole farm economic performance. When expressed as a percentage change relative to the baseline from the 2019 benchmarking data the range in improvement of farm profit was from 4% to 24% ($12 - $100/ha). Notwithstanding that the monitor paddocks in most cases carried many other stock throughout the year (often more than half the total DSE) this improvement in profit is still less than the levels indicated by the GrassGro modelling where the oats crop modelled was wholly dedicated to the steer enterprise and averaged a 58% improvement in gross margin.

Once a method for accounting for the very high digestibility encountered in 2021 was established GrazFeed was found to reliably predict steer weight gains of the order indicated by the

measurements which should give farmers confidence to use GrazFeed to predict performance and perhaps more importantly to feed budget to establish appropriate mob sizes or lengths of grazing periods for a given size mob.

Overall, the use of GrazFeed for these situations would be enhanced if an additional green digestibility pool was added to allow for green herbage which tests higher than the current model maximum of 80%.

5.1 Key Findings

In every case the demonstration paddocks with specialist crops and pastures enabled steers to be held over the winter to reach higher weights than the traditional system of selling as weaners before their first winter. In every case tested this strategy leads to much higher profit per ha on the sown paddock compared with the farm average and in so doing increased the whole farm profit by a significant amount.

5.2 Benefits to industry

The combination of the initial modelling with these PDS results should give Monaro and other southern tablelands producers confidence to change their beef systems away from the focus on number of head produced as weaners to one which targets heavier weight steers either finished for slaughter or suited directly to feedlot entry. While this change will increase the total DSE carried over winter it also facilitates a beef system which retains a greater number of head throughout spring and shifts the peak enterprise pasture requirement into the period of greatest pasture growth enabling higher overall utilisation and utilisation of dry matter when it is at its highest quality.

6 References

Alcock, D. **2017** Feasibility and economics of retaining steer weaners through winter for sale as yearlings. Consultancy report to Monaro Farming Systems.