Maranoa beef production systems

Analysing management strategies to build resilience

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Summary

This report details the economic implications of alternative management strategies for a beef cattle enterprise in the Maranoa Local Government Area of Queensland. Other reports present results for other regions across Queensland's grazing lands (FutureBeef 2024). It is intended that the results of these analyses will support the implementation of resilient grazing, herd, and business practices necessary in managing seasonal variability. The property-level, regionally specific herd, and business models which we have developed can be used by consultants, advisors, and producers to assess both strategic and tactical management decisions for their own properties.

The implications that alternative management strategies have on grazing businesses in the Maranoa are analysed in this report by using scenario analysis to define a base or example property and then measure the impact on this base property of the implementation of the alternative management strategies. The natural, production, financial and human characteristics of the base property were identified using published data and the expert opinion of experienced local beef cattle producers, industry specialists and Queensland Department of Agriculture and Fisheries (DAF) staff.

The base property is 4,000 ha of poplar box and brigalow belah country, entirely used for a beef cattle grazing enterprise sustainably utilising native and sown, primarily buffel grass (*Cenchrus ciliaris*), pastures. The property has a carrying capacity of 940 Adult Equivalents (AE). The base strategy is a self-replacing crossbred (<40% *Bos indicus*) breeding herd, utilising pasture to turn off feeder steers at 20 months of age (460kg), to be sold to a feedlot.

Alternative management strategies that may support enterprise profitability and resilience were investigated using the Breedcow and Dynama suite of herd budgeting software. Breedcow+ steady state models were developed for the base property, running the base strategy, as well as for fully implemented alternative management strategies. Discounted cashflow budgets over thirty years were then developed using Dynama+ and Investan spreadsheets to model the change from the base strategy to the alternative strategy.

The base property and the base strategy turns off 189 feeder steers each year, from 483 breeders mated, generating a herd gross margin after imputed interest of $338,779.

The following alternate strategies are representative of practices within the region, have relevant data available for analysis and are achievable for many producers to implement should they choose:

- Optimising steer sale age and female culling.
- Turning off weaner steers.
- Feeding supplements to steers.
- Grazing weaner steers on forage oats.
- Growing 400ha of wheat as a cash crop.
- Trading and backgrounding steers.

A comparison of the gross margins of alternative management strategies can be found in Table 1. Changing the turn off age of surplus heifers to 20 months and feeding supplements to steers (selling them 31.5kg heavier) were the only alternative management strategies to result in a small increase in gross margin after imputed interest. Thirty-year discounted cashflow budgets were developed for the change from the base strategy to each of the strategies and the annualised Net Present Values (NPV) are also shown in Table 1.

Table 1 Summary of results for the management strategies investigated

Strategy	Gross margin after imputed interest	Change in gross margin after imputed interest	Annualised NPV
Base strategy			
Turning off feeder steers at 20 months, 460kg	$338,779		
Optimising steer sale age			
Turning off weaner steers	$315,232	-$23,547	-$16,693
Turning off bullocks	$299,904	-$38,875	-$31,091
Optimising surplus heifer sale age			
Sell surplus heifers at 20 months	$341,962	$3,183	-$1,112
Sell spayed surplus heifers at 32 months	$334,897	-$3,882	$2,348
Turning off weaner steers			
Turning off weaner steers at 8 months	$315,232	-$23,547	-$16,693
Turning off weaner steers at 6 months	$274,528	-$64,251	-$65,487
Feeding supplements to steers			
Selling 20mth steers 31.5kg heavier	$344,129	$5,350	$5,004
Selling 19mth steers 31.5kg heavier	$341,577	$2,798	$181
Selling 20mth steers 21kg heavier	$338,738	-$41	-$672
Selling 19mth steers 21kg heavier	$336,025	-$2,754	-$5,834
Grazing weaner steers on forage oats			
Lead 40% of weaner steers on oats	$327,070	-$11,708	-$6,534
All weaner steers on oats	$311,715	-$27,064	-$24,675
Growing 400ha of wheat	$337,179	-$1,600	-$11,183
Trading and backgrounding steers	$326,089	-$12,690	-$10,052

Only three of the management strategies shown in Table 1 have positive annualised NPV results and are the only strategies where peak deficit, payback period and IRR are calculated. For spaying surplus heifers and selling them at 32 months, the profitability increases by $2,348 (Annualised NPV), the peak deficit is $30,983 which occurs in year 3, the payback period is 10 years and IRR is 20%.

For supplementing steers, increasing their sale weight by 31.5kg and selling them at 20 months, the profitability increases by $5,004 (Annualised NPV), there is no peak deficit for this strategy since the sale of cows to maintain AE covers the cost of purchasing the troughs.

For supplementing steers, increasing their sale weight by 31.5kg and selling them at 19 months, the profitability increases by $181 (Annualised NPV), the peak deficit is -$3,788 which occurs in year 1 and IRR cannot be calculated.

An additional analysis was conducted into the impact of changing from turning off weaner steers to turning off feeder steers, the reverse of a change shown in Table 1. While the gross margin after imputed interest is higher for the strategy of turning off feeder steers, the cashflow impacts of moving to keep steers for an extra 12 months needs to be carefully analysed. The analysis shows that

profitability increases by $14,985 (Annualised NPV), peak deficit is -$82,278 which occurs in year 2, the payback period is 5 years and IRR is 30%.

The quality of the brigalow and poplar box country assumed to make up the base property, means that the producer has options for alternative cattle management strategies, forage cropping, cash cropping and other grazing enterprises.

Analysis over thirty years found that turning off 20-month-old feeder steers is more profitable than turning off weaners or bullocks. 10-year sales data from the Roma saleyards shows that the average weaner price in March is 22c/kg higher than the May average. The analysis in this report found that weaning and selling in March, to gain the higher c/kg at the saleyard, resulted in the lowest profitability of all strategies, when analysed over thirty years. The extra weight of steers sold at 8 months, or as 20-month-old feeders, outweighed the reduction in price per kilogram. However, this does not diminish the relevance of early weaning as a drought strategy.

Cow culling age is not a factor that has significant influence on profitability for the base property since breeder reproduction rates are high and heifers are being joined at 14 months of age.

The profitability of feeding supplements to steers between May and December, when pasture quality is low, is dependent on whether the weight advantage the steers gained during this time is still there when they are sold. This analysis assumed that the steers gained an extra 31.5kg from supplementation, and if steers remained 31.5kg heavier at sale in May, then this strategy increased profitability. However, if the steers were only 21kg heavier at sale, then profitability decreased slightly.

The increase in gross margin after imputed interest resulting from grazing weaner steers on forage oats, does not cover the cost of growing the oats. This is supported by previous studies that show grazing forage oats reduced profitability (Bowen and Chudleigh 2018).

Growing wheat on the brigalow country resulted in a slight reduction in the gross margin after imputed interest. However, wheat does have the potential for a higher gross margin if climatic conditions suit.

Trading and fattening steers has the potential for a higher gross margin but the interest costs of purchasing steers results in lower profitability than breeding feeder steers.

A beef breeding operation turning off feeder steers is well suited to the Maranoa, with good cattle growth rates, high reproductive performance and proximity to the Roma saleyards and southern Queensland feedlots.

While none of the strategies analysed in the report have proven to be a silver bullet that dramatically increases profitability, many of the strategies result in a similar profit to that of the base strategy. When considering the strategies in this report, a producer may identify strengths within their business or management skills, which may lead to profitability beyond that shown in this report. At the very least, the report offers an insight into the long-term profitability of strategies assuming average management skills.

Whilst every effort was made to ensure the assumptions used in each scenario were accurate and validated with industry participants, relevant experts or published scientific studies, the results presented should be viewed as indicative only.

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1 General introduction

More than 80% of Queensland's 173 million ha are used for grazing livestock on lands extending from humid tropical areas to arid western rangelands (QLUMP 2022). The grazing industries make an important contribution to the Queensland economy, with the beef industry in 2020-21 accounting for 41% ($5.9 billion) of the total gross value of Queensland agricultural production (ABS 2022b).

The beef industry is not without its challenges, with variable rainfall, especially long periods of drought, being a major challenge to these multimillion-dollar businesses. The industry additionally faces variable commodity prices and there is pressure on long-term financial performance and viability due to an ongoing disconnect between asset values and returns, high debt levels and a declining trend in terms of trade (ABARES 2019). Making decisions prior to and amidst this adversity can be difficult, but it's often these decisions that play a large part in supporting the long-term profitability and resilience of beef businesses.

This report is produced as part of the project titled, 'GrazingFutures Livestock Business Resilience'. The objective of the work within this project is to improve the knowledge and skills of advisors and producers in assessing the economic implications of management decisions which aim to increase profitability and resilience. This report details the analysis of the economic implications of alternative management strategies for an example beef cattle enterprise in the Maranoa region of Queensland.

1.1 The Maranoa region of Queensland

1.1.1 The land resource

The Maranoa region for this report is defined as the Maranoa Local Government Area of Queensland, approximately 500km west of Brisbane. The Maranoa covers an area of 5.9 million ha and has a diverse range of soils and vegetation, with the five most predominant broad land types being box woodland, box-mulga, cypress pine, brigalow-belah and Mitchell grass (Vandersee and Slater 1984). The distribution of land types across the Maranoa is shown in Figure 1.

The predominant perennial pasture species in the Maranoa is buffel grass (*Cenchrus ciliaris*) which has naturalised extensively throughout the region. Other common species include Premier digit grass (*Digitaria eriantha*), Bambatsi panic (*Panicum coloratum*), Rhodes grass (*Chloris gayana*), green panic (*Panicum maximum*) and purple pigeon grass (*Setaria incrassate*). Predominant native grasses include Queensland bluegrass (*Dicanthium sericieum*), Kangaroo grass (*Themeda triandra*) and Mitchell grasses (*Astrebla elymoides, lappacea and squarrosa*). Barrel medic (*Medicago truncatula*), burr medic (*Medicago polymorpha*), snail medic (*Medicago scutellate*) and Toreador medic (*Medicago tornata x littoralis hybrid*) are naturally occurring pasture legumes throughout the region. Areas with more fertile soil types commonly grow oats (*Avena sativa*), wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), sorghum (*Sorghum spp*.), chickpea (*Cicer arietinum*) and mung bean (*Vigna radiata*).

Major limitations to pasture (native and sown) and fodder crop productivity in the Maranoa include moisture supply, soil chemical fertility, water erosion susceptibility, regrowth of woody vegetation and some areas being susceptible to scalding (Slater 1993). Furthermore, Singh et al. (2009) identified that there is a high risk of poor and unreliable pasture establishment in the Maranoa region due to shallow soil profiles with subsoil constraints (salinity and sodicity), unpredictable rainfall, dry conditions with high soil temperature and evaporative demand in summer, as well as frost and subzero temperatures in winter.

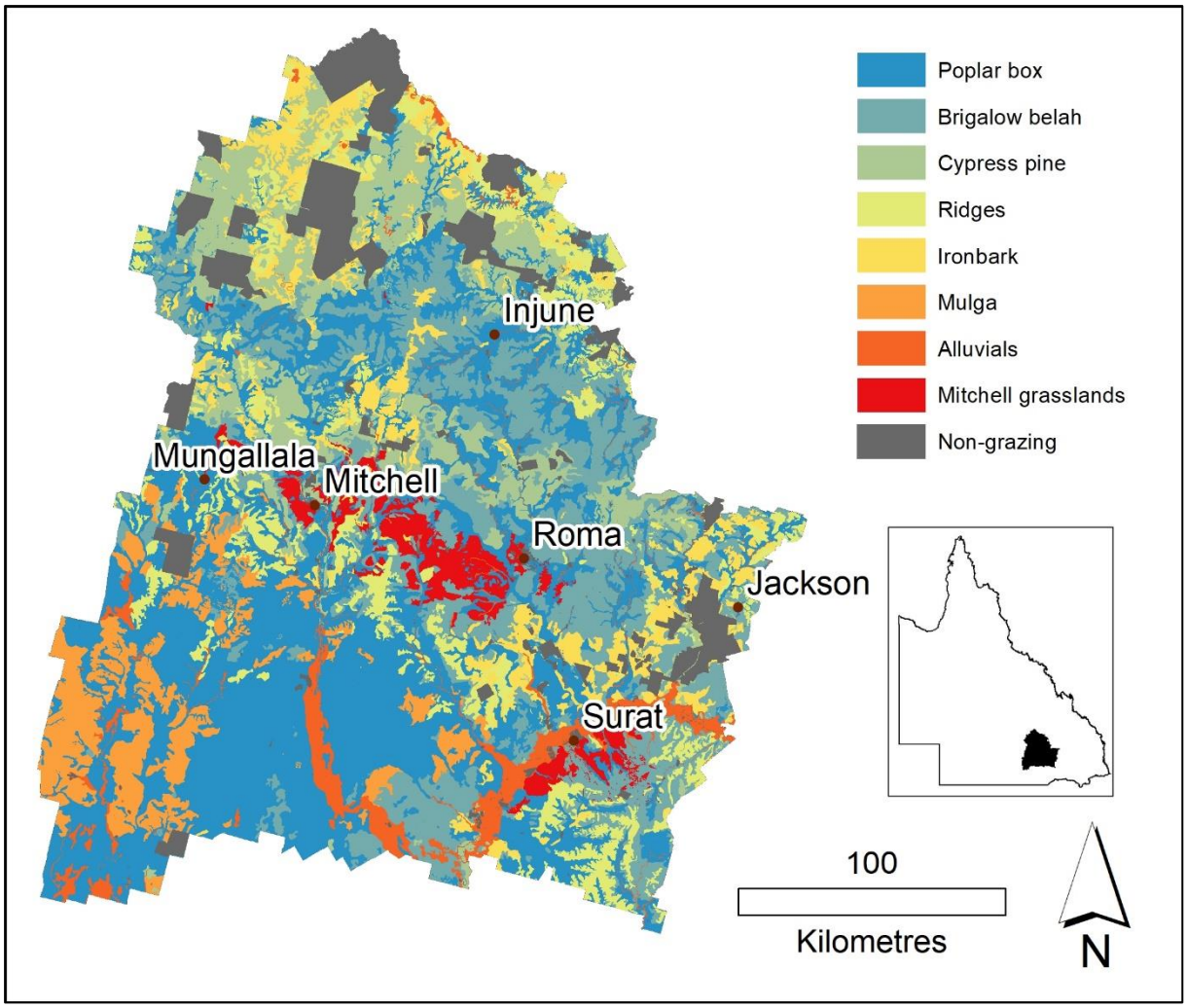

Figure 1 Land types and distribution in the Maranoa region

1.1.2 Rainfall

The Maranoa region has a subtropical climate with variable annual and seasonal rainfall. Table 2 shows that the median rainfall for Roma is 599mm, which mostly occurs in the summer pasture growing season (October to March). Rain at other times of the year can produce high quality herbage for grazing and provide an opportunity for cropping in suitable areas. Following pasture growth in the summer months, livestock production slows as pastures hay off and the digestibility and protein levels of feed declines (DPI 1989). Rainfall variability in the Maranoa is shown in Figure 2, with the annual rainfall of Roma over a 152-year period displayed.

Table 2 Median monthly rainfall (mm) of towns in the Maranoa, 1994-2023 (BOM 2024)

Town	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Injune	58	92	66	31	22	32	21	25	32	61	76	83	617
Mitchell	61	58	43	16	17	23	19	12	17	51	51	55	569
Roma	61	71	47	12	16	23	13	11	17	44	53	58	599
Surat	56	73	42	8	18	22	23	19	15	49	66	56	531

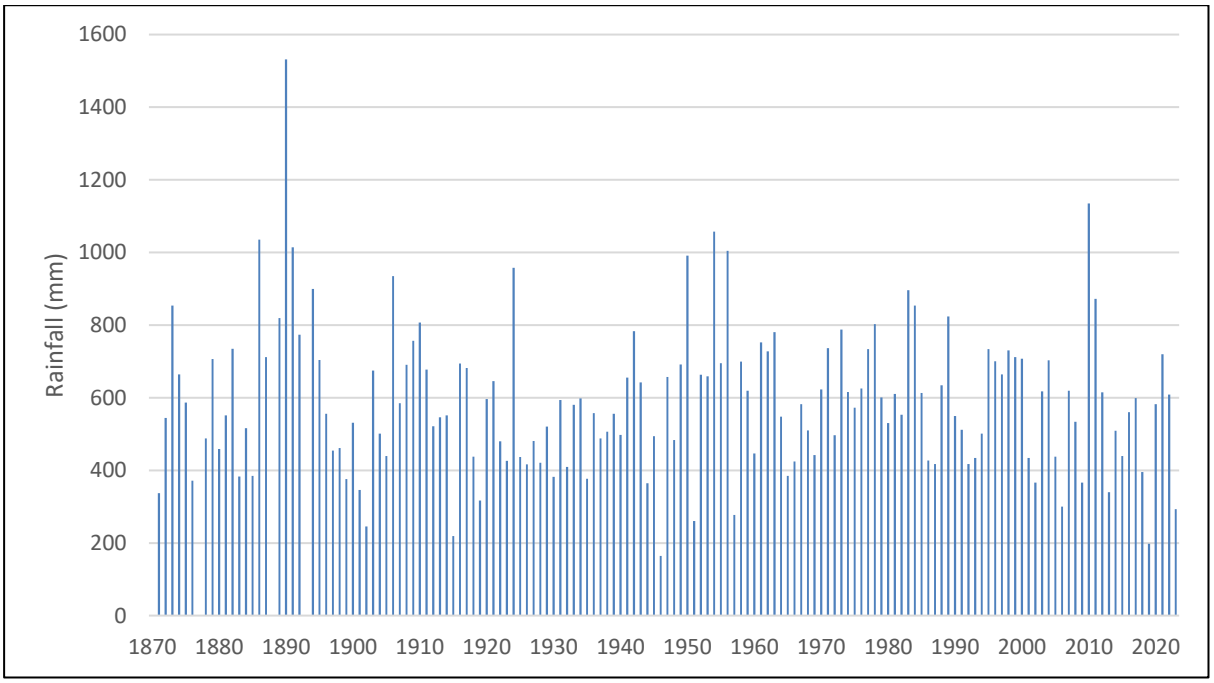

Figure 2 Annual rainfall at Roma, 1871-2023 (BOM 2024)

1.1.3 Maranoa grazing industries

Extensive beef cattle production is the principal land use across the Maranoa region. A total of 91.5% of the area is used for grazing, supporting 668 grazing businesses (ABS 2022a). ABS data reports that beef cattle are grazed on 663 properties and sheep are grazed on 112 properties. In 2020-21 the Maranoa region had a total cattle herd size of 558,651, representing 3% of Australia's and 6% of Queensland's cattle numbers and producing $325 million, or 2% of Australia's and 5% of Queensland's gross value of cattle (ABS 2022b). Grazing of sheep for wool and meat production, as well as rangeland meat goats, are also found in the Maranoa. Many properties in the region contain arable soils used for winter and summer grain and forage cropping.

The region, with its unique mix of productive land types, cattle tick-free status, proximity to a range of market options, local supplies of cattle feedstuffs including grain and cottonseed, and a substantial feedlot industry, has given rise to a diverse range of beef production systems, listed below:

- Breeding cattle for the store trade.
- Breeding and production of feeder cattle.
- Breeding and finishing cattle on forage crops, in on-farm feedlots or on improved pastures for the domestic market through to Jap Ox.
- Backgrounding cattle for feedlots.
- Feedlotting.
- Buying cattle and finishing on crop and/or improved pastures with or without grain supplementation.
- Seed stock production.

Large pastoral companies, corporate entities and a significant number of family operations have made substantial investments in the region to background and finish cattle brought in from breeder blocks in other parts of Queensland or other states. Some of the large enterprises operate or utilise major feedlots in the region as components of their supply chain.

The region features the Roma saleyards, the largest cattle-selling centre in Australia. There are weekly sales (Tuesday), and cattle are typically drawn from southern, western and northwest Queensland, and at different times also from New South Wales, Victoria, South Australia and the Northern Territory. In the last three financial years, annual throughput has ranged from 220,000 to 250,000 head. The biggest annual throughput in the yard's history was in 2009, when nearly 415,000 head were sold.

Hereford cattle once dominated much of the region, particularly around Roma, but there has been a shift towards crossbreeding with breeds such as Santa Gertrudis, Angus and Charolais to generate hybrid vigour. Purebred herds of these breeds also exist. There has also been an increasing interest in the Wagyu breed.

Grazing industries in the district face a range of challenges that impact on productivity including pasture dieback, pasture rundown, Pimelea (*Pimelea spp*.), Parthenium (*Parthenium hysterophorus*), Lovegrass (*Eragrostis trichophora)*, kangaroos and wild dogs. Exclusion fencing has been widely adopted in western Queensland, and some Maranoa producers have also made the decision to erect exclusion fencing in recent years. Coal seam gas production is prevalent in the region, providing an additional income source for some producers with gas infrastructure on their properties.

The prevalence of sheep grazing in the Maranoa has decreased dramatically since the removal of the Australian Wool Reserve Price Scheme in 1991, and the resulting decrease in wool price. This reduction in sheep numbers was exacerbated by increases in the cost of labour, increased risk of wild dog predation and ongoing improved returns from beef cattle, with less variability in returns than wool production.

More recently there has been some replacement within sheep numbers between merinos and low maintenance sheep meat breeds, primarily dorpers. Approximately two thirds of sheep within the Maranoa remain merino and these flocks are run predominantly from Surat and west through to Mitchell, south of the Warrego Highway.

Land values within the Maranoa have increased over time and there is significant disconnect between land values, their productive capacity, and the funds they generate from commodity sales. This disconnect can lead to difficulty covering the cost of land purchase over time, and lower returns on investment.

As the report identifies, the constructed base property can provide a comfortable standard of living for its owner. This, combined with improving equity levels from an increase in property prices, is a reasonable medium to long term prospect.

Grazing land prices reflect the ‘highest and best use’ of the property and there will be producers who will be able to extract additional value from these properties that others may not. There may yet be opportunities to be unlocked in coming years for bio-diversity value, natural capital, change of land use or intensifying production systems.

2 General methods

The implications of alternative management strategies have on grazing businesses in the Maranoa are analysed in this report by using scenario analysis to define a base or example property and then to measure the impact of the alternative management on this base property. The natural, production, financial and human characteristics of the base property were identified using published data and the expert opinion of experienced local beef cattle producers, industry specialists and experienced DAF staff. These experts also assisted in determining the alternative strategies that were analysed and the changes to the base property that occurred due to the implementation of these alternative strategies.

The implications of alternative management strategies were investigated using the Breedcow and Dynama suite of herd budgeting software. The first step was to build a Breedcow+ steady state model for the base property, running the base strategy. Secondly, Breedcow+ was used to investigate the optimal female and steer turn off ages for the base strategy. Thirdly, Breedcow+ models were developed for each of the alternative management strategies, modelling them when the alternative strategy had been fully implemented and all production indicators had reached a steady state. The key indicator when comparing strategies at this stage of the analysis is gross margin after imputed interest, which equals income less variable costs and interest (at 5%) on the capital involved in each strategy.

Finally, Dynama+ and Investan spreadsheets are used to model the change from the base strategy to each of the alternative strategies. This software calculated the following indicators that are provided in this report.

- The annual change in profitability over thirty years (NPV of the change).
- The maximum cumulative cash deficit/difference between the two strategies (peak deficit).
- The number of years before the peak deficit is achieved (years to peak deficit).
- The number years before the investment is paid back (payback period).

Dynama+ and Investan use discounted cash flow techniques to model the changes over a 30-year period with a discount rate of 5%. The models were compiled in real (constant value) terms, with all variables expressed in terms of the price level of the current year (2024), except for livestock prices. Cattle prices were based on the historic 10-year averages, outlined in Section 3.3. The resulting cattle prices were then applied to represent the expected value of real livestock prices going forward. It was assumed that future inflation would equally affect all costs and benefits. The wheat sale price used in this report is also a long-term average price.

A guiding principle of this analysis is that grazing pressure remains the same or appropriate in all alternative strategies. This grazing pressure is measured as Adult Equivalents (AE). This analysis uses linear weight AE, where the liveweight of cattle classes are expressed relative to a standard animal, a 455 kg liveweight steer at maintenance. Other processes are available to calculate AE, including metabolic weight and metabolisable energy requirement. Linear weight (as used in Breedcow Dynama) is used in this analysis to maintain consistency with past reports from this project.

3 Constructed base beef cattle property

3.1 Area, land types and enterprises

The details of the constructed base property, with its herd and business characteristics, was developed after consultation with local producers, industry specialists and experienced DAF staff in 2023 and 2024. The base property was viewed as representative of a number of properties in the Maranoa and operated by managers with average (neither excellent nor poor) management skills.

The base property has a total area of 4,000 ha, entirely used for a beef cattle grazing enterprise utilising native and sown (primarily buffel grass) pastures. 2,600 ha of the property is poplar box land types and primarily used for breeding cattle. The remaining 1,400 ha is brigalow belah land types and is used to background cattle and run young females. The property has a carrying capacity of 940 AE, using a linear weight AE model, where 1 AE is equivalent to a 455kg liveweight steer at maintenance.

The base management strategy is to run a self-replacing crossbred (<40% *Bos indicus*) breeding herd. After weaning, steers graze pasture on the brigalow belah country for the remaining time they are on the property, to be turned off as feeder steers at 20 months of age (460kg) and sold to a feedlot. The herd is control mated with a 3-month joining period commencing in mid-November. The heifers selected as replacements are mated at 14 months of age and are grazed on the brigalow belah country until they wean their first calf. Heifers not required as replacement breeders are sold after weaning. Cows graze on the poplar box country and are culled at 10 years of age. Cull cows are finished on the brigalow belah country for two months before being sold. The average bull percentage used is 3%, bull mortality is 2% and 20% of the bulls are replaced with purchased bulls each year. This strategy allows for 483 breeders to be mated and 189 feeder steers to be sold each year. A calendar of herd management activities for the base strategy is shown in Table 3.

Table 3 Breeding and growing pathway for the base strategy

	Year 1	Year 2	Year 3
July		Sell cull cows & bulls	
August		Calving	
September			
October			
November	Mating		
December			
January		Branding	
February			
March			
April			
May	Pregnancy testing	Weaning / Sell cull heifers	Sell feeder steers
June			

3.2 Herd structure and performance

Table 4 shows the conception rates, loss of calves between conception and weaning, the proportion of empties (PTE) sold, and mortality rates used in this analysis. As a reflection on management practice seen in the region, 20% of empty first calf females have been retained. This reproduction data generates a weaning rate, from all cows mated, of 80%.

Table 4 Reproduction parameters and mortality rates for the base strategy

Initial cattle age (year)	**Weaners**	**1**	**2**	**3**	**4**	**11**
Final cattle age (year)	**1**	**2**	**3**	**4**	**11**	**14**
Expected conception rate for age group (%)	n/a	90	75	88	90	85
Expected calf loss from conception to weaning (%)	n/a	10	8	8	8	8
Proportion of empties (PTE) sold (%)	n/a	100	80	100	100	100
Female death rate (%)	2	5	2	2	2	3
Male death rate (%)	2	2	2	2	n/a	n/a

The base strategy produces 386 weaners from 483 breeders mated and sells 189 feeder steers and 180 females (cull weaner heifers and cull cows). Female sales make up 49% of total sales. The herd structure is shown in Table 5 and the final details of the herd outputs and gross margin are shown in Table 10.

Table 5 Herd structure for the base strategy

Age at start of period	**Number kept for the whole year**	**Number sold**	**Number purchased**	**Total AE**
Extra for cows weaning a calf	n/a	n/a		135
Weaners 5 months to 1 year	289	97		101
Heifers 1 year but less than 2	85	9		75
Heifers 2 years but less than 3	65	16		87
Cows 3 years plus	276	58		408
Steers 1 year but less than 2	-	189		106
Bulls all ages	14	3	3	28
TOTAL	730	372	3	940

Table 6 and Figure 3 show the growth paths of steers and heifers for the base strategy. Male calf daily weight gain from birth in September until weaning in May (at 8 months of age) is 1.0 kg/day. Heifers have a growth rate 5% less than a steer throughout their life. At weaning the average weight of steers is 278kg and heifers is 263kg. After weaning, daily growth rates are low through winter, then increase in December with summer rainfall and improved pasture quality. Feeder steers are sold in May at 20 months of age, with an average weight of 458kg.

Significant portions of the Maranoa region are affected by frost and this significantly impacts the diet quality of the feed base (predominantly buffel grass) for the second half of the year. As previously stated, there is often some winter rainfall in the region, and this can produce medics and increase live weight gain. Early seasonal breaks can occur in October and November. The impact of frost, medics, and early seasonal breaks over a 30-year period have been accounted for when estimating the average steer and heifer growth paths in Table 6, although we acknowledge there will be year to year variability which will require tactical decisions to be made in response to those current conditions.

Table 6 Estimated average steer and heifer growth paths for the base strategy

Cumulative months from birth	Month	Steer weight gain (kg/day)	Steer weight (kg)	Heifer weight gain (kg/day)	Heifer weight (kg)
0	Sep	Birth	36	Birth	33
1	Oct	1.00	66	0.95	62
2	Nov	1.00	97	0.95	91
3	Dec	1.00	127	0.95	119
4	Jan	1.00	158	0.95	149
5	Feb	1.00	189	0.95	178
6	Mar	1.00	217	0.95	205
7	Apr	1.00	248	0.95	234
8	May	1.00	278	0.95	263
9	Jun	0.25	286	0.24	270
10	Jul	0.20	292	0.19	276
11	Aug	0.20	298	0.19	282
12	Sep	0.20	304	0.19	288
13	Oct	0.20	310	0.19	293
14	Nov	0.35	321	0.33	304
15	Dec	0.35	332	0.33	314
16	Jan	1.00	363	0.95	343
17	Feb	1.00	394	0.95	373
18	Mar	1.00	422	0.95	399
19	Apr	0.70	443	0.67	420
20	May	0.50	458	0.48	434

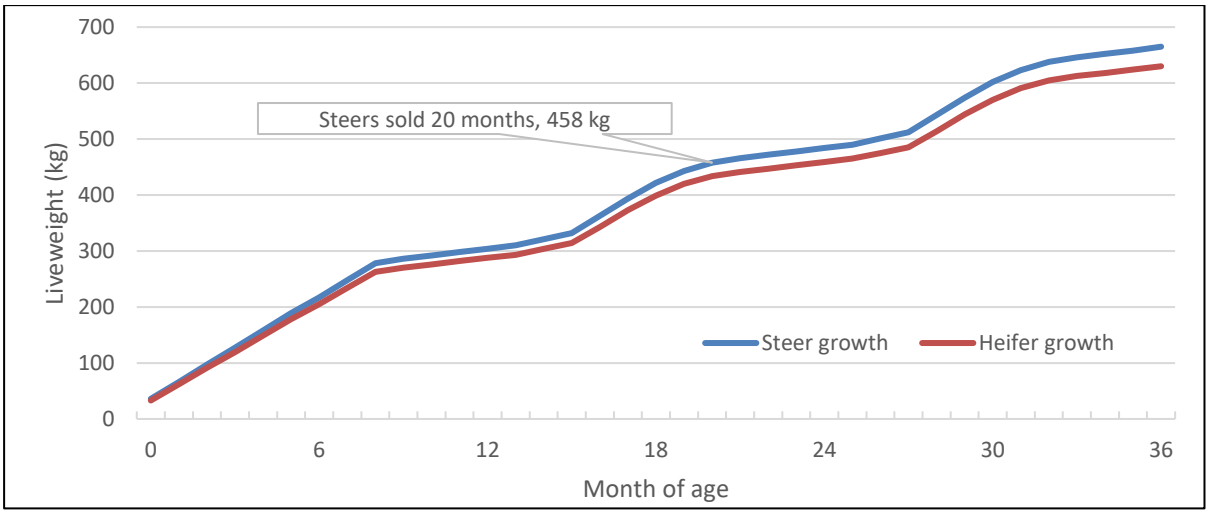

Figure 3 Estimated average steer and heifer growth paths for the base strategy

Table 7 shows the husbandry treatments applied to the various classes of cattle, held for 12 months. The total husbandry costs for the base strategy are $18,572 per year. The largest husbandry costs are weaner hay at $4,634 and vaccines at $5,904 per year. The price of replacement bulls has been set at $10,000 each.

Table 7 Husbandry treatments applied and cost ($/head/year ex GST) for the base strategy

Treatments	**Weaners**	**Females**		**Steers**		**Bulls**
		1-2 years	**2+ years**	**1-2 years**	**2+ years**	
Management tag	$2.23					
NLIS tags	$3.59					
Ultravac 7in1 vaccine	$4.67	$2.34	$2.34	$2.34		$2.34
Vibriosis vaccine		$19.49				$9.75
Pestivirus vaccine		$9.31				
3-day sickness vaccine						$12.27
Pour on for lice and worms	$0.70					
Buffalo fly		$1.93	$2.41	$1.93	$2.41	$2.41
Pain relief (steers) (castration & 5% dehorned)	$1.64					
Pain relief (heifers) (5% dehorned)	$0.07					
Hay for weaners 3kg x 10 days @ $400/t	$12.00					
Pregnancy Testing		$3.70	$3.70			
Bull testing						$97.00
Total	**$23.26***	**$36.77**	**$8.45**	**$4.27**	**$2.41**	**$123.77**

* Total husbandry cost of weaner heifers

3.3 Cattle price data

Cattle price is an important factor influencing profitability in any beef business, and cattle price variability adds difficulty to any budgeting and profit analysis such as contained in this report. Figure 4 shows the variability of cattle prices at the Roma saleyards from July 2013 to June 2023.

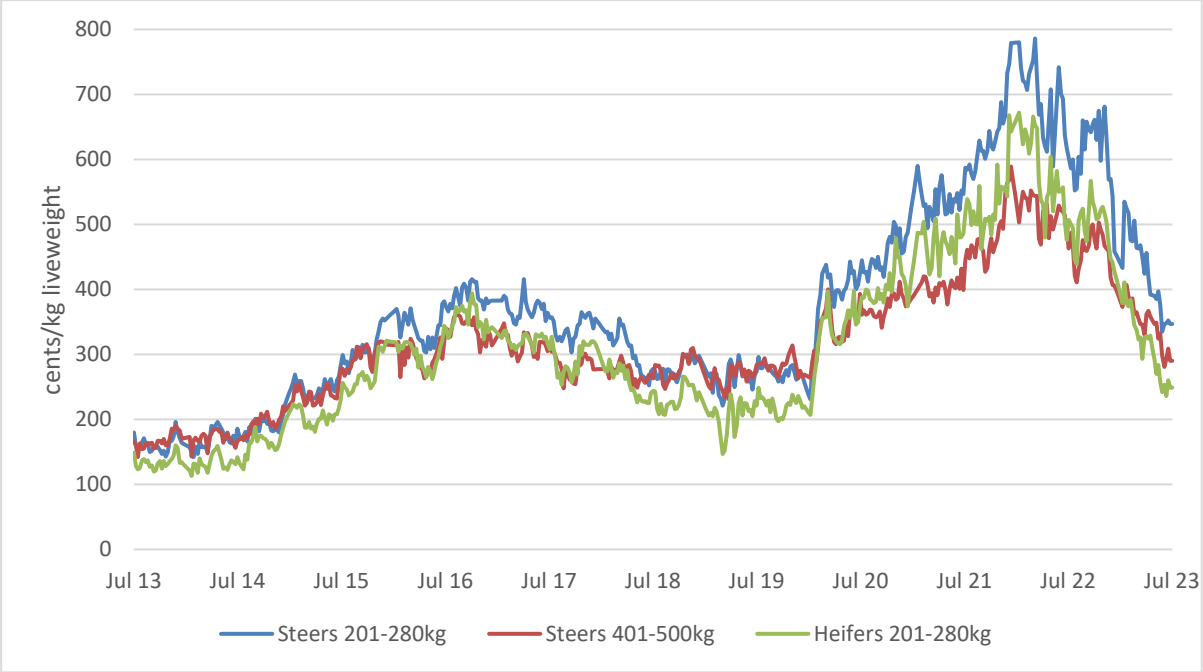

Figure 4 Cattle prices at the Roma saleyards from 2013 to 2023

The cattle prices used in this analysis have been determined, utilising relevant long-term data for the Roma saleyards and MLA over the hook data for cattle sold direct to abattoir. Average prices over the 10-year period until June 2023 were used in this analysis to reflect a long-term cattle price.

For the base strategy, the 20-month-old steers would be sold to a local feedlot, 150 km from the property, using the long-term Roma saleyard prices as the price paid by the feedlot. Cull cows and bulls would be sold to a southern Queensland (SQ) abattoir. When considering the option to turn off bullocks or spayed heifers, they would be sent to a SQ abattoir for slaughter. When considering the option to turn off weaner steers, the weaner steers would be sold at the Roma saleyards.

Cull heifers are also sold at the Roma saleyards. Heifer prices are Roma saleyard averages, where buyers are often wary of the quality of sale heifers. The price applied to spays is an over the hooks price including a MSA premium at a 94% compliance rate.

The price data applied in the herd model to calculate the net price per head of stock sold are shown in Table 8 and Table 9.

Table 8 Male cattle price data used in the base and alternative strategies

Parameter	Steer weaners	Steers 1-2 year	Steers 2-3 year	Cull bulls
Market	Roma saleyards	Local feedlot	SQ abattoir	SQ abattoir
Paddock weight (kg)	278	458	638	770
Weight loss to sale (%)	6%	5%	8%	8%
Sale weight (kg)	261	435	587	708
Price ($/kg liveweight)	$3.70	$3.16	$2.83	$1.81
Commission (%)	4%	0%	0%	0%
Other selling costs ($/head)	$18	$5	$5	$5
Freight ($/head)	$6	$23	$55	$75
Gross price ($/head)	$957	$1,375	$1,661	$1,282
Total selling and freight costs ($/head)	$63	$28	$60	$80
Net price ($/head)	**$904**	**$1,347**	**$1,601**	**$1,202**

Table 9 Female cattle price data used in the base and alternative strategies

Parameter	Heifer weaners	Heifers 1-2 years	Heifers 2-3 years	Spays 2-3 years	Cows 3+ years
Market	Roma saleyards	Roma saleyards	Roma saleyards	SQ abattoir	SQ abattoir
Paddock weight (kg)	263	437	580	600	600
Weight loss to sale (%)	6%	6%	6%	8%	8%
Sale weight (kg)	247	411	545	552	552
Price ($/kg liveweight)	$3.12	$2.86	$2.64	$2.73	$2.26
Commission (%)	4%	4%	4%	0%	0%
Other selling costs ($/head)	$18	$18	$18	$5	$5
Freight ($/head)	$6	$9	$11	$53	$63
Gross price ($/head)	$771	$1,175	$1,439	$1,507	$1,248
Total selling and freight costs ($/head)	$55	$74	$87	$58	$58
Net price ($/head)	**$716**	**$1,101**	**$1,352**	**$1,449**	**$1,190**

3.4 Herd outputs and gross margin

The sale prices, sale weights, selling costs, treatment costs and bull replacement strategy identified previously for the base management strategy were applied to the herd structure shown in Table 5 to produce the herd gross margin shown in Table 10. The herd gross margin after imputed interest of the base strategy is $338,779.

Table 10 Herd parameters and gross margin for the base strategy

Parameter	Base strategy
Total AE	940
Weaner heifers retained	96
Total breeders mated	483
Total breeders mated and kept	426
Total calves weaned	386
Weaners/total cows mated	80%
Female sales/total sales	49%
Total cows and heifers sold	180
Total steers and bullocks sold	189
Average female price	$945
Average steer and/or bullock price	$1,347
Capital value of herd	$837,427
Imputed interest on herd value	$41,871
Net cattle sales	$425,083
Direct costs excluding bulls	$18,572
Bull replacement	$25,860
Herd gross margin	$380,650
Herd gross margin after imputed interest	**$338,779**
Gross margin/AE	$0
Gross margin/AE less interest on livestock capital	$405

AE, adult equivalent expressed as linear weight AE.
Note: bull sales are included in net bull replacement, not net cattle sales.

3.5 Operating returns calculation

The additional information required to complete a profit and investment analysis includes the fixed, capital and finance expenses incurred, together with the opening and closing value of the land, plant and improvements. Table 11 gives the assumed fixed cash costs for the property, totalling $156,600 per year. Table 12 shows the plant inventory for the property, totalling a market value of $212,500.

Table 11 Annual fixed cash costs for the base strategy

Item	Annual Cost
Admin, office, phone, accounting	$20,000
Rates, rents	$20,000
Electricity, power	$7,000
Fuel and oil	$20,000
Insurance	$20,000
Motor vehicle expenses	$20,000
Repairs and maintenance	$25,000
Contract mustering	$6,000
Wages and contractors	$18,000
Total	**$156,000**

Table 12 Plant inventory for the base strategy

Item	Market Value
4wd Ute	$30,000
Tractor	$60,000
Farm truck	$60,000
Motor Bikes	$5,000
Side by side	$10,000
Slasher	$1,500
Trailer	$1,000
Dozer	$25,000
Workshop and saddlery	$20,000
Total	**$212,500**

Non-cash items required to calculate operating profit are depreciation, which was calculated using the information in Table 12, and an allowance for the operator's labour and management which was set at $100,000. The value of the land and fixed improvements was set at $17,833,400, at an average of $4,458/ha.

Results of the profit analysis for the base strategy can be seen in Table 13 with an operating profit of $82,399 and a return on total capital of 0.4%. No allowance for any potential capital gain in land value was included. The low return on total capital result is evidence of the disconnect between the productive capacity of grazing land and the price of the land, discussed in Section 1.1.3.

Interestingly, a similarly developed hypothetical Maranoa property with 100% poplar box country was valued in 1993 at $200/ha and generated a return on total capital of 6.8% (Murphy 1993).

Land development and breeding management have extracted greater productivity over the past thirty years, however the increase in land values have exceeded the increase in commodity prices whilst input costs have increased at a greater rate than commodity prices.

Table 13 Expected value of annual outcomes for base strategy

Factor	Value
Operating profit	$82,399
Return on total capital	0.4%

4 Strategies to build profitability and resilience

The following strategies, identified by experienced industry specialists and DAF staff, are representative of practices within the region, have relevant data available for analysis and are achievable for many producers to implement should they choose.

- Optimising steer sale age and female culling.
- Turning off weaner steers.
- Feeding supplements to steers.
- Grazing weaner steers on forage oats.
- Growing 400ha of wheat as a cash crop.
- Trading and backgrounding steers.

Alternate strategies considered but not explored in this study included fertilising pasture, self-replacing low maintenance meat breed enterprise and planting legumes.

Whilst every effort was made to ensure that the assumptions used in each scenario were accurate and validated with industry participants, relevant experts or published scientific studies, the results presented should be viewed as indicative only.

4.1 Optimising steer sale age and female culling

4.1.1 Introduction

After modelling the base property and base strategy, the next step in a Breedcow Dynama analysis is to investigate opportunities to improve profitability by changing steer and female sale ages. This is undertaken by creating new steady-state Breedcow models comparing the alternative ages of sale, whilst maintaining equivalent grazing pressure.

4.1.2 Optimal steer sale age

This section compares the following steer sale age strategies.

- The base strategy of turning off steers at 20 months of age as feeders.
- Turning off steers one year earlier than the base strategy, at 8 months of age as weaners.
- Turning off steers one year later than the base strategy, at 32 months of age as bullocks.

This is undertaken while maintaining grazing pressure at 940 AE and with no other change to herd management.

As the steer turn off age increases, the number of breeders mated decreases to maintain the same grazing pressure. Table 14 shows that the number of breeders mated when turning off weaners is 569, when turning off feeders is 483 (15% less than when turning off weaners) and when turning off bullocks is 395 (31% less than when turning off weaners).

Table 14 also shows that the herd gross margin after imputed interest is highest for the base strategy, turning off feeder steers. The herd gross margin after imputed interest for turning off 20-month-old feeder steers is $338,779, while for 8-month-old weaners it is $315,232 and for 32-month-old bullocks it is $299,904.

Turning off steers older than 3 years of age is not common in the Maranoa and was not considered in this analysis. Being close to the Roma saleyards and the southern Queensland feedlots has made turning off steers as weaners or feeder steers appealing options to Maranoa producers. More commentary on the option of turning off weaner steers can be found in Section 4.2.

Table 14 Herd parameters and gross margin for alternative steer turn-off ages

Parameter	**Weaner steers 278 kg (8 months)**	**Feeder steers 458 kg (20 months) Base strategy**	**Bullocks 638 kg (32 months)**
Total AE	940	940	940
Weaner heifers retained	113	96	79
Total breeders mated	569	483	395
Total breeders mated and kept	501	426	348
Total calves weaned	454	386	315
Weaners/total cows mated	80%	80%	80%
Female sales/total sales	48%	49%	49%
Total cows and heifers sold	212	180	147
Total steers and bullocks sold	227	189	151
Average female price	$945	$945	$945
Average steer and/or bullock price	$904	$1,347	$1,601
Capital value of herd	$779,916	$837,427	$892,215
Imputed interest on herd value	$38,996	$41,871	$44,611
Net cattle sales	$405,494	$425,083	$381,535
Direct costs excluding bulls	$20,844	$18,572	$15,896
Bull replacement	$30,422	$25,860	$21,124
Herd gross margin	$354,228	$380,650	$344,515
Herd gross margin after imputed interest	**$315,232**	**$338,779**	**$299,904**
Change in herd gross margin after imputed interest	-$23,547	$0	-$38,875
Gross margin/AE	$377	$405	$367
Gross margin/AE less interest on livestock capital	$335	$360	$319

An investment analysis of the change from the base strategy to both strategies can be found in Table 15. For turning off weaners, the profitability decreases by $16,693 per year (measured as Annualised NPV) as a result of adopting this strategy. For turning off bullocks, the profitability decreases by $31,091 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative result for both of these strategies, peak deficit, payback period and IRR calculations were not undertaken.

Table 15 Returns for changing from the base strategy to alternative steer turn-off ages

Factor	**Turn off weaner steers at 8 months**	**Turn off bullocks at 32 months**
NPV	-$256,607	-$477,949
Annualised NPV	-$16,693	-$31,091
Peak deficit (with interest)	na	na
Year of peak deficit	na	na
Payback period (years)	na	na
IRR	na	na

All terms defined in the Glossary of terms and abbreviations

The base strategy of turning off 20-month-old feeder steers is more profitable than turning off weaners or bullocks, given the assumptions made in this analysis. Turning off weaners results in running more breeders than in the base strategy, which reduces a producer's ability to sell nonbreeding animals in dry times. Turning off bullocks provides a producer with more selling options, and the ability to sell animals earlier than planned if market prices rise sharply. Furthermore, turning off bullocks gives the producer more options to sell cattle if conditions turn dry, without selling breeders.

4.1.3 Optimal cow cull age

Table 16 shows the herd parameters and gross margins for cow culling ages between 9 and 12 years of age while not changing any other factor and maintaining grazing pressure at 940 AE. The herd gross margins after imputed interest for these strategies are within $920 of the base strategy, indicating that for the base property where breeder fertility is high and heifers are being joined at 14 months of age, cull cow age is not a factor that has significant influence on herd gross margin. Therefore, no investment analysis has been undertaken examining a transition from the base strategy to these strategies.

Table 16 Herd parameters and gross margin for alternative cow cull ages

Parameter	**Cull cows at 9 years**	**Cull cows at 10 years Base strategy**	**Cull cows at 11 years**	**Cull cows at 12 years**
Total AE	940	940	940	940
Weaner heifers retained	102	96	92	88
Total breeders mated	482	483	484	486
Total breeders mated and kept	424	426	427	428
Total calves weaned	384	386	388	389
Weaners/total cows mated	80%	80%	80%	80%
Female sales/total sales	49%	49%	49%	49%
Total cows and heifers sold	179	180	181	182
Total steers and bullocks sold	188	189	190	191
Average female price	$962	$945	$932	$921
Average steer and/or bullock price	$1,347	$1,347	$1,347	$1,347
Capital value of herd	$838,620	$837,427	$836,484	$836,075
Imputed interest on herd value	$41,931	$41,871	$41,824	$41,804
Net cattle sales	$425,718	$425,083	$424,581	$424,043
Direct costs excluding bulls	$18,732	$18,572	$18,447	$18,357
Bull replacement	$25,790	$25,860	$25,916	$26,024
Herd gross margin	$381,197	$380,650	$380,218	$379,663
Herd gross margin after imputed interest	**$339,266**	**$338,779**	**$338,394**	**$337,859**
Change in herd gross margin after imputed interest	$487	$0	-$385	-$920
Gross margin/AE	$406	$405	$404	$404
Gross margin/AE less interest on livestock capital	$361	$360	$360	$359

4.1.4 Optimal heifer cull age

Table 17 shows the herd parameters and gross margins for the following strategies for selling surplus heifers while not changing any other factor and maintaining grazing pressure at 940 AE.

- Culling heifers as weaners (the base strategy), selling at the Roma saleyards.
- Culling heifers at 20 months, selling at the Roma saleyards.
- Selling spayed heifers at 32 months, to a SQ abattoir. Spaying is costed at $8 per head.

As the surplus heifer cull age increases, the number of breeders mated decreases to maintain the same grazing pressure. Table 17 shows that the number of breeders mated when culling surplus heifers as weaners is 483, when culling at 20 months of age is 451 (7% less than when culling surplus heifers as weaners) and when culling as spays at 32 months of age is 411 (15% less than when culling surplus heifers as weaners).

Table 17 Herd parameters and gross margin for alternative cull ages of surplus heifers

Parameter	**Sell surplus heifers at 8 months Base strategy**	**Sell surplus heifers at 20 months**	**Sell spayed surplus heifers at 32 months**
Total AE	940	940	940
Weaner heifers retained	96	180	164
Total breeders mated	483	451	411
Total breeders mated and kept	426	397	362
Total calves weaned	386	360	328
Weaners/total cows mated	80%	80%	80%
Female sales/total sales	49%	48%	48%
Total cows and heifers sold	180	166	150
Total steers and bullocks sold	189	176	161
Average female price	$945	$1,153	$1,337
Average steer and/or bullock price	$1,347	$1,347	$1,347
Capital value of herd	$837,427	$845,496	$859,152
Imputed interest on herd value	$41,871	$42,275	$42,958
Net cattle sales	$425,083	$429,150	$416,809
Direct costs excluding bulls	$18,572	$20,798	$16,979
Bull replacement	$25,860	$24,116	$21,976
Herd gross margin	$380,650	$384,236	$377,854
Herd gross margin after imputed interest	**$338,779**	**$341,962**	**$334,897**
Change in herd gross margin after imputed interest	$0	$3,183	-$3,882
Gross margin/AE	$405	$409	$402
Gross margin/AE less interest on livestock capital	$360	$364	$356

Table 17 also shows that herd gross margin after imputed interest increases slightly as the cull age of surplus heifers is increased to 20 months of age. The herd gross margin after imputed interest for culling surplus heifers as weaners is $338,779, while for 20-month-old heifers is $341,962 and for 32-month-old spayed heifers it is $334,897.

An investment analysis of the change from the base strategy to both strategies can be found in Table 18. For selling surplus heifers at 20 months, the profitability decreases by $1,112 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative result, peak deficit, payback period and IRR calculations were not undertaken.

The selling surplus heifers at 20 months of age was slightly negative for annualized NPV, whereas the change in herd gross margin after imputed interest is slightly positive. This is caused by Breedcow+ (used to calculate gross margins) using cattle numbers with decimal places (e.g. bulls purchased = 2.586), whereas Dynama (used to calculate Annualised NPV) using whole numbers (e.g. bulls purchased = 3). Combined with the discounting of cashflows over the thirty-year analysis in Dynama+, this causes variation in results, more noticeable in this case where one is slightly positive, and one is slightly negative.

For spaying surplus heifers and selling them at 32 months, the profitability increased by $2,348 per year (measured as Annualised NPV) as a result of adopting this strategy. The peak deficit is $30,983 which occurs in year 3, the payback period is 10 years and IRR is 20%.

This result is slightly positive, $2,348, whereas the change in herd gross margin after imputed interest is slightly negative, -$3,882. Again, this is caused by the decimal places, detailed above. In this case Breedcow+ calculates bull replacement costs decreasing from $25,860 to $21,976 (shown in Table 17), whereas Dynama+ calculates bull replacement costs decreasing from $30,000 to $20,000.

Table 18 Returns for changing from the base strategy to alternative sale ages of surplus heifers

Factor	**Sell surplus heifers at 20 months**	**Sell spayed surplus heifers at 32 months**
NPV	-$17,101	$36,093
Annualised NPV	-$1,112	$2,348
Peak deficit (with interest)	na	-$30,983
Year of peak deficit	na	3
Payback period (years)	na	10
IRR	na	20%

There is no significant change to annualised NPV with either of these heifer options. Keeping heifers for an extra one or two years will reduce breeder numbers and provide a producer with more options to sell animals if conditions turn dry. However, producers may feel that keeping heifers for an extra one or two years will increase the complexity of herd management with little or no increase in profitability.

4.2 Turning off weaner steers at 6 or 8 months of age

4.2.1 Introduction

The option of turning off steers as weaners or as feeder steers has been a debate regularly undertaken in the Maranoa over many years. Producers who sell weaner steers are influenced by some of the following factors:

- Less productive land types e.g. cypress pine and ironbark, are typically deemed as 'breeder country' rather than fattening country.
- Personal preference to have breeders and turn off weaners.
- Preference to sell weaners while they are in good condition off their mothers and not hold them for a further six months without much gain in liveweight.
- Weaners destined for backgrounding for feedlots in the region are highly sought after, driving the cents/kg higher.
- The length of time between joining females and the sale point of progeny is less.

This section compares the base strategy of turning off 20-month-old feeder steers at 460kg with the strategy to turn off weaner steers at 8 months of age. Given the steers are now leaving the property 12 months earlier, the number of breeders is increased from 483 to 569 to maintain a carrying capacity of 940 AE. There is no change to cow, heifer, or bull management with this strategy.

A secondary selling strategy is also examined, that being weaning and turning off steers and surplus heifers 2 months earlier in March (at 6 months) to gain a higher price per kilogram at the Roma saleyards. An examination of the average monthly price of 201-280kg steers for the last 3, 5 and 10 financial years at the Roma saleyards can be found in Table 19. Over the last 10 financial years the average price in May was 365 c/kg and in March it was 22 c/kg higher at 387 c/kg. The 201-280 kg heifer average price also had a 22 c/kg gap. The price difference of steers between March and May was 39 c/kg over the last 5 years and 56 c/kg over the last 3 years. Some producers may be tempted to turn off steers earlier to gain this extra price per kilogram. For this strategy we have increased the weaner steer and heifer price by 22 c/kg.

Table 19 Average monthly price for 201-280kg steers at the Roma saleyards (c/kg)

Month	Last 3 years to Jun 2023	Last 5 years to Jun 2023	Last 10 years to Jun 2023
Jan	605	449	373
Feb	576	480	382
Mar	**574**	**482**	**387**
Apr	544	448	364
May	**518**	**451**	**365**
Jun	519	449	367
Jul	533	416	338
Aug	555	453	366
Sep	558	446	358
Oct	583	445	361
Nov	601	484	391
Dec	565	445	360

4.2.2 Results and discussion

The implementation of the first strategy to wean and sell at 8 months results in 227 weaner steers being sold at $904/head, generating a net income of $205,232 rather than the base strategy where 189 feeder steers were sold at $1,347/head, generating net income of $254,850, which is shown in Table 20. This occurs even though the weaner price is 58 cents per kilogram higher than the feeder steer price.

Implementation of the second strategy to wean and sell at 6 months results in 235 weaner steers being sold at $774/head, generating a net income of $174,508, lower than the base strategy and the strategy to turn off 8-month-old weaners. This occurs even though the 6-month-old weaner price was 22 cents per kilogram higher than the 8-month-old weaner price and is 80 cents per kilogram higher than the feeder steer price.

If this price differential between the March and May price was 56c/kg, which was the average for the last 3 years (2020-23), the 235 weaner steers would be sold at $810/head, generating a net income of $190,132. This is still lower than the net income for weaners sold at 8 months of age and the base strategy.

Table 20 Income from steers and heifers for alternative turn off strategies

Parameter	**Base strategy Turn off at 20 months**	**Weaner strategy Turn off at 8 months**	**Weaner strategy Turn off at 6 months**
Steers paddock weight at sale (kg)	458	278	217
Gross steer price ($/kg)	$3.16	$3.70	$3.92
Gross steer price ($/head)	$1,375	$967	$800
Net steer price ($/head)	$1,347	$904	$744
Total steers sold	189	227	235
Net income from steer sales	$254,850	$205,232	$174,508
Heifer paddock weight at sale (kg)	263	263	205
Gross heifer price ($/kg)	$3.12	$3.12	$3.34
Gross heifer price ($/head)	$771	$771	$644
Net heifer price ($/head)	$716	$716	$594
Total heifers sold	97	114	118
Net income from heifer sales	$69,242	$81,457	$69,816
Net income from all cattle sales	$425,083	$405,494	$367,068

Table 21 shows the herd parameters and gross margins for turning off 8-month-old and 6-month-old steers. It shows that the herd gross margin after imputed interest is highest for the base strategy of turning off feeder steers at $338,779. The gross margin after imputed interest for the strategy to turn off 8-month-old steers is $315,232 and the result for the strategy to turn off 6-month-old steers drops to $274,528.

Table 21 Herd parameters and gross margin for selling steers at 8 months and 6 months

Parameter	Base strategy Turn off at 20 months	Weaner strategy Turn off at 8 months	Weaner strategy Turn off at 6 months
Total AE	940	940	940
Weaner heifers retained	96	113	117
Total breeders mated	483	569	587
Total breeders mated and kept	426	501	517
Total calves weaned	386	454	469
Weaners/total cows mated	80%	80%	80%
Female sales/total sales	49%	48%	48%
Total cows and heifers sold	180	212	219
Total steers and bullocks sold	189	227	235
Average female price	$945	$945	$880
Average steer and/or bullock price	$1,347	$904	$744
Capital value of herd	$837,427	$779,916	$791,490
Imputed interest on herd value	$41,871	$38,996	$39,574
Net cattle sales	$425,083	$405,494	$367,068
Direct costs excluding bulls	$18,572	$20,844	$21,535
Bull replacement	$25,860	$30,422	$31,431
Herd gross margin	$380,650	$354,228	$314,102
Herd gross margin after imputed interest	**$338,779**	**$315,232**	**$274,528**
Change in herd gross margin after imputed interest	$0	-$23,547	-$64,251
Gross margin/AE	$405	$377	$334
Gross margin/AE less interest on livestock capital	$360	$335	$292

An investment analysis of the change from the base strategy to both strategies can be found in Table 22. As outlined in Section 4.1.2, when changing from the base strategy to a strategy of turning off weaners at 8 months of age, profitability decreases by $16,693 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative result, peak deficit, payback period and IRR calculations were not undertaken.

When changing from the base strategy to a strategy of turning off weaners at 6 months of age profitability decreased by $65,487 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative result, peak deficit, payback period and IRR calculations were not undertaken.

Table 22 Returns for changing from the base strategy to alternative weaner turn off ages

Factor	Turn off weaner steers at 8 months	Turn off weaner steers at 6 months
NPV	-$256,607	-$1,006,690
Annualised NPV	-$16,693	-$65,487
Peak deficit (with interest)	na	na
Year of peak deficit	na	na
Payback period (years)	na	na
IRR	na	na

Weaning two months early and selling in March, to gain the higher c/kg at the saleyard, resulted in the lowest profitability of all strategies analysed in this report. The extra weight of steers sold at 8 months, or as 20-month-old feeders, outweighed the reduction in price per kilogram.

However, this does not diminish the relevance of early weaning as a drought management strategy. A benefit of early weaning is conserving the body condition score of cows so that they have a higher chance of cycling and conceiving when next joined. There could also be financial advantages of selling weaners early and banking that money, rather than risk a decline in the market and weaner condition due to drought conditions.

4.2.3 Changing from turning off weaners to turning off feeder steers

Section 4.1.2 and section 4.2.2 have reported that changing from the base strategy of turning off 20 month old feeder steers to a strategy of turning off 8 month old weaner steers will decrease profitability by $16,693 per year (measured as Annualised NPV).

As some producers have a preference to turn off weaner steers, this section examines the impact of changing from turning off weaners steers to turning off feeder steers, the reverse of the change analysed in previous sections. While the gross margin after imputed interest is higher for the strategy of turning off feeder steers, the cashflow impacts of moving to keep steers for an extra 12 months needs to be carefully analysed.

Table 23 shows that profitability increases by $14,985 per year (measured as Annualised NPV) as a result of changing to this strategy. Peak deficit is -$82,278 and occurs in year 2 when no steers are sold, which is offset by the sale of cows that is required to maintain AE at 940. This deficit is paid back in year 5.

Table 23 Returns for changing from turning off weaners to turning off feeder steers

Factor	Turn off feeder steers at 20 months
NPV	$230,361
Annualised NPV	$14,985
Peak deficit (with interest)	-$82,278
Year of peak deficit	2
Payback period (years)	5
IRR	30%

The transition from turning off weaner steers to turning off 20-month-old feeder steers needs to be planned carefully. Some breeders will need to be sold to maintain an appropriate number of AE on the property as the weaner steers, that would have otherwise been sold, increase in weight. Producers may also wish to sell some weaners for one or two years to maintain cashflow. Furthermore, producers need to have capital available to cover the peak deficit of -$82,278 which will be paid back in five years. Finally, the reduction in breeder numbers when the strategy is implemented increases producers' ability to sell nonbreeding animals in dry times.

4.3 Feeding supplements to steers

4.3.1 Introduction

Many producers consider the option of feeding their steers a supplement to increase their growth rate and meet a market specification earlier. In this section we have examined the option to feed steers a supplement in the May to December period, when pasture quality has declined. A typical supplement fed to weaner steers in the district is a dry lick (costed at $1,150/t) containing 10% urea, 10% salt and protein meal. An intake of 200g/day is assumed and fed to each steer for 210 days, at a cost of $48.30 per steer. This supplement is assumed to increase weight gain by 150g/day, which results in an extra 31.5kg of weight gain per steer.

Two strategies are analysed.

- Supplement steers and turn them off at 20 months of age, as per the base strategy.
- Supplement steers and turn them off at 19 months of age, where producers are aiming to meet a market specification earlier.

While the steers will be 31.5kg heavier when the supplement feeding ceases, this liveweight gain advantage may be diminished by sale time at 19 or 20 months. The growth path of cattle in the base strategy, outlined in section 3.2, includes compensatory growth that will occur when the cattle move from a low plane of nutrition (over winter and spring) to a high plane of nutrition (in summer).

The aim of strategies that supplement steers, is to improve their plane of nutrition over winter and spring, in order to gain an estimated additional 31.5kg. However, as these supplemented steers have been on a higher plane of nutrition than the base strategy steers, they may not have the same compensatory gain over the summer as is expected from the base strategy steers. As a result, they may not gain as much weight as the base strategy steers over summer.

To examine the possible impact of compensatory growth on the supplement strategies, the strategies have been analysed with an increased sale weight of 31.5kg, as well as an increased sale weight of 21kg (two thirds of the 31.5kg gain).

4.3.2 Results and discussion

Table 24 shows the result for supplementing steers and increasing sale weight by 31.5kg. For the strategy to supplement steers and turn them off at 20 months of age, the number of breeders mated decreases slightly from 483 to 479, since the bigger steers will eat more pasture after they have been fed the supplements. The bigger steers resulted in the average steer price increasing from $1,347 to $1,440 per head. The herd gross margin after imputed interest has increased by $5,350.

For the strategy to supplement steers and turn them off 1 month earlier at 19 months of age, the number of breeders mated has increased from 483 to 487, keeping the number of AE at 940. The pasture the steers would have eaten in their 20th month is now available to the remainder of the herd. The result is that the herd gross margin after imputed interest has increased by $2,798.

Table 25 repeats the analysis of these two strategies but with a 21kg increase in sale weight of steers, rather than a 31.5kg increase. The strategy to sell steers at 20 months results in a decrease in herd gross margin after imputed interest of $41. The strategy to sell steers at 19 months results in a decrease in herd gross margin after imputed interest of $2,754.

Table 24 Herd parameters and gross margin for supplementing steers and increasing their sale weight by 31.5kg

Parameter	Base strategy	Supplement Sell @ 20mth 31.5 kg heavier	Supplement Sell @ 19mth 31.5 kg heavier
Total AE	940	940	940
Weaner heifers retained	96	95	97
Total breeders mated	483	479	487
Total breeders mated and kept	426	422	429
Total calves weaned	386	383	389
Weaners/total cows mated	80%	80%	80%
Female sales/total sales	49%	49%	49%
Total cows and heifers sold	180	178	182
Total steers and bullocks sold	189	188	191
Average female price	$945	$945	$945
Average steer and/or bullock price	$1,347	$1,440	$1,396
Capital value of herd	$837,427	$829,895	$844,029
Imputed interest on herd value	$41,871	$41,495	$42,201
Net cattle sales	$425,083	$438,820	$437,881
Direct costs excluding bulls	$18,572	$27,568	$28,038
Bull replacement	$25,860	$25,628	$26,064
Herd gross margin	$380,650	$385,624	$383,779
Herd gross margin after imputed interest	**$338,779**	**$344,129**	**$341,577**
Change in herd gross margin after imputed interest	$0	$5,350	$2,798
Gross margin/AE	$405	$410	$408
Gross margin/AE less interest on livestock capital	$360	$366	$363

Table 25 Herd parameters and gross margin for supplementing steers and increasing their sale weight by 21kg

Parameter	Base strategy	Supplement Sell @ 20mth 21 kg heavier	Supplement Sell @ 19mth 21 kg heavier
Total AE	940	940	940
Weaner heifers retained	96	96	97
Total breeders mated	483	480	488
Total breeders mated and kept	426	422	430
Total calves weaned	386	383	390
Weaners/total cows mated	80%	80%	80%
Female sales/total sales	49%	49%	49%
Total cows and heifers sold	180	179	182
Total steers and bullocks sold	189	188	191
Average female price	$945	$945	$945
Average steer and/or bullock price	$1,347	$1,409	$1,365
Capital value of herd	$837,427	$831,171	$845,183
Imputed interest on herd value	$41,871	$41,559	$42,259
Net cattle sales	$425,083	$433,574	$432,460
Direct costs excluding bulls	$18,572	$27,611	$28,076
Bull replacement	$25,860	$25,667	$26,100
Herd gross margin	$380,650	$380,296	$378,284
Herd gross margin after imputed interest	**$338,779**	**$338,738**	**$336,025**
Change in herd gross margin after imputed interest	$0	-$41	-$2,754
Gross margin/AE	$405	$405	$402
Gross margin/AE less interest on livestock capital	$360	$360	$357

An investment analysis of the change from the base strategy to supplementing steers and selling them at 19 or 20 months, 31.5kg heavier than the base strategy can be found in Table 26. A capital purchase of feed troughs, at a cost of $3,000 has been included in all the supplementation strategy analysis. Furthermore, extra annual overhead costs have also been included in all the supplementation strategy analysis, to cover the extra fuel ($250) and labour ($1,250), whether paid or unpaid, required to pick up and feed out the supplement.

For supplementing steers, increasing their sale weight by 31.5kg and selling them at 20 months, the profitability increases by $5,004 per year (measured as Annualised NPV) as a result of adopting this strategy. There is no peak deficit for this strategy since the sale of cows to maintain AE at 940 covers the cost of purchasing the troughs.

For supplementing steers, increasing their sale weight by 31.5kg and selling them at 19 months, the profitability increases by $181 per year (measured as Annualised NPV) as a result of adopting this strategy. A peak deficit of -$3,788 occurred in year 1.

Table 26 Returns for feeding supplements to steers and increasing sale weight by 31.5kg

Factor	**Supplement Sell @ 20mth 31.5 kg heavier**	**Supplement Sell @ 19mth 31.5 kg heavier**
NPV	$76,929	$2,785
Annualised NPV	$5,004	$181
Peak deficit (with interest)	na	-$3,788
Year of peak deficit	na	1
Payback period (years)	na	na
IRR	na	na

An investment analysis of the change from the base strategy to supplementing steers and selling them at 20 and 19 months, but only 21kg heavier than the base strategy can be found in Table 27. For supplementing steers, increasing their sale weight by 21kg, and selling them at 20 months, the profitability decreases by $672 per year (measured as Annualised NPV) as a result of adopting this strategy. For supplementing steers, increasing their sale weight by 21kg, and selling them at 19 months, the profitability decreases by $5,834 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative results, peak deficit, payback period and IRR calculations were not undertaken.

Table 27 Returns for feeding supplements to steers and increasing sale weight by 21kg

Factor	**Supplement Sell @ 20mth 21 kg heavier**	**Supplement Sell @ 19mth 21 kg heavier**
NPV	-$10,337	-$89,687
Annualised NPV	-$672	-$5,834
Peak deficit (with interest)	na	na
Year of peak deficit	na	na
Payback period (years)	na	na
IRR	na	na

Due to the nature of compensatory gain, discussed above, it is unlikely that the steers supplemented in this analysis will be sold 31.5kg heavier (the weight gained from supplementation) than steers who are not supplemented. Table 27 shows that if the steers were sold 21kg heavier (that is two thirds of the 31.5kg weight gain) profitability slightly decreases. The potential result of this strategy is dependent on many critical factors. These include the weight gain response to the supplementation and the extra sale weight generated by the supplementation. Producers need to be very objective about this option and not overestimate the benefit of steers gaining more weight than they would have without supplementation.

4.4 Grazing weaner steers on forage oats

4.4.1 Introduction

Planting forage oats and grazing cattle on the oats has been a regular occurrence on many properties in the Maranoa over the years. However, with the increase in input costs, many producers now question the economic viability of this strategy. Furthermore, similar reports for other regions in Queensland, have found that changing to a strategy of grazing forage oats decreased profitability (Bowen and Chudleigh 2018).

Forage oats were assumed to be grazed for 85 days, from July to September. The steers gained 1.0 kg/day on forage oats and were stocked at 0.6 ha per weaner steer. A contractor was used to prepare and plant the forage oats crop. The land area allocated to forage oats was assumed to be ready for cropping, therefore required no development costs and would be fallow in between crops. The costs of the forage oats crop can be found in Table 28.

Table 28 Growing costs of forage oats

Variable Costs	QTY	RATE		COST		TOTAL ($/ha)
Fallow Management						
Operation: sprayer (Contractor)	3			$14.87	/ha	45
Herbicide: Glyphosate 450 CT	2	2.0	L/ha	$4.80	/L	19
Herbicide: 2,4-D Amine 625	2	0.3	L/ha	$6.50	/L	4
Herbicide: Starane Advanced	2	0.3	L/ha	$2.35	/L	1
Herbicide: Glyphosate 450 CT	1	1.2	L/ha	$4.80	/kg	6
Ammonia sulphate & surfactant	3			$3.10	/ha	9
					TOTAL	84
Planting						
Seed		40	kg/ha	$1.80	/kg	72
Operation: planter (Contractor)	1			$61.11	/ha	61
					TOTAL	133
Nutrition						
Nutrient: Urea		100	kg/ha	$0.75	/kg	75
Nutrient: Granulock Z		40	kg/ha	$1.30	/kg	52
Operation: Spreader (Contractor)	1			$17.01	/ha	17
					TOTAL	144
Total Variable Costs						**$361**

Two strategies involving grazing forage oats were analysed and compared to the base strategy.

1. Grazing the lead weaner steers (the heaviest 40%) on forage oats and turning them off at 13 months, with the rest of the steers turned off as per the base strategy.
2. Grazing all weaner steers on forage oats and turning them off at 13 months.

Strategy 1, grazing the lead weaner steers on forage oats, required 49 ha of forage oats, which reduced the capacity of the rest of the property from 940 to 925 AE. Figure 5 shows the range of steer weight before oats grazing, including the lead steers shown with stripes. The 40% lead weaner steers had a 302kg minimum weight and a 309kg average group weight before grazing forage oats. After grazing forage oats, the average sale weight of the lead steers was 394kg. The remaining (tail) steers were turned off at 20 months as per the base strategy but at a lower average weight, 447 kg rather than the 458 kg of the base strategy, since the heavier steers had already been sold as a lead group.

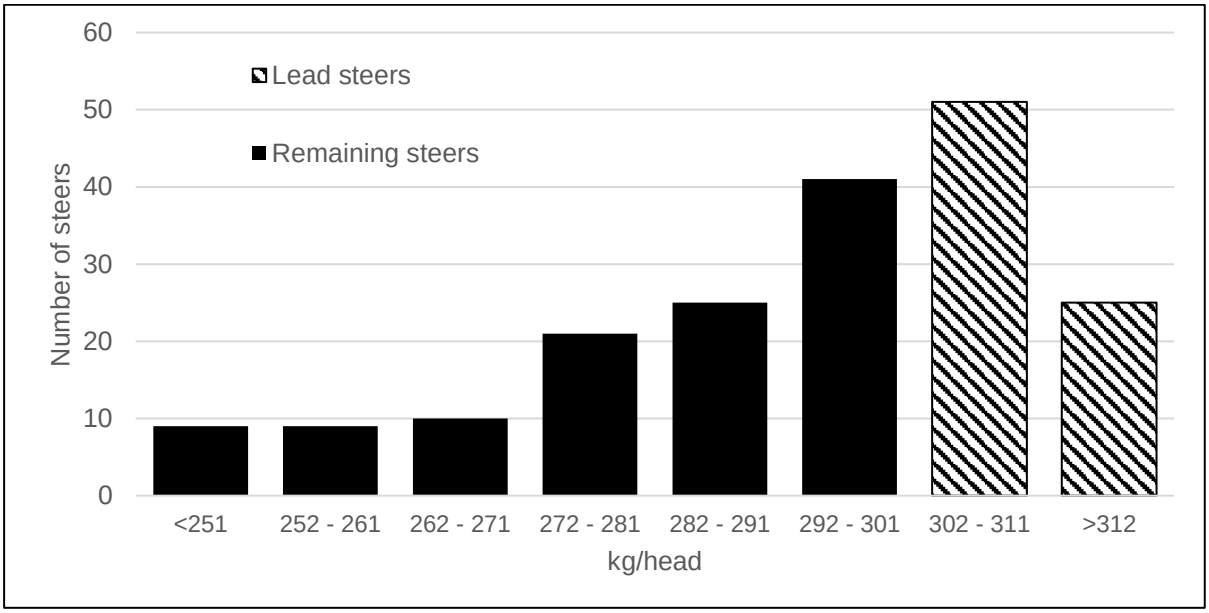

Figure 5 The range of steer weights before oats grazing, with lead steers shown with stripes

Strategy 2, grazing all weaner steers on forage oats, required 136 ha of forage oats, which reduced the capacity of the rest of the property to 899 AE. The weaner steers had an average weight of 292 kg before grazing forage oats and after grazing forage oats the sale weight was 377kg. This is a heavier sale weight compared to weaners sold in Section 4.2. The growth paths for the base strategy and strategy 2 are displayed in Figure 6.

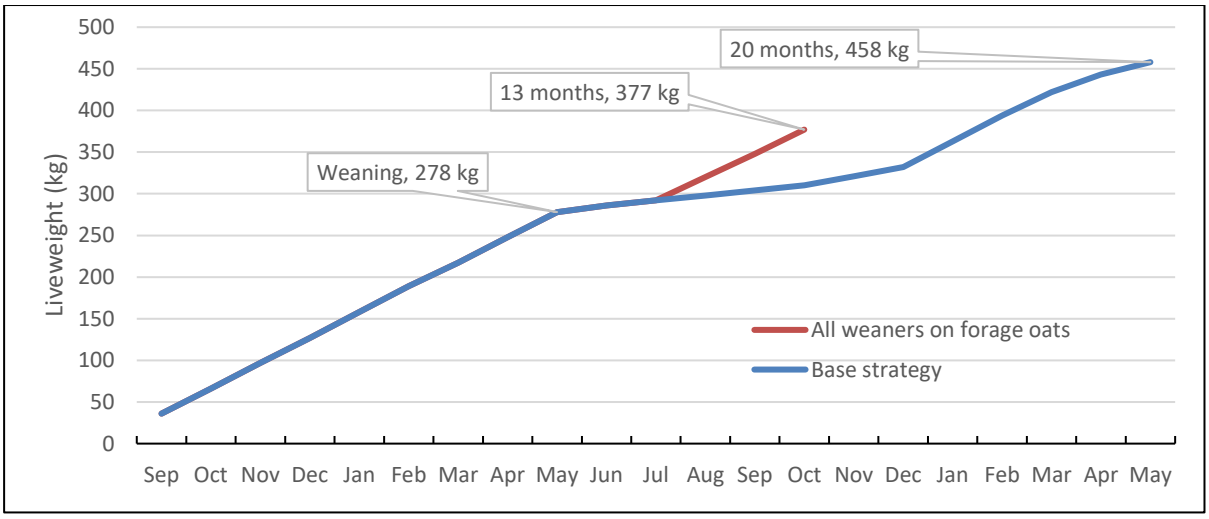

Figure 6 Estimated average steer growth paths for the base strategy and weaners on forage oats

Seasonal conditions do not allow for forage oats to be planted every year. After consultation with local producers and service providers, and reviewing rainfall data, it has been assumed that conditions will allow forage oats to be grown in 7 out of 10 years. In years when forage oats are not grown, the steers that were destined to graze forage oats are sold in July and the remaining steers continue to be turned off at the planned 20 months sale weight. Furthermore, the fallow management costs of forage oats were still incurred in years when forage oats were not planted. Weighted averages were calculated for the sale weights of steers and the cost of forage oats, given the 7 years in 10 that forage oats was grown. See Table 29.

Table 29 Weighted average of forage oats parameters

Parameter	Forage oats planted 7 in 10 years	Forage oats not planted 3 in 10 years	Weighted average
Cost of forage oats $/ha	$361	$84	$278
Strategy: 40% weaners on forage oats			
Average sale weight of weaners (kg)	394	309	368
Strategy: All weaners on forage oats			
Average sale weight of weaners (kg)	377	292	352

4.4.2 Results and discussion

Table 30 shows the herd gross margin after imputed interest of the base strategy is $338,779, and this increased by $1,977 to $340,756 when the lead steers on forage oats strategy is implemented, and by $10,821 to $349,600 when the strategy to feed all weaner steers on forage oats is implemented. Full details of the herd parameters and gross margins for these two strategies can be found in Table 31.

However, Table 30 also shows that the increases in herd gross margin after imputed interest are less than the cost of forage oats, in both strategies. The net result for the lead steers on forage oats strategy is -$11,708 and for the strategy to feed all weaner steers on forage oats is -$27,064.

Table 30 Herd gross margin and the cost of growing forage oats

Parameter	Base strategy	Lead weaner steers on forage oats strategy	All weaner steers on forage oats strategy
Herd gross margin after imputed interest	$338,779	$340,756	$349,600
Difference in herd gross margin from base strategy to strategies		$1,977	$10,821
Area of forage oats required (ha)		49	136
Cost of forage oats		$13,685	$37,885
Net result		-$11,708	-$27,064

Some producers may be able grow forage oats at a lower cost than shown in Table 28 by owning their own equipment and using their own labour to prepare and plant the forage oats. This approach does not come without its owns costs, with increased capital investment, machinery depreciation and labour costs (either paid or unpaid) that when fully considered, may generate a forage oats growing costs similar to what is described in Table 28.

Table 31 Herd parameters and gross margin for grazing weaner steers on forage oats strategies

Parameter	**Base strategy**	**Lead weaner steers on forage oats strategy**	**All weaner steers on forage oats strategy**
Total AE	940	925	899
Weaner heifers retained	96	100	107
Total breeders mated	483	502	536
Total breeders mated and kept	426	442	472
Total calves weaned	386	401	428
Weaners/total cows mated	80%	80%	80%
Female sales/total sales	49%	49%	48%
Total cows and heifers sold	180	187	200
Total steers and bullocks sold	189	198	214
Average female price	$945	$945	$945
Average steer and/or bullock price	$1,347	$1,269	$1,149
Capital value of herd	$837,427	$833,061	$734,825
Imputed interest on herd value	$41,871	$41,653	$36,741
Net cattle sales	$425,083	$428,190	$434,643
Direct costs excluding bulls	$18,572	$18,930	$19,639
Bull replacement	$25,860	$26,852	$28,663
Herd gross margin	$380,650	$382,409	$386,341
Herd gross margin after imputed interest	**$338,779**	**$340,756**	**$349,600**
Change in herd gross margin after imputed interest	$0	$1,977	$10,821
Gross margin/AE	$405	$413	$430
Gross margin/AE less interest on livestock capital	$360	$368	$389

An investment analysis of the change from the base strategy to the two strategies of feeding oats to weaner steers can be found in Table 32. For grazing the lead 40% of weaner steers on oats and then selling them, the profitability decreases by $6,534 per year (measured as Annualised NPV) as a result of adopting this strategy. For grazing all weaner steers on oats and then selling them, the profitability decreases by $24,675 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative results, peak deficit, payback period and IRR calculations were not undertaken.

Table 32 Returns for feeding oats to weaner steers

Factor	**Lead weaner steers on forage oats strategy**	**All weaner steers on forage oats strategy**
NPV	-$100,445	-$379,314
Annualised NPV	-$6,534	-$24,675
Peak deficit (with interest)	na	na
Year of peak deficit	na	na
Payback period (years)	na	na
IRR	na	na

The increase in gross margin after imputed interest resulting from grazing weaner steers on forage oats does not cover the cost of growing the oats. This is supported by previous studies that show grazing forage oats reduced profitability (Bowen and Chudleigh 2018). While the oats is growing, there is a large amount of feed available for three months. However, this country will not produce much feed of significance over summer, since all the pasture would be eradicated to grow a good oats crop, and hence have little grazing value. Producers need to be very clear of the benefits of the oats and the lost pasture utilisation before adopting a strategy of grazing oats.

4.5 Growing 400ha of wheat as a cash crop

4.5.1 Introduction

Growing cash crops in the Maranoa has been commonplace for over a century especially with the advent of subdivision and superphosphate. For beef producers, deciding on the use of their most fertile land provides opportunities and considerations. Therefore, the decision to grow a cash crop, such as wheat in this section, needs considerable analysis.

This section has analysed the strategy of removing 400 ha of brigalow belah country from the beef operation and growing a wheat cash crop. This will reduce the carrying capacity of the remaining property used for beef from 940 AE in the base strategy to 818 AE in this strategy.

It is assumed that wheat is grown in 7 out of 10 years and yields 2.2 t/ha in those 7 years. A long-term wheat price of $310/tonne (on farm) has been used. When wheat is not grown, fallow management costs are still be incurred. The operations required for the wheat crop were undertaken by contractors, as such no machinery was required to be purchased.

The country allocated to wheat was assumed to be ready for cropping, therefore required no development costs and would be fallow in between crops. The purchase of grain silos ($136,000) and an auger ($35,000) are included in the investment analysis.

4.5.2 Results and discussion

Table 33 shows that the 400ha of wheat will produce a gross margin of $74,956 in the 7 years in 10 that wheat is grown, and a gross margin of -$33,669 in the 3 years in 10 that wheat is not grown (fallow costs). The weighted average of the gross margin over 10 years is $42,369. The wheat gross margin can be found in Table 34.

Table 33 also shows that decrease in carrying capacity of pasture from 940AE to 818AE reduces the herd gross margin after imputed interest by $43,969. Full details on the changes to herd parameters and gross margins can be found in Table 35.

The net result is that the weighted wheat gross margin of $42,369 is $1,600 less that the decrease in herd gross margin after imputed interest of $43,969.

Table 33 Summary of wheat and herd gross margins

Parameter	**Wheat planted 7 in 10 years**	**Wheat not planted 3 in 10 years**	**Weighted average**
Yield (t/ha)	2.2	0	
Income ($/ha)	$682	$0	
Variable Costs ($/ha)	$495	$84	
Gross Margin ($/ha)	$187	-$84	$106
Area (ha)	400	400	400
Total wheat gross margin	$74,956	-$33,669	$42,369
Change in herd gross margin after imputed interest			-$43,969
Net result			-$1,600

Table 34 Wheat gross margin

Income		**YIELD**		**PRICE**		**TOTAL ($/ha)**
Grain		2.2	t/ha	$310	/t	$682
Variable Costs	**QTY**	**RATE**		**COST**		**TOTAL ($/ha)**
Fallow Management						
Operation: sprayer (Contractor)	3			$14.87	/ha	45
Herbicide: Glyphosate 450 CT	2	2.0	L/ha	$4.80	/L	19
Herbicide: 2,4-D Amine 625	2	0.3	L/ha	$6.50	/L	4
Herbicide: Starane Advanced	2	0.3	L/ha	$2.35	/L	1
Herbicide: Glyphosate 450 CT	1	1.2	L/ha	$4.80	/kg	6
Ammonia sulphate & surfactant	3			$3.10	/ha	9
					TOTAL	84
Planting						
Seed		40	kg/ha	$1.05	/kg	42
Operation: planter (Contractor)	1			$61.11	/ha	61
					TOTAL	103
Nutrition						
Nutrient: Urea		100	kg/ha	$0.75	/kg	75
Nutrient: Granulock Z		40	kg/ha	$1.30	/kg	52
Operation: Spreader (Contractor)	1			$17.01	/ha	17
					TOTAL	144
Crop Protection						
Operation: sprayer (Contractor)	2			$14.87	/ha	30
Herbicide: Tordon 242	1	1	L/ha	$12.00	/L	12
Wetter	1			$0.50	/ha	1
Fungicide: Folicur	1	0.145	L/ha	$13.00	/L	2
					TOTAL	44
Harvesting						
Operation: Harvest Draper Front	1			$67.86	/ha	68
Operation: Chaser Bin	1			$18.26	/ha	18
					TOTAL	86
Post-Harvest & other						
Operation: Grain on farm cartage	2.2	t/ha	60km	$0.20	/t/km	26
Levy		0.98%		$682.00	/ha	7
					TOTAL	26
Total Variable Costs						**$361**
Gross Margin						**$187**

Table 35 Herd parameters and gross margin when 400ha is used for a wheat cash crop

Parameter	Base strategy	400ha is used for a wheat crop
Total AE	940	818
Weaner heifers retained	96	84
Total breeders mated	483	421
Total breeders mated and kept	426	370
Total calves weaned	386	336
Weaners/total cows mated	80%	80%
Female sales/total sales	49%	49%
Total cows and heifers sold	180	157
Total steers and bullocks sold	189	165
Average female price	$945	$945
Average steer and/or bullock price	$1,347	$1,347
Capital value of herd	$837,427	$728,740
Imputed interest on herd value	$41,871	$36,437
Net cattle sales	$425,083	$369,913
Direct costs excluding bulls	$18,572	$16,162
Bull replacement	$25,860	$22,504
Herd gross margin	$380,650	$331,247
Herd gross margin after imputed interest	**$338,779**	**$294,810**
Change in herd gross margin after imputed interest	$0	-$43,969
Gross margin/AE	$405	$405
Gross margin/AE less interest on livestock capital	$360	$360

An investment analysis of the change from the base strategy to the strategy of growing 400ha of wheat and reducing the land used for cattle grazing can be found in Table 36. Profitability decreases by $11,183 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative results, peak deficit, payback period and IRR calculations were not undertaken.

Table 36 Returns for growing 400ha of wheat and reducing cattle operation

Factor	Growing 400ha of wheat
NPV	-$171,904
Annualised NPV	-$11,183
Peak deficit (with interest)	na
Year of peak deficit	na
Payback period (years)	na
IRR	na

Some producers might be attracted by the potential of wheat to have a high yield and gross margin if climatic conditions suit. However, in this 30-year analysis, profitability decreases when a strategy to grow 400ha of wheat is adopted. Growing wheat requires best management practices to be adopted to maximise potential yields. Producers who own and operate their own machinery can avoid the contractor costs used in this analysis, but they need to consider the significant labour (paid and unpaid) and capital costs associated with this strategy.

4.6 Trading and backgrounding steers

4.6.1 Introduction

Another consideration for producers in the Maranoa is whether to run a breeder herd or trade and background steers. A key difference between these strategies is that the breeder herd turns off a range of livestock classes (e.g. steers, cull heifers and cull cows), while the backgrounding herd only turns off a single class (e.g. steers).

For this strategy, 278 kg steers are purchased in May and sold 12 months later at 458 kg, having gained 180kg. This strategy mirrors the base strategy, so that weaners are purchased at the same weight that the base strategy weaned them, then achieved the same weight gain and the feeder steers are sold at 20 months to the same market as the base strategy.

The sale price of these steers is $2.16/kg. This sale price, as well as the market, sale weight and deductions, are the same as in the base strategy, detailed in Table 8. The nominal purchase price of $3.70 /kg is the same as the weaner price in the base strategy. Buying costs, a landed price and variable costs are detailed in Table 37. The landed price is $3.79.

This strategy was analysed using the Bullocks calculator, available on the Breedcow Dynama website https://breedcowdynama.com.au.

Table 37 Parameters for the trading and backgrounding steers strategy

Parameter	Value
Purchase weight (kg)	278
Sale weight (kg)	458
Buying costs ($/head)	
Transport ($/head)	$18.63
Induction ($/head)	$5.22
Buying costs ($/kg)	$0.09
Nominal purchase price ($/kg)	$3.70
Landed purchase cost ($/kg)	$3.79
Variable costs ($/head)	$1.93

4.6.2 Results and discussion

Table 38 shows the herd parameters of this strategy and the base strategy. To maintain a carrying capacity of 940 AE, the strategy of trading cattle requires 1,162 weaner steers to be purchased, selling 1,139 feeder steers after 12 months, with a 2% death rate. Even though the herd gross margin of the trading cattle strategy is higher than the base strategy, the herd gross margin after imputed interest of the steer trading strategy is $12,690 lower than that of the base strategy.

Table 38 Herd parameters and gross margin for the trading and backgrounding steers strategy

Parameter	Base strategy	Trading cattle strategy
Total AE	940	940
Weaner heifers retained	96	
Total breeders mated	483	
Total breeders mated and kept	426	
Total calves weaned	386	
Weaners/total cows mated	80%	
Female sales/total sales	49%	
Total cows and heifers sold	180	
Total steers and bullocks sold	189	1,139
Average female price	$945	
Average steer and/or bullock price	$1,347	$1,349
Capital value of herd	$837,427	$1,150,083
Imputed interest on herd value	$41,871	$57,504
Net cattle sales	$425,083	$1,535,920
Direct costs excluding bulls	$18,572	$2,243
Bull replacement	$25,860	$0
Herd gross margin	$380,650	$383,593
Herd gross margin after imputed interest	**$338,779**	**$326,089**
Change in herd gross margin after imputed interest	$0	-$12,690
Gross margin/AE	$405	$408
Gross margin/AE less interest on livestock capital	$360	$347

An investment analysis of the change from the base strategy to the strategy of trading and backgrounding steers can be found in Table 39. Profitability decreases by $10,052 per year (measured as Annualised NPV) as a result of adopting this strategy. Given the negative results, peak deficit, payback period and IRR calculations were not undertaken.

Table 39 Returns for the trading and backgrounding steers strategy

Factor	Trading and backgrounding steers strategy
NPV	-$154,528
Annualised NPV	-$10,052
Peak deficit (with interest)	na
Year of peak deficit	na
Payback period (years)	na
IRR	na

Trading and fattening steers gives producers the flexibility to delay steer purchases if pasture is in short supply. Trading steers has the same market risk at sale time as a breeder operation but has an added market risk at the time of purchasing steers.

Trading and fattening steers has the potential for a higher gross margin than the base breeder strategy but the interest costs of purchasing steers results in lower profitability than breeding feeder steers. The interest cost in this analysis is calculated at 5%, being a long-term assumption that takes into consideration that some producers may borrow this capital and others may use their own capital. If the actual interest cost was due to a stock mortgage, it would likely be much higher than 5% and the actual decrease in gross margin after interest would be larger.

The parameters used to analyse all the strategies in this report, assume average (neither excellent nor poor) management skills. There are opportunities for better results to be achieved by producers with excellent management and trading skills. For instance, with this strategy of trading and backgrounding steers, there are opportunities for producers to seek steers sired by high performance bulls with high estimated breeding values (EBVs). Being able to source steers with the genetic potential to perform and meet market specification in a timely manner could increase the gross margin of this strategy.

5 Conclusions

This report has examined several alternative strategies that could be used by producers to build profitability and resilience. Whilst every effort was made to ensure the assumptions used in each scenario were accurate and validated with industry participants, relevant experts or published scientific studies, the results presented should be viewed as indicative only. The following are some conclusions and considerations for producers.

The quality of the brigalow and poplar box country assumed to make up the base property in this analysis, means that the producer has options for alternative cattle management strategies, forage cropping, cash cropping and other grazing enterprises.

A beef breeding operation turning off feeder steers is well suited to the Maranoa, with good cattle growth rates, high reproductive performance and proximity to the Roma saleyards and southern Queensland feedlots. Analysis over thirty years for the modelled property found that turning off 20-month-old feeder steers is more profitable than turning off weaners or bullocks.

10-year data from the Roma saleyards shows that the average weaner price in March is 22c/kg higher than the May average. The analysis in this report found that weaning and selling in March, to gain the higher c/kg at the saleyard, resulted in the lowest profitability of all strategies, when analysed over thirty years. The extra weight of steers sold at 8 months, or as 20-month-old feeders, outweighed the reduction in price per kilogram. However, this does not diminish the relevance of early weaning as a drought strategy.

Cow culling age is not a factor that has significant influence on profitability for the base property since breeder reproduction rates are high and heifers are being joined at 14 months of age.

The profitability of feeding supplements to steers between May and December, when pasture quality is low, is dependent on whether the weight advantage the steers gained during this time is still there when they are sold. This analysis assumed that the steers gained an extra 31.5kg from supplementation, and if steers remained 31.5kg heavier at sale in May, then this strategy increased profitability. However, if the steers were only 21kg heavier at sale, then profitability decreased slightly.

The increase in gross margin after imputed interest resulting from grazing weaner steers on forage oats, does not cover the cost of growing the oats. This is supported by previous studies that show grazing forage oats reduced profitability (Bowen and Chudleigh 2018).

Growing wheat on the brigalow country resulted in a slight reduction in the gross margin after imputed interest. However, wheat does have the potential for a higher gross margin if climatic conditions suit.

Trading and fattening steers has the potential for a higher gross margin but the interest costs of purchasing steers results in lower profitability than breeding feeder steers.

While none of the strategies analysed in the report have proven to be a ‘silver bullet’ that dramatically increases profitability for the modelled property, many of the strategies result in a similar profit to that of the base strategy. These strategies are worth considering, especially if the producer’s skills or resources might give the producer an advantage when implementing one of these strategies.

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7 Glossary of terms and abbreviations

AE	Adult equivalent. An AE is a standard animal unit used to describe and quantify grazing pressure imposed on pasture by foraging ruminants. An AE rating is applied to grazing ruminants which approximates their grazing pressure relative to a standard animal.
Amortise	An amortised value is the annuity (series of equal payments) over the next *n* years equal to the present value at the chosen relevant compound interest rate.
Cumulative cash flow	Cumulative cash flow is the predicted final bank balance of the property at the end of the investment period due to the implementation of the strategy.
DAF	Department of Agriculture and Fisheries, Queensland Government
Depreciation (as applied in estimating operating profit)	A form of overhead cost that allows for the use (fall in value) of assets that have a life of more than one production period. It is an allowance that is deducted from gross revenue each year so that all the costs of producing an output in that year are set against all the revenues produced in that year. Depreciation of assets is estimated by valuing them at either current market value or expected replacement value, identifying their salvage value in constant dollar terms and then dividing by the number of years until replacement. The formula used in this analysis is: replacement cost – salvage value)/number of years until replacement.
Discount rate	The interest rate used to determine the present value of a future value by discounting. This helps determine if the future cash flows from a project or investment will be worth more than the capital outlay needed to fund the project or investment in the present.
Discounted cash flow	This technique is a way of allowing that when money is invested in one use, the chance of spending that money in another use is gone. Discounting means deducting from a project's expected earnings the amount which the investment funds could earn in its most profitable alternative use. Discounting the value of money to be received or spent in the future is a way of adjusting the future net rewards from the investment back to what they would be worth in the hand today.
Fixed (or overhead) costs	Defined as costs which are not affected by the scale of the activities in the farm business. They must be met in the operation of the farm. Examples include wages and employee on-costs, repairs, insurance, shire rates and land taxes, depreciation of plant and improvements, consultants' fees and the operators allowance for labour and management. Some fixed costs (such as depreciation or operator's allowance) are not cash costs. It is usual to count the smaller amounts of interest on a typical overdraft or short-term working capital as an operating expense (fixed cost) and deducted in the calculation of

	operating profit. The returns to lenders of fixed capital (interest, rent, lease payments) are deducted in the calculation of net profit.
Gross margin	The gross income received from an activity less the variable costs incurred. Gross margins are only the first step in determining the effect of a management decision on farm or business profitability. To determine the value of a potential strategy to the 'whole farm' or business, a more complete economic analysis is required in the form of a marginal analysis that considers the effect of alternative strategies at the property or business level.
IRR	Internal rate of return. This is the discount rate at which the present value of income from a project equals the present value of total expenditure (capital and annual costs) on the project, i.e., the break-even discount rate. This indicates the maximum interest that a project can pay for the resources used if the project is to recover its investment expenses and still just break even. *IRR can be expressed as either* ***the return on the total investment*** *or* ***the return on the extra capital****.*
NPV	Net present value. Refers to the net returns (income minus costs) over the life of an investment, expressed in present day terms. A discounted cash-flow allows future cash-flows (costs and income) to be discounted back to an NPV so that investments over varying time periods can be compared. The investment with the highest NPV is usually preferred. NPV was calculated at a 5% rate of return which was taken as the real opportunity cost of funds to the producer. Annualised NPV converts the Marginal NPV to an amortised, annual value. *The* ***annualised NPV*** *can be considered as an approximation of the* ***average annual change in profit over thirty years****, resulting from the management strategy.*
Operator's allowance	An allowance for the owners' labour and management; it can be estimated by reference to what professional farm managers/overseers are paid. Although it is often not paid in the farm accounts, it is an input required to generate the operating profit and must be deducted if a true estimate of operating profit and the return to the total capital in the business/property is to be calculated. It is generally not equal to the irregular wages paid to or drawings made by the owners. If some wages have been paid to the owners in the farm accounts and they are already included in the calculation of fixed costs, then the only difference between the wages paid and the true opportunity cost of their labour and management will need to be allowed for when calculating operating profit.
Operating profit	The return to total capital (equivalent to total assets) invested after the variable and overhead (fixed) costs involved in earning the revenue have been deducted. Operating profit represents the reward to all the owners of the capital tied up in the enterprise. Operating profit equals gross margin (total receipts minus variable costs) minus overheads. When operating profit is expressed as a percentage return to total capital it indicates the efficiency of the use of all the capital invested in the farm

	enterprise. In the Dynama spreadsheet (within the Breedcow and Dynama (BCD) software package) the 'return on total non-cash assets' is equivalent to the operating profit. Both calculations are identical and are adjusted for the annual change in livestock inventory and the annual cash surplus or deficit.
Payback period	The number of years it takes for the cumulative present value to become positive. Other things being equal, the shorter the payback period, the more appealing the investment.
Peak deficit	This is an estimate of the peak deficit in cash flow caused by the implementation of the management strategy. It assumes interest is paid on the deficit and is compounded for each additional year that the deficit continues into the investment period. It is a rough estimate of the impact of the investment on the overdraft if funds for the development are not borrowed but sourced from the cash flow of the business.
Rate of return on total capital	An estimate of how profitable a business is relative to its total capital (or total assets). It is the operating profit expressed as a percentage of the average of the total capital employed for the period under review (usually a year). In the Dynama spreadsheet (within the Breedcow and Dynama (BCD) software) the 'percentage return on total non-cash assets' can be taken as equivalent to the rate of return on total capital but only for steady-state base cattle herds before implementing a change in management.
Variable costs	These costs change according to the size of an activity. The essential characteristic of a variable cost is that it changes proportionately to changes in business size (or to change in components of the business).
Year of peak deficit	The year in which the peak deficit is expected to occur.