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Economic Effects of Alternate Growth Path, Time of Calving and Breed Type Combinations across Southern Australian Beef Cattle Environments: Time of Calving at the Western Australian Experimental Site

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Abstract

In a Beef CRC project undertaken over the period 2001-2006, different combinations of beef cattle genetics, growth/nutritional pathways and calving seasons were examined across a number of sites in Southern Australia for their ability to achieve targeted market specifications. In this paper the focus is on the Western Australian experimental site. The target market was a heavy domestic steer of around 500kg liveweight, and the steers were all Angus crossbreeds. Comparisons were made between Angus sires selected for high retail beef yield (RBY), for high intramuscular fat (IMF), and for both high RBY and high IMF. Three different growth treatments were imposed following weaning: (Fast ~ 1.0kg/day, then feedlot finishing; Slow ~ 0.6 kg/day, then pasture finishing; Compensatory ~ Weight loss of approximately 10 per cent from weaning, over the next 4-5 months, followed by compensatory growth and pasture finishing). Autumn and Winter calving systems were also compared. The consequences on carcase weight, carcase and meat quality and enterprise profitability (as measured by enterprise gross margins) were then examined. The primary drivers of profitability for the cattle enterprises evaluated were weight gain and feed costs. Those sires selected for high RBY outperformed other sires in terms of carcase value of their progeny. However, fast growth finishing options were less profitable except in a situation of cheap feed prices, since these treatments were feedlot finished. Changing calving time from Autumn to Winter decreased profitability to weaning by 10 per cent when stocking rate was unchanged. There are major implications for local agribusiness firms from decisions made in this production environment due to the reliance on supplementary feeding and feedlot finishing to meet domestic market specifications.

Keywords: beef, breed, growth path, time of calving, economics, evaluation, Western Australia

Introduction

Around one third of Australian beef production is consumed domestically (ABARE 2007), and most of the supply for this market is derived from the higher rainfall areas of southern Australia (ABARE 2008). Meat quality is becoming an increasingly important issue for Australian beef producers as domestic market specifications become more stringent. For example, using an industry data set of around 20,000 short-fed animal records, Slack-Smith *et al*. (2009) showed that about 28 per cent of these animals were outside of specification for carcase weight, while about 16 per cent were outside of specification for P8 fat depth. The development of the Meat Standards Australia (MSA) grading system has shown that domestic consumers are able to discriminate between beef of differing eating qualities (Polkinghorne *et al*. 2008), and that they are willing to pay a premium for higher quality beef (Griffith *et al*. 2009, Lyford *et al*. 2009). Premiums for intramuscular fat (IMF) are now available through some over-the-hook and contract markets. Therefore, producers now have options to produce cattle with a focus on carcase yield (retail beef yield or RBY), or on IMF, or in some cases, on both traits. However, there is little evidence available supporting selection of particular types of cattle in typical production environments.

The "Regional Combinations" project of the Cooperative Research Centre for Cattle and Beef Quality (Beef CRC) was designed to build on the nutritional and genetic principles affecting the quality of beef production studied in previous research programs. The project focussed on regional beef production systems at four sites in southern Australia - southern New South Wales (NSW), western Victoria (VIC), south-east South Australia (SA) and south-west West Australia (WA) – over the period 2001-2006.

One of the specific objectives of the project was to examine the economics of different combinations of beef cattle genetics, growth/nutritional pathways and calving seasons to achieve targeted market specifications across these various environments. In this paper, a farm-level modelling system is described that allows an economic evaluation of the experimental results, and the economic outcomes of applying this system at the WA site are reported. Implications are then drawn for beef cattle producers and agribusiness firms in the study area.

The overall design and methodology of the Regional Combinations project was described by McKiernan *et al*. (2005), while most of the biophysical outcomes have been reported in McKiernan *et al*. (2007). The broad economic implications have been reported in Davies *et al*. (2009), while the specific results for the NSW site focussing on feedlot finishing (Davies, Alford and Griffith 2009), and for the VIC site focussing on pasture finishing (Graham *et al*. 2009), have been reported separately.

Beef Production in South-West Western Australia

The distinguishing feature of the design for the WA site was the focus on time of calving, and the inclusion of a "compensatory" growth path which is common practice in the area, due to the particular climatic patterns in this region.

The Mediterranean climate of south-western Australia typically involves a dry Summer/Autumn period with a late Autumn break, followed by a wet Winter and Spring. This climatic environment results in rapid pasture growth in late Winter and Spring with associated high cattle growth rates. In these predominantly annual pastures a decline in quantity and quality of dry standing pasture through Summer and Autumn is associated with poor to negative growth rates in cattle if supplements are not provided (McKiernan *et al*. 2007, Section 4.4).

Traditionally in the south-west of WA calving is between February and April with weaning around December/January. This production pattern means lactating cows can often be at peak milk production at a stage when pasture nutrition restricts growth/lactation and supplements are required to optimise milk production or survival. This traditional system evolved through the demand for increasingly heavy milk-fed vealers slaughtered for the domestic market around 9-10 months of age. However at this time, the majority of weaners do not meet the market specifications and need to be finished either in the feedlot on high-grain diets, or on high performance pasture. Although there is an increasing demand for grain-fed cattle for domestic consumption, many cattle are still pasture finished.

Supplementing the lactating cow is a major cost in this traditional calving system. Generally the earlier the calving occurs in the year, the higher the supplementary feeding cost. Calving later will significantly reduce these costs and supplements are likely to be used more efficiently if fed directly to the weaned calf.

In dry land pasture systems there are increasing arguments offered regarding the potential benefits from calving later (Winter/Spring) and weaning calves younger, especially if they are destined for finishing in a feedlot. In the whole farm production system this approach may well have economic benefits in the breeder phase, for example higher stocking rates resulting in more calves/ha, less need for conserved feed, joining on a rising plane of nutrition, and the associated earlier weaning allows for a longer period between weaning and calving. There are also some negatives such as the likelihood of an increased level of calving difficulties, possible increase in calf scours, wetter conditions and shorter day length during calving, compromising husbandry, and lighter calves at weaning if weaned at the same time (McKiernan *et al*. 2007, Section 4.4).

In the grow-out phase, early-weaned calves are likely to require better quality feed over summer to perform as well as older weaners on similar pastures. However, if these weaners are destined for finishing in a feedlot they are less likely to exceed domestic target turn-off weights, especially in the case of the later maturing breeds and will be suitable for finishing later in the year. Thus, time of calving was considered a major local management issue which has a large effect on the profitability of beef production in this region.

The details of the experimental design at the WA site were as follows:

- Two times of calving - Autumn calving and Winter calving;
- High accuracy EBV (70 per cent and above) Angus sires in the top five per cent for either RBY%, IMF% or both RBY% and IMF%.

The progeny from both the Autumn and Winter calving groups were weaned in early January each year. A total of 150 steers per time of calving from the selected sire types were chosen for finishing on three different post weaning growth paths over three consecutive years:

- Rapid growth (>1.0kg/d) from weaning to feedlot entry weight of 400 kg with slaughter at a final average live weight of 500 kg;
- Slow growth from weaning (~ 0.6 kg/d) to 400 kg live weight then rapid finish on pasture (or feedlot) to a final average live weight of 500 kg;
- Compensatory growth: Weight loss of approximately 10 per cent from weaning, over the following 4-5 months, followed by compensatory growth and finishing on pasture to a final average live weight of 500 kg. The Slow and Compensatory cattle were slaughtered on the same day.

Method of Analysis

In these types of experiments, a series of protocols are imposed to meet the requirements for statistical analysis of the results in relation to the objectives and hypotheses tested. However these protocols often result in decisions being made that would not be consistent with normal commercial practice (for example, weaning on the same day, slaughter on the same day). Therefore it was decided not to model the experimental data exactly as recorded, but to examine the implications of the experimental outcomes for a commercial producer by incorporating the key results into regionally-representative cattle enterprise models (see also Alford *et al*. 2007). The limitations of this methodological approach to extrapolation of trial data to farm level analyses can be addressed to some extent through the appropriate validation of the model used and the use of sensitivity analyses of key assumptions (Dillon and Anderson 1990). See also the discussion in Davidson and Martin (1965) on this topic.

Beef-N-Omics

A farm level economic evaluation of the experimental outcomes was undertaken using the Beef-N-Omics software package (Dobos *et al*. 1997; Dobos, Carberry and Davies 2006). This package is designed to analyse the effects that different management practices have on the profitability of a beef herd. The program integrates herd structures, feed budgets and gross margin budgets for beef cattle breeding herds.

User inputs are required on aspects of the beef enterprise such as cow herd size, live weight, calving times, age and weight of progeny at turn off, market prices, seasonal pasture growth and carryover, and variable costs. The package calculates gross margin per cow, per $100 capital, per hectare and per tonne dry matter (DM), as well as the monthly feed surplus or deficit. Adjustments to these input parameters can be made to assess their impact on feed requirements and subsequently on herd gross margins.

Beef-N-Omics is a static herd model designed so that all the inputs are used in the calculations. This assumes that these inputs have been the same for the entire history of the herd being analysed. Because of this, Beef-N-Omics cannot be used accurately to assess the outcome of changes to aspects like sales policy, breeding or culling policy or calving patterns which will only be applied for a year or two, for example, during droughts. It should also be emphasised that Beef-N-Omics is not a full biological model. A disadvantage with this approach is that users must remember to input all the correlated consequences of any change to major inputs. A misleading output could result if this is not the case. Examples are provided in the User's Manual (Dobos *et al*. 2006).

General approach

The general approach to modelling was as follows (see also Davies *et al*. 2009; Davies, Alford and Griffith 2009; Graham *et al*. 2009). First, the production system modelled was chosen to be representative of the region where the experimental site was located in terms of seasonal conditions, pasture types and production practices (South-west WA around the Bunbury region).

Second, for a given pasture resource (for grazing and hay production), energy available for the cow herd was varied by altering the stocking rate to just provide sufficient metabolisable energy (ME) to meet the relevant sets of cattle growth rates. Breeding cow numbers and resultant steer progeny were adjusted until the April feed deficit was as close as possible to 50 kg/ha which allows for some weight loss in the breeding cows during this period, suggested as commercial practice by local research and advisory staff. Thus as shown in the modelling experiments reported in Table 7 below, 154 breeding cows could be run on the assumed 190 ha of available pasture for the Winter calving, Fast growth scenario, but only 116 breeding cows could be run for the Autumn calving, Slow growth scenario. The limitations of this approach are recognised given the simple ME approach used by Beef-N-Omics and the associated pasture modelling, however the methodology allows for a consistent approach across all experimental treatments.

Third, for each treatment analysed, actual group mean weaning and slaughter weights are entered from the experimental data. Two types of finishers are assumed: breeders who finish their own steers; or specialist finishers.

Fourth, given actual average prices received for each steer group and a set of assumed costs (here based on 2006 averages), gross margins are calculated for the treatment being analysed.

Input data

The specific input assumptions made for the WA analyses are given below. The pasture data (for Vasse) is given in Table 1. The growth path assumptions for a breeder/finisher are given in Tables 2 and 3, and the growth path assumptions for a specialist finisher are given in Table 4. The costs and returns are taken from the earlier study of Della Bosca *et al*. (2004) (see also Section 9.4 of McKiernan *et al*. (2007) and Davies *et al*. (2009) for greater detail)[1].

Feed budgeting

The advantage of using the Beef-N-Omics methodology became evident when the original time of calving analysis (Della Bosca *et al*. 2004) was redone. Table 5 reports the Beef-N-Omics results for the base Autumn calving enterprise and two Winter calving options, the first where the stocking rate was increased so that an equal amount of supplementary feeding was needed to balance the feed budget, and the second where the stocking rate was further increased but more land was set aside to make fodder to provide for the feed deficits.

Inputting the original data for the base Autumn calving herd of 250 breeders run on 350 ha and retaining progeny for 9 months through to 360 kg, Beef-N-Omics calculated that supplementary feed of 219 tonnes was required in March and April to balance the feed budget. This required 44 ha of the available pasture area to be set aside for hay making. In contrast, for the Winter calving option, where the progeny were sold at 7 months at around 280 kg, a total of 293 breeders could be run with the same level of supplementary feeding. The third option, Winter calving with a 10 per cent higher stocking rate, required 312 tonnes of hay from 62 hectares set aside.

Table 1. WA Pasture Growth Rate

Month	Kg/ha/day
January	0
February	0
March	0
April	5
May	20
June	28
July	28
August	37
September	49
October	64
November	44
December	5

Table 2. WA Growth Path Assumptions for Breeder/Finishers

Area used for beef cattle: 190 ha
Area used for fodder conservation: 25 ha
Amount of hay produced: 5 tonnes/ha = 125 tonnes
Hay has been used as follows. First, the quantity required for the steers was calculated, followed by the amount required by the cows to bring the feed deficit in February and March to zero. The balance of the 125 tonnes of hay was allocated to partially cover the April feed deficit.
Breeding cow numbers and resultant steer progeny were adjusted until the April feed deficit was as close as possible to 50 kg/ha which allows for some weight loss in the breeding cows during this period.
The Fast growth treatments were fed a grain component in their ration which was assumed to cost $180/tonne as fed. Components of the diet under each growth strategy are given in Table 3 below.
All steers were retained and were grown out in one of the three growth path options.
Heifers were assumed to be sold at weaning.

Table 3. Components of the Diet Under Each Growth Strategy

	Autumn, Fast Growth	Winter, Fast Growth	Autumn, Slow Growth	Winter, Slow Growth	Autumn, Loss then Gain	Winter, Loss then Gain
Grain	85%	72%				
Hay	13%	26%	28%	26%	47%, 0%	47%, 0%
Pasture			72%	74%	53%, 100%	53%, 100%
Additives	2%	2%				
Days from weaning to slaughter	103	191	262	306	134, 138	80, 170
Cost of grain supplement	$10,150	$15,820				

The monthly feed budgeting indicated that despite the Winter calving delaying feed demand due to pregnancy, there was more feed demanded from Winter calving options in the early summer because of the additional numbers of cows and progeny, and this effectively depleted the body of standing dry feed quicker, resulting in supplementary feed being required earlier (in January) compared to March for the Autumn calving system.

Table 4. WA Growth Path Assumptions for Specialist Finishers

For the Slow growth and Compensatory gain options, it was assumed that an area of 60 ha was used for the specialist finishing, with 10 ha shut up in June to allow for hay production in November. The yield assumed for the hay area was 5 t/ha and this was fed in Autumn. Stock were purchased in January and depending on the growth and time of calving option, the time that stock were on the property varied from 8 to 10 months. For the remaining period, pasture was assumed to be carried through until the following January. The stocking rate was adjusted until the pasture available plus the 50 tonnes of supplementary hay produced on the property matched the steer requirements. The cost of making the hay was assumed to be $40 per tonne. The Fast finishing option was predominantly completed on grain and thus a feedlot situation was assumed. Grain prices as fed were assumed to be $180 per tonne for the grain and $100 per tonne as fed for the hay. 100 steers were assumed.

The reduction in feed requirements for Winter calving indicated by Beef-N-Omics were considerably less than the original analysis and as a consequence the Winter calving options did not have the gross margin improvements that the earlier analysis showed. Ignoring owner-operator labour, if the fodder was valued at a very conservative value of $40/tonne (the cost of making the fodder), the gross margin for the Winter calving high stocking rate option was only marginally higher than the Autumn calving option. However, when fodder was valued around the opportunity cost of $100/tonne, the base Autumn calving option was superior. At the same stocking rate the gross margin for the Autumn calving system was around 10 per cent higher. An additional consideration is that the Autumn calves were assumed to put on an extra 80 kg over the extra two months they were on pasture (1.33kg/day), and this overrode the lower price/kg received. If growth rates for the Autumn calves were slower in the extra two months, the gross margin results could be quite different. Break even occurred when steer weights were 336kg, and heifer weights 331kg, or about 1.0kg/day.

Results

Time of calving

Using the Beef-N-Omics methodology (where permanent labour costs are excluded), the Autumn calving option had a higher gross margin than the Winter calving option at the same stocking rate and growth path (Table 5). However, the relative performance of the time of calving options in a whole farm context will be quite sensitive to the labour levels assumed. A small increase in the labour level required for the Winter calving high stocking rate enterprise would negate the current gross margin differences demonstrated when hay grown on farm is valued at $40/tonne. At a labour cost of $20/hr, the breakeven difference in labour required is only 52 hours. Also, feed cost savings from Winter calving operations need to be significant to compensate for the loss of income. A decision to change from the traditional Autumn calving to a Winter calving will hinge on the grazier's estimate of the marginal value of their labour at the time of the year when labour requirements vary (presumably because there is less Autumn feeding). If feed savings are not as high as those used in the original analyses, the gross margin advantages from the shift are likely to be lower.

Table 5. Trading off Stocking Rate, Feed Deficit, Hay Production and Profit

Time of Calving	Autumn	Winter, same supplementary feed	Winter, higher stocking rates
Number of breeders run on 350 hectares	250	293	325
Amount of supplementary feeding	March 122t, April 97t, total 219t	February 73t, March 96t, April 51t, total 220t	January 44t, February 98t, March 107t, April 63t, total 312t
Area set aside for haymaking	44 ha	44 ha	62 ha
Age and weight when steers sold	9 months, 360 kg	7 months, 280 kg	7 months, 280 kg
Total income from enterprise	$126,714	$120,741	$134,032
Enterprise gross margin when fodder valued at $40/t	$80,218	$73,346	$81,267
Enterprise gross margin when fodder valued at $100/t	$67,123	$60,128	$62,565

Growth path

Weights, prices and other data for each of the post-weaning growth path treatments are given in Table 6. The noteworthy features of these data are that the Winter calved steers have much lower weaning weights, and that the prices received for fast growth steers are at least $0.10/kg higher than their slower growing brothers.

Table 6. Weights, Prices Received and Other Data for Time of Calving and Growth Treatments

Variable	Autumn				Winter			
	Fast Growth	Slow Growth	Loss then Gain	Av.	Fast Growth	Slow Growth	Loss then Gain	Av.
Cow Mating Liveweight (kg)				493				503
Cow Weaning Liveweight (kg)				639				580
Calving %				52.5				47.2
Steer Weaning Liveweight (kg)	343	342	343,304		275	273	273, 248	
Steer Weaning P8 (mm)				6.13				3.96
Steer Daily Gain (kg/day)	1.34	0.63	0.58		1.11	0.71	0.65	
Days Post-weaning	103	262	262		191	305	305	
Steer Slaughter Liveweight (kg)	485	512	498		495	500	482	
Steer Slaughter Price ($/kg LW)	1.71	1.59	1.59		1.73	1.62	1.61	

Results for the breeder/finisher option are given in Table 7. Included are data on the sensitivity of the gross margins to 10 per cent positive and negative shifts in slaughter weight and slaughter prices.

Table 7. Results by Time of Calving and Growth Treatments – Breeder/Finisher

	Autumn, Fast Growth	Winter, Fast Growth	Autumn, Slow Growth	Winter, Slow Growth	Autumn, loss then gain	Winter, loss then gain
Months weaning to slaughter	5	7	8	10	8	10
No. breeders carried	145	154	116	132	125	136
No. steers grown out	65	69	52	59	56	61
April feed deficit (kg/ha)	-44	-63	-47	-53	-50	-56
Total Gross Margin, excl. labour ($)	46,924	43,829	42,169	45,849	43,002	44,002
GM/ ha ($)	246.97	213.18	221.94	241.31	226.33	231.59
Change in gross margin ±10% slaughter weight	±5,229	±5,371	±4,049	±4,588	±4,274	±4,526
Change in gross margin ±10% slaughter price	±5,145	±5,332	±4,090	±4,532	±4,284	±4,516

It would appear on the basis of these results that several options are very close in terms of enterprise profitability as measured by gross margins. The Autumn calving, Fast growth strategy produced the highest gross margin but this result is very sensitive to grain costs and labour requirements. The Winter calving, Slow growth option has the highest gross margin if grain prices extend to $200 per tonne. The Winter calving, Fast growth option was significantly lower than other options because of the high grain requirement to get them to the finished stage. Grain prices would have to fall to an as-fed price of $120 for this option to achieve the same gross margin as the Winter calving, Slow growth option. These relatively small differences in gross margin provide some evidence of the flat "profit" surfaces found in other sectors of Australian agriculture (Pannell 2006; Farquharson 2006). They also show that the traditional production system used in the region (weight loss then compensatory growth) produces gross margins of approximately the same order of magnitude as the specified Fast and Slow growth alternatives.

This analysis has set aside any consideration of owner-operator labour costs. The assumption is however, that labour costs will not vary that much between the alternative finishing strategies - there is an equal amount of feed conserved under the different strategies thus conservation costs and feeding out costs should be similar. The Fast growth strategies use significant amounts of grain but it has been assumed that labour has been covered by assuming an as-fed cost of $180 per tonne for any grain consumed. The labour costs to tend the breeding cows and the calves until weaning will vary depending on breeding cow numbers, but the strategies with the lower number of breeders retain the steers post weaning for a longer period; hence, labour is required post weaning for a longer period. This will at least partially cancel out lower labour requirements for the breeding cattle.

Results for the specialist finisher are given in Table 8. At the feed prices assumed, fast finishing of Autumn born steers using a feedlot was not profitable because of a higher maintenance requirement than the steers born in the Winter. Fast finishing of Winter born steers also produced very modest results.

Table 8. Results by Time of Calving and Growth Treatments – Specialist Finisher

	Autumn, Fast Growth	**Winter, Fast Growth**	**Autumn, Slow Growth**	**Winter, Slow Growth**	**Autumn, Loss then Gain**	**Winter, Loss then Gain**	**Autumn, Loss then Gain Alternative***
No. steers grown out	100	100	65	56	99	60	133
Total Gross Margin, excl. labour and interest ($)	-911	4,013	6,784	12,348	7,815	9,859	5,702
GM/steer ($)	-9.11	40.13	104.38	220.52	39.47	164.32	21.44
GM/ha ($)	n/a	n/a	113.08	205.81	130.26	164.32	95.04

* Assumed that of the 60ha available, 10ha was closed for hay production from June and produced 5t/ha, and a further 20ha was closed up for hay production in mid August and produced 3t/ha.

The Winter calving, Slow growth path produced the best returns (as in the breeder/finisher scenario), but here by a significant margin. This was partly because the final price ($1.62/kg LW) was higher than the other Slow or Compensatory growth options. Even if the price was reduced to the lowest price of $1.59/kg LW, the gross margin per hectare was still superior to the others. The reasons why this enterprise produced the highest gross margin was because the time to finish the animal was 10 months and the latter portion of this time was in a period of relatively abundant feed. The feed demand in the January to March period, when feed was short, was quite low because the body weight, and hence maintenance requirements, were lowest. Whilst there was a lower number of steers finished, the margin per steer was sufficiently higher to compensate. If interest on initial capital outlaid to purchase these animals was taken into account, the gross margin results would have been even more in favour of the Winter calving, Slow growth option.

Breed types

The differences between the sire breed types were minor, so gross margins were not calculated separately by breed type. The RBY-sired animals had a small advantage in overall value through their faster growth rate between the first weighing at between 2-3 months of age and weaning, higher weaning weight, and lower fat cover. Thus, high growth breed types typically have much to offer in terms of overall profitability because of their extra weight at sale, but need to be managed carefully to ensure acceptable compliance for other traits, such as fat cover or IMF%. For example, McKiernan *et al*. (2007, Table 4.4.12) report that only 63.6 per cent of the Fast grown animals met the WA P8 fat depth specification, compared with 76.0 per cent and 78.9 per cent respectively for the Slow and Compensatory growth path animals.

Discussion

Thus, the primary drivers for profit for the cattle enterprises evaluated were the amount of weight gain and the costs. Since the Fast growth treatments were feedlot finished compared to pasture fed for the others, the Fast growth options were less profitable except in a situation of cheap feed prices. At feed prices of $120 per tonne for grain and $80 per tonne for hay, the Winter calving, Fast option produced the highest gross margin. However, for the Autumn calving, Fast option, grain and hay prices had to fall to around $70 per tonne fed for this option to produce the same gross margin as the Winter calving, Slow growth strategy.

The Slow and Compensatory treatments in the Winter calving management group were more profitable than the Fast growth treatment. The advantage to the grass fed alternatives was mainly due to the lower cost of feed. The reverse was true for the Autumn calving treatment where the Fast growth treatment was the most profitable option. In this case, there was little difference in the cost of feed and the animals in the Fast growth treatment achieved greater income from sales.

These gross margin results at the cattle enterprise level need to be confirmed with more complex whole-farm analyses before major investment decisions are made, especially in relation to the expected requirements for operator or permanent labour.

Further, there is a high degree of variability in the year to year values for some key variables, which suggests the need for a close look at the relative risks of various alternatives in particular farming environments. Unfortunately, the authors do not have ready access to the raw experimental data so a formal assessment of the variability of the different options could not be done here. However, some relevant information is available for interested readers in Section 9.4 of McKiernan *et al*. (2007).

Finally, it should be noted again that these results are based on steady state herd models, and no account is taken of the investments required or the time needed to change over from one production system to another.

Conclusions and Implications

Regional cattle producers need to have a good understanding of their whole farm system and of the markets for the cattle they produce when considering whether to change enterprises. The effects of carcase weight and faster growth have emerged as the main drivers of enterprise profitability in this region of south-west WA. Grain and hay prices, potential weaner growth rates and prices received are the key factors to consider for regional producers considering a shift to fast finishing growth paths. For example, grain prices would have to fall from an as-fed price of $180 to $120 per tonne for the Winter calving, Fast growth option to achieve the same gross margin as the Winter calving, Slow growth option.

When considering a shift from the traditional Autumn calving to a Winter calving option, factors involved are differences in labour requirements, supplementary feed requirements, stocking rates and the amount of land to set aside for hay production, as well as sale weights and prices received for both weaners and finished steers. For example, the Autumn calving option had a higher gross margin than the Winter calving option at the same stocking rate and growth path and with fodder valued at market rates. Only if the fodder was valued at a very conservative value of $40/tonne (the cost of making the fodder), would the gross margin for the Winter calving high stocking rate option exceed that for the Autumn calving option.

Therefore, due to the reliance on supplementary feeding and feedlot finishing to meet domestic market specifications in this production environment, local agribusiness firms such as feedlotters, feed suppliers, seed and fertiliser suppliers and contract hay makers will be affected by decisions made in the cattle production system. In times of high grain and supplement prices, the results reported above suggest that contract finishing firms and feed suppliers will be adversely affected.

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[1] Analysis of the West Australian time-of-calving experiment had been previously undertaken using a whole-farm spreadsheet model (Della Bosca *et al*. 2004; McKiernan *et al.* 2007). That analysis was redone in the Beef-N-Omics framework so that the results were aligned with the analyses done for the other States. In doing so, some adjustments were made to the original cost items (removing permanent labour allowance, repairs and maintenance expenses and other fixed costs, and adding in the cost of bull purchases). See Davies *et al.* (2009) for a formal comparison of the effects of these changes.