NSW DEPARTMENT OF
PRIMARY INDUSTRIES

The Economic Effects of Alternate Growth Path and Breed Type Combinations to Meet Beef Market Specifications across Southern Australia

Lloyd Davies
Cooperative Research Centre for Beef Genetic Technologies and
Senior Economist, NSW Department of Primary Industries, Tocal

Helen Quinn
Cooperative Research Centre for Beef Genetic Technologies and
Senior Farm Business Economist, Department of Primary Industries Victoria, Box Hill

Tony Della Bosca
Cooperative Research Centre for Beef Genetic Technologies and
Regional Economist, Department of Agriculture and Food WA, Bunbury

Andrew Alford
Cooperative Research Centre for Beef Genetic Technologies and
Livestock Research Officer, NSW Department of Primary Industries, Armidale

Garry Griffith
Cooperative Research Centre for Beef Genetic Technologies and
Principal Research Scientist, NSW Department of Primary Industries, Armidale

Economic Research Report No. 39

May 2009

mla
MEAT & LIVESTOCK AUSTRALIA

CRC BEEF

Abstract
The "Regional Combinations" project of the CRC for Cattle and Beef Quality focussed on regional beef production systems at sites at southern NSW, western Victoria, south-east SA and south-west WA. The combined effects of different growth paths, diverse genetic potential and time of calving on performance and carcase traits were examined in detail for each site over a number of years to determine the best regional combinations to meet targeted market specifications. This provided the information to identify the most profitable systems across different environments in southern Australia. The data identified weight gain as the biggest driver of profitability of production. Between growth treatments, at most sites there was a large difference in the gross margins between the Fast and Slow treatments favouring the Fast grown animals, even after accounting for the higher cost of producing pasture capable of sustaining faster growth. In terms of breeds, in NSW the Euro breed types consistently outperformed the Wagyus, in WA the high RBY sires outperformed the others, and in Victoria there was little difference across breeds except for the Wagyus. Changing calving time from autumn to winter in WA decreased profitability to weaning when the stocking rate was unchanged, but increased the gross margin when the stocking rate was increased by 10%. In Victoria, there was little difference in gross margins between autumn and spring calving, however comparing the average gross margins for calving season and growth path, the earlier finishing Fast growth path system autumn calving gave the highest gross margins per hectare, and for the Slow finishing system, spring calving gave the highest gross margin. These economic advantages were due to better alignment of animal requirements to feed availability, which had a major effect on the cost of production through reduced supplementary feed costs.

Keywords: beef; growth path, breed type; economic; evaluation; Australia
JEL Code: Q12, Q16

ISSN 1442-9764
ISBN 978 0 7347 1915 7

Senior Author's Contact:
Dr Garry Griffith, NSW Department of Primary Industries Beef Industry Centre, JS Barker Building, University of New England, Armidale, NSW, 2351.
Telephone: (02) 67 701 826
Facsimile: (02) 67 701 830
Email: garry.griffith@dpi.nsw.gov.au

Citation:
Davies, L., Quinn, H., Della Bosca, A., Alford, A. and Griffith, G. (2009), *The Economic Effects of Alternate Growth Path and Breed Type Combinations to Meet Beef Market Specifications across Southern Australia*, Economic Research Report No. 39, NSW Department of Primary Industries, Armidale, May.

Table of Contents

List of Tables

List of Figures

Acknowledgments

The financial and in-kind support of the Cooperative Research Centre for Cattle and Beef Quality and its partner agencies Meat and Livestock Australia, New South Wales Department of Primary Industries, Department of Primary Industries Victoria, South Australian Research and Development Institute, Department of Agriculture and Food Western Australia, and the University of New England is gratefully acknowledged. Thanks also to the many staff of these agencies that assisted in field operations, data collection and processing, biometrics and administrative support.

The generous support in cash and kind of the commercial co-operators, AgReserves Australia Ltd (NSW site) and Alcoa Farmlands (WA site), is gratefully acknowledged, as is the individual support of all the field staff and management of those organisations. The co-operation and assistance of Cargill Beef Australia at the finishing and processing stages of the experiments is also acknowledged.

The economics team pays a special tribute to the outstanding project management team of Bill McKiernan, John Wilkins, John Graham, Geoff Tudor, Mick Deland, Brian McIntyre and Jim Walkley who provided support, data and other assistance whenever asked.

Kirrily Pollock, Leanne Orr, Stuart Mounter and John Mullen provided valuable comments on an earlier version of this Report.

Acronyms and Abbreviations used in the Report

ABARE	Australian Bureau of Agricultural and Resource Economics
ADG	Average daily gain
BEEF CRC	Cooperative Research Centre for Cattle and Beef Quality
BNO	Beef-N-Omics, a software package (see Appendix A)
BREEDPLAN	The national beef genetics recording and analysis system
CFA	Cast-for-age
DM	Dry matter
EBV	Estimated Breeding Values
EMA	Eye muscle area
GM	Activity gross margin
HSCW	Carcase weight
IMF	Intramuscular fat
LW	Liveweight
ME	Metabolisable energy
MSA	Meat Standards Australia
P8	A particular site on the rump where external fat cover is commonly measured
RBY	Retail beef yield
RD&E	Research, development and extension

Executive Summary

The ‘Regional Combinations’ project was an integral component of the CRC for Cattle and Beef Quality (1999–00 to 2005–06). It was designed to build on the nutritional and genetic principles affecting the quality of beef production studied in previous research programs by focussing on regional beef production systems at four sites across southern Australia – southern New South Wales (NSW), western Victoria (VIC), south-east South Australia (SA) and south-west West Australia (WA). The overall design and methodology was described by McKiernan et al. (2005).

The combined effects of different growth paths, genetic potential and time of calving on performance and carcase traits were examined in detail for each site over a number of years to determine the best regional combinations to meet targeted market specifications. This provided the production information to evaluate the regional outcomes economically and to identify the most profitable and biologically efficient systems within representative environments across southern Australia.

Two different growth treatments were imposed following weaning (Fast ≈ 0.8 kg/day, Slow ≈ 0.6 kg/day, and for the WA site only, Compensatory ≈ weight loss and then reclaimed) to animals of diverse genetic potential for carcase traits (retail beef yield and intramuscular fat). The consequences on carcase and meat quality were then examined. Data were analysed to examine the effects of growth treatment post weaning and both sire carcase type (defined by either breed type or Estimated Breeding Values (EBV) for carcase traits) and sire carcase class (sire type grouped into high yield, high intramuscular fat or combined high yield and high intramuscular fat classes). The effects of calving seasons were also analysed for VIC and WA, and in SA for one season. The sites involved had different market targets and finishing regimes but a common underlying experimental design.

The implications of these experimental outcomes for a commercial producer were then calculated by incorporating the key results into regionally-representative cattle enterprise models using the Beef-N-Omics software package.

At the NSW site there was a large ($176/ha) difference in the gross margins for pre-feedlot production between the Fast and Slow treatments favouring the Fast grown animals, even after accounting for the higher cost of producing pasture capable of sustaining faster growth. Conversely, there was a considerable advantage to the Slow treatment animals for weight gain in the feedlot (Compensatory growth) compared to the Fast, which resulted in higher gross margins for Slow treatment animals ($29/steer). However, the difference in the feedlot phase was much smaller than the difference pre-feedlot hence insufficient to outweigh the economic advantage of the Fast growth treatment overall.

Results from the VIC site further demonstrated the importance of finishing cattle on a Fast growth path to enable quicker turnover, ensuring that periods of higher stocking rates while finishing cattle prior to slaughter are kept to a minimum. The highest gross margin per hectare was achieved using a Fast growth treatment, post weaning.

Economic analyses of post weaning production for the WA experiments were heavily influenced by finishing regime, since Fast growth treatments were feedlot finished compared to pasture fed for the other treatments. 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.

The NSW data identified weight gain as the biggest driver of profitability of production pre-feedlot, highlighting the differences due to carcase types and gain achieved within growth treatments. The Charolais carcase type, even within the slower growth treatment, outgrew all other breed types and was the most profitable. During feedlot finishing, the results were variable, with the Charolais types achieving the best gross margin following slower pre feedlot growth (due to high compensatory growth), but mid field following the Fast pre-feedlot phase. The Red Wagyu type, the slowest growing, performed worst in terms of gross margin. High growth breed types 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.

The VIC site analyses also showed the importance of producing cattle with heavier slaughter weights, highlighted when comparing the Wagyu ($376/ha) to the other breeds ($412/ha).

The WA economic analyses confirmed these findings with the animals from high retail beef yield sires having an advantage in overall value through their greater carcase weight. As noted above, the major effect on profitability post weaning at the WA site was the cost of the feedlot finishing for the Fast growth treatment compared to pasture finish and time of calving. In the SA data, there was very little difference across the Angus sire classes.

Changing calving time from autumn to winter in WA decreased profitability to weaning when the stocking rate was unchanged, but increased the gross margin when the stocking rate was increased by 10%. Reproductive rates were not affected. This clear economic advantage in production to weaning for the winter calving system was due to better alignment of animal requirements to feed availability, which had a major effect on the cost of production through reduced supplementary feed costs. In VIC there was little difference overall, with Autumn calving the best for the Fast growth treatment and Spring calving best for the Slow. In SA, the Autumn calving outperformed the Spring calving by around $55/ha.

Results from this experiment are not prescriptive but can give guidance on the expected biophysical outcomes and on the expected economic impacts. However, regional cattle producers need to have a good understanding of their whole farm system when considering the appropriate combinations of breed type and growth path that is best for them. For example, while there may be large differences in mean gross margins between the Fast and Slow treatment groups, there may be significant differences in individual farm businesses in relation to input requirements and availability, and pasture types and growth rates through the year and consequent implications for stocking rates at different growth rates. Sale weights and prices received for both weaners and finished cattle will also vary through the year as will supplementary feed requirements, availability and price. A specialised software package like Beef-N-Omics makes consideration of all these various factors formal and explicit.

1. Introduction

Approximately 35 per cent of Australian beef production is consumed domestically (ABARE 2007). The domestic market is therefore still the largest single market destination for Australian beef. The majority of the supply for the domestic market is derived from the higher rainfall areas of southern Australia where turnoff rates and cattle values are higher than for the pastoral regions of northern Australia (ABARE 2008).

Well-defined specifications have existed for many years for Australian cattle targeted at particular market endpoints. The primary parameters have been related to carcase yield (hot carcase weight and P8 fat depth), with values outside preferred ranges attracting discounts from processors. However, meat quality is becoming increasingly important as an issue for Australian beef producers in meeting more stringent and changing market specifications. 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. 1998), and that they are willing to pay a premium for higher quality beef (Griffith et al. 2009). Intramuscular fat (IMF) has been shown to be positively correlated with improved eating quality (Egan et al. 2001) and minimum IMF% (as assessed by marble score) is now included in some high quality domestic market specifications. Premiums for IMF are now available through some over-the-hooks and contract markets. Therefore, producers now have options to produce cattle with a focus on carcase yield, IMF, or in some cases, both traits.

However, the evidence supporting selection of an optimal growth path to meet a particular market endpoint is not clearcut. Robinson et al. (2001a,b) suggested that growth depression during pre-finishing reduced IMF% in the carcase. However, Pethick et al. (2004) cited examples where this did not occur and in fact slower growth resulted in higher IMF%. Pethick et al. (2004) concluded that there was limited published data available on the effect of pre-finishing growth and the pattern of response may differ between breed types. Further, Gregory et al. (1994) reported unfavourable genetic correlations between traits affecting carcase composition and palatability, indicating that genotypes with high yield potential may have lower eating quality.

To be able to provide sound advice to producers about optimal growth paths, it is important to examine these potential antagonisms in the context of the Australian domestic beef trade requirements, as both yield and eating quality can have large effects on carcase value[1]. Further, in determining responses to growth and genetic treatments in an experimental design, many other aspects of live animal production and characteristics of the carcase affecting compliance and quality need to be examined. Carcase and meat quality traits other than yield and IMF% also need to be assessed for response to the genetic and nutritional treatments imposed.

The 'Regional Combinations' project was designed to build on the nutritional and genetic principles affecting the quality of beef production studied in previous research programs by focussing 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). The overall design and methodology was described by McKiernan et al. (2005).

[1] This will also become increasingly important in premium overseas markets.

The specific objectives of the project were:

- ⇒ To quantify the effects of post weaning nutrition, as affecting growth rate, within and between genotypes varying in propensity for meat quality (yield and/or traits influencing eating quality) or growth, on end product carcase compliance and meat quality;
- ⇒ To determine and/or validate the optimum combinations of beef cattle genetics and growth/nutritional pathways to achieve targeted specifications across various environments in southern Australia;
- ⇒ To examine the capability (regionally specific) and cost (economics) of the above combinations achieving greater compliance rates; and
- ⇒ To increase the uptake of beef production technology generated by this and other CRC initiatives throughout regional Australia.

In this report, the experimental results from this seven year project are reviewed, a farm-level modelling system is described that allows an economic evaluation of the experimental results, and the economic outcomes of applying this system in each of the southern Australian sites are summarised. In some of the sites, different ways of analysing the experimental data are reported. Implications are then drawn for beef cattle producers in the southern Australia study area.

Further detail, especially on the technical aspects of the experiments, can be found in McKiernan et al. (2005, 2007).

2. The Regional Combinations Experiments and the Effects on Performance and Carcase Traits

2.1 Overview of the Study[2]

The combined effects of different growth paths and diverse genetic potential on performance and carcase traits were examined in detail for each of the four project sites to determine the best regional combinations to meet targeted market specifications. The effects of calving season on performance of the progeny were also examined at the VIC and WA sites.

Genetic alternatives

Sires were chosen to generate genetically diverse experimental progeny for the carcase traits intramuscular fat (IMF%) and retail beef yield (RBY%). They were chosen on the basis of Estimated Breeding Value (EBV) data for those traits where available, otherwise on performance expected as a characteristic of the breed (or more generally carcase class) from which they were drawn. The carcase classes chosen were:

- ⇒ Class high for RBY% – drawn from the Charolais, Limousin and Belgian Blue breeds and from Angus chosen on the basis of high EBVs for RBY%.
- ⇒ Class high for IMF% – drawn from the Black Wagyu breed and from Angus chosen on the basis of high EBVs for IMF%.
- ⇒ Class high for both RBY% and IMF% – drawn from the Red Wagyu breed and from Angus chosen on the basis of high EBVs for both traits.

These three classes are subsequently referred to as ‘RBY’, ‘IMF’ and ‘RBY&IMF’. There were different sires within each carcase class on the basis of being drawn from different breeds. Each carcase class, but not all sires, were represented by progeny at all sites. Many of the sires used were common across sites thus establishing the genetic links required for combined analysis of effects, and in particular to allow examination of genotype by environment interactions.

Growth alternatives

To represent production systems typical of most areas of southern Australia, three broad post weaning growth paths were established to test the ability of the progeny to meet market specifications. One growth path was used in SA, two in NSW and VIC, and three in WA (see Figure 2.1):

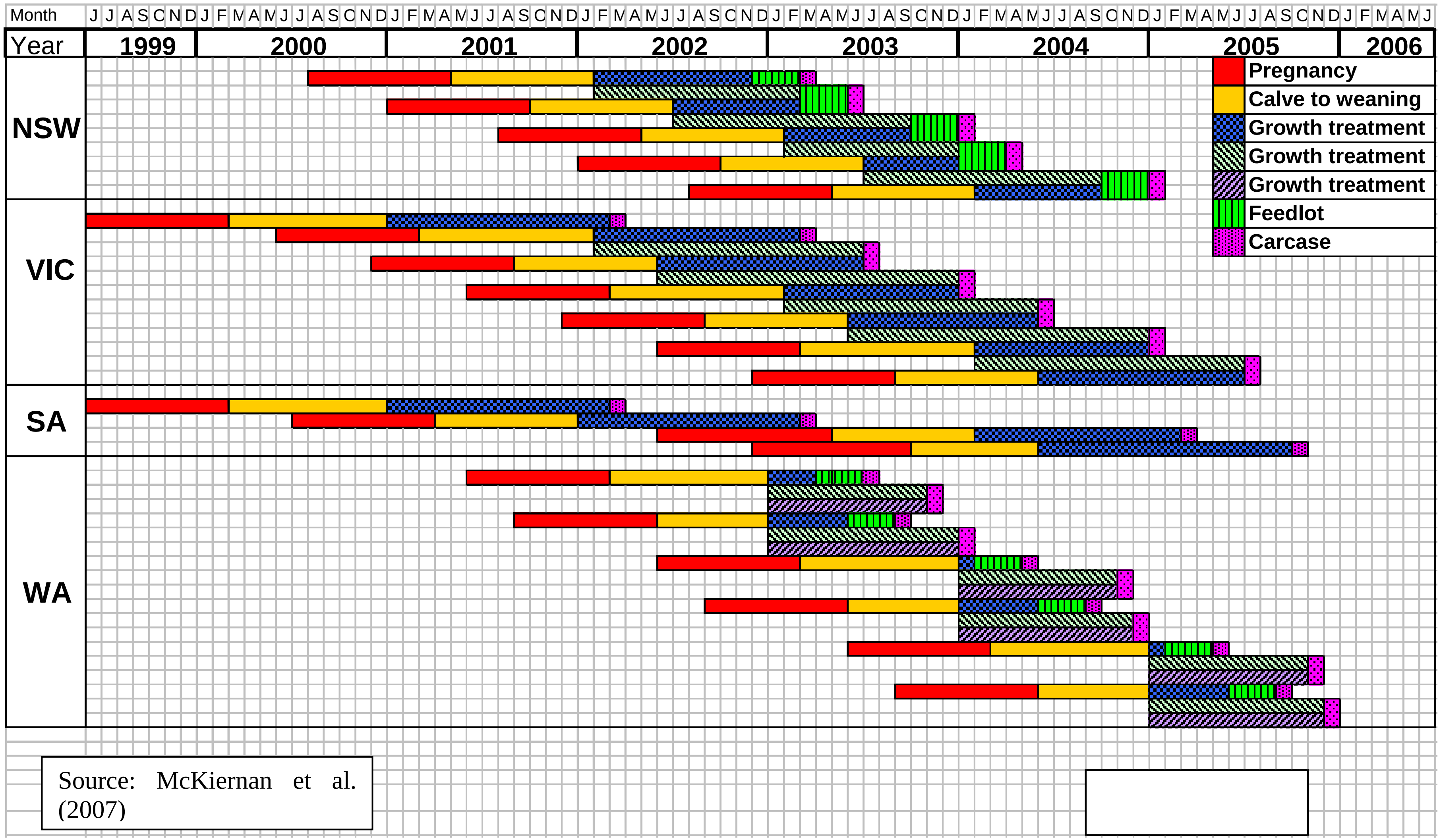
- ⇒ High growth path to achieve 0.7–1.0 kg gain per day from weaning to feedlot entry or slaughter.
- ⇒ Moderate/slow (or conventional) growth path to achieve approximately 0.5–0.6 kg gain per day from weaning to feedlot entry or slaughter.
- ⇒ Weight loss immediately post weaning followed by a period of rapid compensatory growth on pasture to slaughter (WA only).

The treatments imposed to create these growth paths are subsequently referred to as ‘Fast’, ‘Slow’ or ‘Compensatory’ growth treatments.

The progeny were grown out, finished and slaughtered according to the experimental protocols, and the consequences on carcase and meat quality were then examined. Data were analysed to examine the effects of growth treatment post weaning and both sire carcase type

[2] This summary has been taken from McKiernan et al. (2007).

Figure 2.1: 'Regional Combinations' project experimental design



Source: McKiernan et al. (2007)

and sire carcase class were evaluated. The sites involved had different market targets and finishing regimes but a common underlying experimental design. Figure 2.1 shows that for the SA site there are just four seasonal replicates of the one growth path treatment (Slow). For the NSW and WA sites, matings were timed at least once a year over a number of years so that the Slow growth group from one calving was managed to reach the same mean feedlot entry weight at the same time as the Fast growth group from the next calving. The same principle was followed at the VIC site except that those cattle were finished on grass.

The target market for the NSW animals was the Cargill 100-day grain fed grid, around 350 kg carcase weight (HSCW); for VIC the grass-fed grid at around 350 kg HSCW; for SA the European Union or heavy domestic trade grid at a range of weights; and for WA a 100-day feedlot grid at around 500 kg liveweight.

2.2 Effects of Growth Treatment

At the NSW site there was a large effect of prior growth treatment on cattle growth rate during their subsequent feedlot finishing. This effect of compensatory growth also appeared to be greater in the higher growth potential types. Growth treatment influenced all fatness traits. At all sites, faster grown animals had greater subcutaneous and intramuscular fat and also had higher dressing percentages. At the NSW and VIC sites, yield was unaffected by growth path, but at the WA site the Fast growth treatment had the lowest yield. At the VIC and WA sites there was a small but significant advantage to the Fast growth treatment in eating quality of the strip loin cut, as predicted from the MSA model, while actual palatability results from the NSW site show a strong trend for better eating quality in faster grown animals when assessed via consumer taste panels.

2.3 Effects of Sire Carcase Type

Results at all sites showed significant effects of sire carcase type for liveweight and virtually all carcase traits measured in the progeny. Differences in sires chosen on breed type, or EBV within breed type, for fat and/or yield traits, were reflected, as expected, for those traits in their progeny. Specifically, the progeny of Angus sires chosen for high RBY% or high IMF% EBVs differed in subcutaneous fatness, IMF% and RBY% carcase traits as predicted. At all sites there were clear differences in actual or predicted eating quality between carcase types and between carcase classes favouring the progeny of high IMF sires. High yielding types produced carcases of acceptable eating quality, but not as good as those with higher IMF characteristics. Responses to sire type in EMA and RBY were clearly in line with expectations, with the European types significantly superior in most cases.

Results from the current analyses indicate there are likely to be few, if any, interactions between backgrounding growth rate and genetic merit that affect carcase traits at finish for the range of growth rates observed here. Thus the ranking of progeny of different sire types for various carcase traits should be similar under different growth regimes.

2.4 Effects of Sex of Progeny

In relation to the sex of the progeny, results from the VIC, SA and WA sites were very consistent – heifers grew slower and had lighter carcases than steers. They were also fatter and had higher marbling scores than the steers and had lower RBY% (particularly VIC and

WA), while the steers had slightly better compliance to carcase specifications, thus receiving less discounts and higher prices than heifers.

2.5 Effects of Calving Season

The effects of calving season on performance of the progeny were examined at both the VIC and WA sites. There was little difference in carcase traits due to calving season at either site.

2.6 Meeting Market Specifications

The production systems and market targets across the sites were quite different. Thus the results of analyses of compliance to specific market specifications highlighted the importance of an end point focus and the design of systems to achieve the desired outcome for the targeted product.

The dominant outcome at all sites was the influence of final or carcase weight on overall product value. Under current payment systems, the reward for meeting carcase quality specifications is always overshadowed by the dominant effect of total weight on carcase value. Presently price signals are masked and do not actively encourage changes in production systems to improve compliance for quality traits. Future changes to pricing systems to increase emphasis on carcase quality or yield traits will need to have sufficient incentives to justify changes in breeding and production systems.

In NSW, the three Angus sire carcase types performed better than others at meeting grid specifications in both Fast and Slow growth treatments. Types with higher growth potential (particularly the Charolais) had lower compliance levels due to lower P8 fatness and were often too heavy at the common feedlot finishing time. There was a trend for better compliance of the Fast growth treatment carcases to grid specifications for almost all traits. The Fast growth carcases better met both P8 fat and fat colour specifications, resulting in an overall increase in compliance over the Slow growth treatment.

In the VIC and SA systems, whilst the percentages of carcases meeting both fat and HSCW specifications were low overall, the Limousin sired progeny performed best and the Wagyu sired performed worst, in the latter case due to the majority being underweight. While the carcases from the VIC site had relatively low compliance rates overall, the indices of ‘customer satisfaction’ again favoured those from the Fast growth path compared to the Slow.

At the WA site, the proportions of RBY and IMF sired animals that met specifications as well as the discounts and average prices received indicated similar meat quality characteristics. These two groups were also rated similarly in customer satisfaction, however, the RBY sired animals had an advantage in overall value through their greater HSCW. Fast growth path animals at the WA site had the lowest rates of compliance to specifications, mainly due to excessive carcase weight and fatness. However, Fast growth animals achieved very high levels of compliance for fat and meat colour.

These results provided the production information to evaluate the regional outcomes economically and to identify the most profitable and biologically efficient systems within representative environments across southern Australia.

3. Methodology for the Economic Evaluation

As with a previous analysis of cattle experimental work (Alford et al. 2007), the nature of the experimental protocols imposed in this project resulted in a number of decisions being made that would not be consistent with normal commercial practice. The very poor seasonal conditions at several of the sites during much of the experimental phase necessitated the use of large levels of supplementation of some cow treatment groups to obtain the targeted high nutritional planes. These levels and consequent costs of feed supplements would be obviously uneconomic in commercial beef production terms. Also, because of the experimental protocols, feedlot entry was based on cohort age, not on individual weights as would be done commercially, and slaughter was also based on age rather than a target weight.

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. 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.

A farm level economic evaluation of the experimental outcomes was undertaken following the production phases relevant at each site. The economic evaluation was based on 2006 average prices and costs. The Beef-N-Omics (BNO) software package (Dobos et al. 1997, 2006) was used for economic evaluation of the phase of production prior to feedlot finishing (the 'on-farm' analyses). The program integrates feed budgets and financial gross margin calculations for beef cattle breeding and trading enterprises, and is designed to generate the effects on profitability of a beef herd as a result of changes in management inputs. Further detail is provided in Appendix A. The production system modelled was chosen to be representative of the region where each experimental site was located.

The general approach was as follows. First, to reduce the complexity of the economic analysis, it was decided to use BNO assuming the same land resource and mostly the same associated pasture resource for each of the growth treatments. 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. The use of supplementary feeding was allowed if standard regional practice. Thus for example, at the NSW site, 116 breeding cows and progeny could be run on the 120 ha of good quality pasture to achieve the Fast growth path, but only 67 breeding cows and progeny could be run on the 150 ha of poorer quality pasture to reach the Slow growth path (see next section for more detail). The limitations of this approach are recognised given the simple ME approach used by BNO and the associated pasture modelling, however the methodology allows for a consistent approach across all experimental treatments.

Second, for each treatment analysed, final weights (feedlot entry weight or slaughter weight if grass-finished) are entered from the experimental data. Third, given a set of prices and costs, gross margins are calculated for the treatment being analysed.

The way in which the BNO package was implemented across the different sites varied according to the complexities of the experimental design at the various sites. These differences will be described in the following sections.

4. Feedlot Finishing at the New South Wales Site[3]

4.1 Implementing the Methodology

Analysis of production on the farm
Local knowledge was used to determine the proportions of pastures required to finish the steers at the desired rates. Pasture growth rates were based on data collected in the NSW Riverina for each pasture type. Details of these assumptions are provided in Appendix B.1 and B.2. 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. The use of supplementary feeding was allowed if standard regional practice in a typical year. Thus for example, 120 ha of good quality pasture[4] could achieve the Fast growth path for 116 breeding cows and progeny, but only 67 breeding cows and progeny could be run on the 150 ha of poorer quality pasture to achieve the Slow growth path.

Once the feed supply aspect was settled, adjustments were then made to the experimental data to ensure that each breed type had an average feedlot induction weight of approximately 380 kg[5]**.** This adjustment was necessary because different breed types had different growth rates but had to be placed in the feedlot on the same day to fit the experimental design. As a result, some types were too heavy and others were too light, which resulted in some types receiving significant price penalties because they were outside liveweight specifications at slaughter. The average induction weight for each breed type x growth path combination was set to an average of 380 kg by adjusting the time of induction. For slower growing types, the number of additional days required to attain induction weight was calculated and a daily agistment rate was charged to cover the costs to hold the slower growing types for additional periods.

Stocking rate
It is common practice in southern NSW to give supplementary feed to beef cattle in the late summer or early autumn period. Following consultation with local advisory officers, a maximum monthly pasture deficit of 100 kg per ha in the case of the Fast growth enterprises and up to 300 kg per ha for the Slow growth enterprise was used in the model[6]. The Angus RBY breed type was chosen as a representative breed type and cow numbers were progressively increased in the BNO package until the feed budget showed the required deficits.

Therefore, the stocking rates generated by the model were as follows:
(i) Fast growth treatment - 116 breeders including female progeny till 8 months of age (weaning) and male progeny to 16 months of age.

[3] More detail is available in Davies, Alford and Griffith (2009).

[4] The 120 ha included 20 ha of irrigated lucerne and 10 ha of winter fodder crop.

[5] At the NSW site the breed types included were Angus selected for high RBY, Angus selected for high IMF, Angus selected for both high RBY and high IMF, Charolais, Limousin, Black Wagyu and Red Wagyu. The growth paths selected were a High growth path to achieve 0.7–1.0 kg per day from weaning to feedlot entry, and a Moderate/slow (or conventional) growth path to achieve 0.5–0.6 kg per day from weaning to feedlot entry. Analysis of the unadjusted data is available in McKiernan et al. (2007).

[6] The Slow growth enterprise allowed for greater deficits because of the lower growth rates required for the steers and the fact that there is no irrigated summer pastures assumed for this enterprise.

(ii) Slow growth treatment - 67 breeders including female progeny till 8 months of age (weaning) and male progeny to 21 months of age.

Determination of supplementary feed requirements
The experimental cows were relatively small framed and averaged less than 480 kg liveweight throughout the study period. A loss of 10 kg in liveweight during one month (March) was considered normal practice for the Fast growth treatment, while a loss of 10 kg per month for two months was considered normal practice in the Slow growth treatment, for cows of this size. In both treatments, the spring flush was considered sufficient to return the cows to their original weight. Using the Droughtpack module from StockPlan® (Davies et al. 2007), feeding at 1.3 kg/steer/day below maintenance resulted in a loss in weight of 0.33 kg/day or 10 kg for the month. Supplementary feed was fed in the Fast growth scenario until the feed deficit in March was -38 kg/ha for the month. For the Slow growth scenario, a 10 kg/steer/month weight loss allowed in February and March converts to a monthly feed deficit of -18 kg/ha[7]. Supplementation in other months was made where necessary to reduce the deficit to zero. Supplementary feed was assumed to be 10 MJ/kg DM, cost $150/tonne and 90% DM.

Cost adjustments for slower growing breeds
As BNO works as a monthly model, the calculated age at induction was rounded to the nearest month for the fastest growing types (Charolais). For the slower growing steer types, an additional cost was determined by calculating the additional days required to achieve the induction weight, and applying a daily rate for "agistment" (50 c/steer). This cost includes: (i) interest on sales proceeds that would occur if the fastest growing breed was selected and (ii) the costs of tying up land for additional periods. In BNO this total per head cost was added as an "other cost" against the yearlings. Mean induction weights used for all types were generated by a spline analysis[8], and were very close to the targeted 380 kg (range 379 to 382 kg).

It should be noted here that because of the differences in pastures and turnoff times we are comparing two entirely different enterprises and it is not feasible for commercial farmers to easily change from one system to the other. The Fast growth scenario relies on access to 20 ha of highly productive irrigated pastures to help fill the late summer, autumn feed gap and also on 10 ha of fodder crop to help fill the autumn, early winter deficit.

Herd parameters, costs and returns
Prices and costs used in the analysis are for 2005/06. Since the evaluation of the feedlot phase was based on actual prices paid for the experimental cattle at a particular point in time (Table 4.1), costs and returns for the cow-calf activity were chosen to be consistent with this time period. The cow-calf activity was chosen to be representative of the NSW South West Slopes and was derived from a standard NSW Department of Primary Industries budget (NSW DPI

[7] Feed deficits for Fast growth options were calculated as follows: 116 head x 1.3kg deficit per day x 30.4 days per month = 4584 kg of allowable feed deficit ÷ 120 ha = 38 kg per ha deficit allowed for March.
Deficits for Slow growth options were 67 head x 1.3 kg deficit per day x 30.4 days per month = 2648 kg ÷ 150 ha = 18 kg/ha allowed for February and March.

[8] A mixed model cubic smoothing spline analysis (Verbyla et al. 1999) was used to both describe the growth paths and to predict live and carcase weights where various corrections were required. In particular, a set of data was generated to predict the performance of steers if each growth treatment x sire type group was set to a mean 380 kg feedlot induction weight. The "extra days" taken (compared to the fastest group) for groups of steers to achieve this 380 kg mean was also part of the data generated from this procedure.

Table 4.1. Current and projected changes in grid prices for fat and weight specifications

Trait	Current	Projected
P8 fat depth (mm)		
0-5.5	-$1.20	-$1.20
6-9.5	-$0.15	-$0.15
10-18.5	$0.00	$0.00
19-32.5	$0.00	-$0.10
33-42	-$0.20	-$0.20
Carcase weight (kg)		
420+	$3.52	$3.52
400-419.5	$3.82	$3.82
380-399.5	$3.90	$3.90
360-379.5	$3.91	$3.90
330-359.5	$3.91	$3.91
300-329.5	$3.91	$3.86
280-299.5	$3.86	$3.81
260-279.5	$3.42	$3.42
<259.5	$3.22	$3.22

2006) (see Appendix B.3 for greater detail). The areas of pasture and associated stocking rates used in the BNO model were chosen to provide a breeding herd roughly equivalent to the herd size assumed in the standard cow-calf budget.

Analyses of production in the feedlot phase
A spreadsheet model was used to calculate the gross margin outputs for this section of the analysis. The assumptions made for this analysis are described in Appendix B.4.

Analyses using standard grid specifications
The valuation of carcases was based on the Cargill 100 day grain fed grid for July 2005 (see Table 4.1, column 1). The effect on the gross margin of using a constant price based on the average grid price for all carcase types was also examined. This was $3.83/kg carcass weight.

Analyses using tightened grid specifications
It is considered highly likely that processor grid specifications will be tightened in the future to provide a stronger signal for producers to supply desired carcases. The two most likely traits to undergo tightening of their acceptable ranges will be fat and weight specifications. Yield of retail beef and marbling are also currently under consideration by processors for inclusion in payment systems, but these are not investigated here. Calculations have been made using projected changes in grid prices for fat and weight specifications, as shown in Table 4.1 (column 2).

There were no time-of-calving experiments in NSW.

4.2 Results

Price penalties were incurred due to over- and under-weight of carcases of the fastest and slowest growing breed types as a result of the variation in feedlot entry liveweights. In commercial practice, where individual producers would not have the large range in carcase types examined here, the liveweight of the animals presented to the feedlot would be much less variable and could be targeted to an optimal average.

The number of days that each breed type required to attain group mean feedlot induction weights of 380 kg was generated by a 'spline analysis' of growth data. The time taken for the Charolais, the fastest growing breed type, to attain the targeted feedlot induction weight was 15 months and 21 months for the Fast and Slow growth treatments respectively. The additional times taken for other breeds to achieve the same target, compared to the Charolais, are shown in Table 4.2, which also shows the 'agistment' costs charged in the gross margin calculations as a result of this extra time required. The average additional cost added to cover the retention of livestock beyond 15 and 21 months was $15.89 for the Fast treatments and $25.73 for the Slow treatments. The induction and carcase weights generated from the 'spline analysis' that were used for the gross margin calculations in this section are shown in Table 4.3.

Table 4.2. Additional days and agistment charges for breed types within growth treatments to attain a feedlot induction weight of 380 kg compared to Charolais

Carcase type	Additional days to attain 380 kg induction weight		Agistment charged per steer at 50¢ per additional day	
	Slow growth	Fast growth	Slow growth	Fast growth
Angus RBY	53	32	$27	$16
Angus IMF	25	31	$13	$15
Angus RBY and IMF	52	30	$26	$15
Charolais	0	0	$0	$0
Limousin	44	32	$22	$16
Wagyu black	88	43	$44	$22
Wagyu red	99	56	$49	$28
Average	51	32	$26	$16

Table 4.3. Mean weights for breed types within 'Slow' and 'Fast' growth treatments

Carcase type	Induction liveweight (kg)		Carcase weight (kg)	
	Slow	Fast	Slow	Fast
Angus RBY	380	380	356	348
Angus IMF	379	380	350	344
Angus RBY and IMF	380	379	354	345
Charolais	381	379	367	347
Limousin	380	380	361	351
Wagyu black	381	381	353	349
Wagyu red	383	383	348	338
Average	380	376	355	346

Gross margins "on farm"

The on-farm gross margins for the various treatment groups are shown in Table 4.4. The Charolais groups had higher returns compared to all others, and additional price premiums from 1.4¢ to 10.4¢ per kg would need to be received by the other breed types for the same on-farm gross margins to be attained. There was a consistent improvement in gross margins from the fast growth path, of around $70 per cow or $175 per ha on average.

Table 4.4. On-farm gross margins for breed types within growth treatments and price premiums required for gross margins to equal Charolais

Carcase type	Slow		Fast		Difference Fast *v.* Slow		Additional premiums required (¢/kg) for equivalent gross margin per hectare to Charolais	
	(Gross margin /cow)	(Gross margin /ha)	(Gross margin /cow)	(Gross margin per ha)	($/cow)	($/ha)	Slow	Fast
Angus RBY	$209	$93	$274	$265	$66	$172	2.7 ¢	6.1 ¢
Angus IMF	$220	$98	$280	$270	$60	$172	1.4 ¢	3.0 ¢
Angus RBY and IMF	$214	$95	$279	$270	$65	$174	2.1 ¢	4.7 ¢
Charolais	$232	$103	$296	$286	$64	$182	0.0 ¢	0.0 ¢
Limousin	$215	$96	$284	$274	$69	$178	2.0 ¢	4.3 ¢
Wagyu black	$196	$88	$270	$261	$74	$174	4.3 ¢	9.7 ¢
Wagyu red	$194	$87	$273	$264	$79	$177	4.6 ¢	10.4 ¢
Average	$211	$94	$279	$270	$68	$176		

Gross margins for the feedlot phase

The Slow growth treatments consistently out performed the Fast growth treatments in the feedlot (Table 4.5; gross margins using actual grid prices). The Charolais groups again showed a difference of $60 per steer in favour of the Slow treatment. The differences between treatments for the other types were much lower (average $29 per steer).

Table 4.5. Feedlot gross margins for breed types within growth treatments and premiums required for gross margins to equal Charolais

Carcase type	Slow growth	Fast growth	Difference Fast *v.* Slow	Premium to match Charolais slow growth	Premium to match Limousin fast growth
Angus RBY	$205	$178	$26	8.2 ¢	3.0 ¢
Angus IMF	$186	$166	$21	13.5 ¢	6.7 ¢
Angus RBY and IMF	$197	$176	$21	10.4 ¢	3.8 ¢
Charolais	$234	$174	$60	0.0 ¢	4.2 ¢
Limousin	$215	$189	$26	5.1 ¢	0.0 ¢
Wagyu black	$191	$175	$16	12.1 ¢	3.9 ¢
Wagyu red	$169	$139	$30	18.4 ¢	14.7 ¢
Average	$200	$171	$29		

A “what if” scenario was examined to see the effect of applying a constant grid value to all treatment groups, with the outcome of this exercise shown in Table 4.6. This showed that the gross margins and the ranking of the types were similar using constant or variable grid values.

Table 4.6. Feedlot gross margins for breed types within growth treatments - constant price of $3.832/kg

Carcase type	Slow growth	Fast growth	Difference
Angus RBY	$205	$178	$26
Angus IMF	$183	$162	$21
Angus RBY and IMF	$196	$169	$27
Charolais	$239	$178	$61
Limousin	$223	$193	$30
Wagyu black	$193	$181	$12
Wagyu red	$171	$141	$29
Average	$201	$172	$30

Impact of tighter grid specifications

As previously discussed, there are likely to be changes in the processing industry through the implementation of more stringent specifications for the traits that affect carcase value. Table 4.7 shows the comparison of carcase values using the standard grid specifications (July 2005 Cargill grid), as generally used for the gross margin calculations, against a proposed “tightened” grid as described above in Table 4.1.

Table 4.7. Comparison of carcase values based on actual specifications of the Cargill grid or on proposed “tightened” specifications for weight and fat

Carcase type	July 2005 grid		Tightened grid	
	Slow growth	Fast growth	Slow growth	Fast growth
Angus RBY	$3.832	$3.839	$3.826	$3.831
Angus IMF	$3.842	$3.843	$3.829	$3.834
Angus RBY and IMF	$3.834	$3.850	$3.823	$3.848
Charolais	$3.817	$3.821	$3.814	$3.809
Limousin	$3.810	$3.820	$3.802	$3.808
Wagyu black	$3.827	$3.816	$3.823	$3.805
Wagyu red	$3.829	$3.825	$3.817	$3.806
Average	$3.829	$3.834	$3.821	$3.823

With tighter specifications for weight and fat, prices were reduced by around 1¢/kg on average, which was fairly consistent across all types. With such minor changes in price, the resultant gross margins (Table 4.8) showed little variation from those previously calculated (Table 4.5), with almost identical ranking of the types within growth treatments.

Table 4.8. Feedlot gross margins for types within growth treatments using carcase prices based on tightened grid specifications

Carcase type	Slow growth	Fast growth	Difference
Angus RBY	$202	$178	$24
Angus IMF	$182	$163	$19
Angus RBY and IMF	$193	$171	$22
Charolais	$233	$170	$47
Limousin	$212	$184	$38
Wagyu black	$190	$171	$18
Wagyu red	$165	$133	$33
Average	$197	$168	$29

4.3 Discussion and conclusions

At the NSW site, there was a large difference between the Fast and Slow treatments favouring the Fast grown in the on farm analyses (gross margin advantage of $68 per cow and $176 per ha over the Slow grown), even after accounting for the higher cost of producing pasture capable of sustaining faster growth. This was primarily due to steers being sold earlier allowing more cows to be run on the pastures for the Fast growth treatment, whilst still maintaining the same annual and monthly pasture deficits[9].

Although the average difference between Fast and Slow growth treatments was $176 per ha, within breed types this difference varied with the Charolais the highest at $182 per ha and the Angus IMF the lowest at $172 per ha. It is postulated that this is a reflection of the growth potential of the various breed types and when a potentially faster growth type is given the opportunity to grow it performs better under those more favourable conditions.

The biggest driver of profitability between breed types was weight and liveweight gain achieved within treatments. The Charolais breed type, even within the slower growth treatment, outweighed and outperformed all other breed types. The slower growing Angus and Wagyu types performed worse. This clear advantage to Fast growth over Slow (on average and across breed types), and its magnitude, suggest there is considerable margin for even greater costs (supplementary feeding, pasture improvement, etc) to be absorbed to achieve a faster pre-feedlot growth.

During the feedlot phase, those steers entering the feedlot at heavier liveweights also exited at heavier liveweights and were considerably discounted for being overweight at the end (a function of the research design requiring feedlot entry at the mean target entry averaged over all types). Therefore breed types like Charolais were heavily discounted on exit ($3.738/kg and $3.761/kg in the slow and fast treatments compared to the treatment averages of $3.813/kg for both). Despite this the Charolais type in the slow treatment still had the highest gross margin due to a substantial benefit in overall carcase value where their total weight advantage compensated for the $/kg disadvantage. The Charolais weight advantage was considerably enhanced by the higher than treatment average compensatory effect in feedlot gain in the slow growth group.

[9] Although not reported, this advantage also shows in the return per $100 of livestock capital because, with faster growth, there is less money tied up in stock on hand.

Within the Fast growth group, this growth advantage did not occur, reducing the overall weight advantage of the Charolais, allowing the discounts to have more of an effect, and resulting in them being ranked near the average compared with the other breed types.

There was a considerable advantage in weight gain to the Slow growth groups (2.54 kg/day) compared to the Fast groups (2.39 kg/day), occurring across all breed types and resulting in an average advantage at finish of 13kg of carcase weight and hence overall value. This was the major factor in the higher gross margin of the Slow treatment group compared to the Fast. The Red Wagyu type, the slowest growing, performed worst in terms of gross margin.

Considering the pre-feedlot and feedlot analyses together, the highest gross margins in the pre-feedlot phase were produced by the Fast growth treatment groups, whereas the Slow growth treatments performed better in the feedlot. However, the magnitude of the economic advantage pre-feedlot, combined with the improvements in carcase traits reported above, certainly favour the Fast growth option overall.

5. Grass Finishing at the Victorian Site[10]

5.1 Implementing the Methodology

The specific input assumptions made for the Victorian analyses are given in Appendix C. The pasture data (for Hamilton) is given in Appendix Table C.1, and the herd parameters, costs and returns in Appendix Table C.2. The actual price grid used is shown in Appendix Table C.3. Prices and costs used in the analysis are for 2006. Herd costs and returns for the cow-calf activity representative of the Hamilton district of Victoria are derived from a standard Department of Primary Industries Victoria budget (see McKiernan et al. 2007 for greater detail). Since the Victorian animals were finished on grass, not in a feedlot, there was no need for the adjustments required to the NSW data, nor any need for examination of alternative grid pricing systems.

For the Victorian site, stocking rate was determined by adjusting breeding cow numbers until the total feed deficit was 200kg DM/Ha, suggested as commercial practice by local research and advisory staff. Thus, 100 breeding cows could be run on the assumed 200 ha of available pasture for the Slow, Autumn calving all breeds scenario, but 118 breeding cows could be run for the Fast, Autumn calving all breeds scenario (see Table 5.1 below)[11].

5.2 Results

In this experiment, all calves were weaned at a common weight and the weaners were grown to approximately 550 kg on grass and slaughtered. Whilst the growth treatments chosen were not extreme in terms of weight gain per day achieved, they resulted in a mean difference of 5.3 months in age at slaughter: the Fast growth path averaging 22.2 months at slaughter, and the Slow growth path averaging 27.9 months. There was a mean difference of 12 kg in slaughter liveweight favouring the Slow growth paths, but no difference in carcase weight (HSCW), because of a compensating effect of a higher dressing percentage in the Fast growth path groups.

The proportions of carcases meeting the relevant price grid (Appendix Table C.3) were examined to assess compliance. The percentages of carcases meeting both of the major criteria in the specification (HSCW and rump fat (P8)) were low in all groups. The Wagyu-sired progeny had the lowest compliance, due to the majority of carcases failing to meet the weight specification. Whilst differences were small, there was a trend for the Angus sire types selected for higher RBY% to have more progeny meeting market specifications than those selected for high IMF%. Compliance was dependent mainly on variation in liveweight and fat. Since there is no consideration of carcase yield in the grid, there was no advantage in payment for higher yielding animals, and this will remain the case until changed by the processors. Penalties due to poor compliance are compounded by low carcase weight.

---

[10] Further detail is available in Graham et al. (2009).

[11] At the Victorian site the breed types included were Angus selected for high RBY, Angus selected for high IMF, Angus selected for both high RBY and high IMF, Belgium Blue, Limousin (both high RBY), and Black Wagyu (high IMF). Two different growth treatments were imposed following weaning (Fast ~ 0.8kg/day, Slow ~ 0.6 kg/day). The effects of calving seasons were also analysed.

Tables 5.1, 5.2 and 5.3 compare gross margins per cow and per ha for the various combinations of growth treatment and season of calving. These results demonstrated the importance of finishing cattle on a Fast growth path to enable faster turnover. This ensures that the period of higher stocking rate when slaughter cattle are being run on the property is as short as possible. The Wagyu progeny had a large effect on the outcomes of these analyses because of their much lower slaughter and carcase weights compared to other groups. Thus scenarios were examined both with and without these animals included.

Table 5.1 shows that whilst the highest gross margin/cow ($717) was achieved with a Slow growth group (Spring calving, Wagyu excluded), the highest gross margin per ha ($412) was achieved using a Fast growth path post weaning (Autumn calving, Wagyu excluded). The Beef-N-Omics analyses demonstrated the importance of producing cattle with heavier slaughter weights, highlighted when comparing the best outcome ($412/ha, Wagyu excluded), with the same scenario for Wagyu progeny only ($376/ha). Apart from the Wagyu progeny, there were only small and mostly not significant differences between the various sire type groups for carcase weight, and thus the gross margin results for separate scenarios will not be presented.

Table 5.1. Gross margins of various combinations of growth treatment and season of calving using common weaning weights for all sire types

Calving Season	Growth path	Sire type	No cows**	GM Total $	GM $/cow	GM $/ha
Autumn	Fast	No Wagyu*	117	82,472	705	412
Autumn	Fast	All	118	80,257	680	401
Autumn	Fast	Wagyu only	122	75,235	617	376
Spring	Fast	No Wagyu	104	74,382	715	372
Spring	Fast	All	106	74,084	699	370
Spring	Fast	Wagyu only	109	68,508	628	342
Autumn	Slow	No Wagyu	99	68,177	689	341
Autumn	Slow	All	100	66,439	664	332
Autumn	Slow	Wagyu only	103	61,274	595	306
Spring	Slow	No Wagyu	102	73,120	717	366
Spring	Slow	All	104	72,934	701	365
Spring	Slow	Wagyu only	105	66,228	639	331

* All sire types used excluding Wagyu
** Comparative carrying capacity generated by Beef-N-Omics for the various scenarios

There was little difference in mean gross margins between autumn and spring calving (Tables 5.2 and 5.3), however comparing the average gross margins for calving season and growth path, it can be seen that for the earlier finishing Fast growth path system, autumn calving gave the highest gross margins per hectare ($396), and for the Slow finishing system, spring calving gave the highest gross margin ($354). This would most likely be due to the autumn calving system with earlier finishing cattle being more likely to match feed supply, compared to a spring calving system.

Thus the effects of carcase weight and faster growth have emerged as the main drivers of profitability. Further, the results have demonstrated the effect of using BREEDPLAN EBV's for selection of the most appropriate sires to produce carcases with the best compliance to the targeted market.

Table 5.2. Gross margins ($/ha) for growth path and season of calving

	Growth path		
Calving Season	Fast	Slow	Mean
Autumn	396	326	361
Spring	361	354	358
Mean	379	340	360

Table 5.3. Gross margins ($/ha) for sire type, growth path and season of calving

Sire type	Fast	Slow	Autumn	Spring	Average
All	386	349	367	368	367
No Wagyu	392	354	377	369	373
Wagyu	359	319	341	337	339
Grand Total	379	340	361	358	360

5.3 Discussion and Conclusions

The effects of carcase weight and faster growth have emerged as the main drivers of profitability in this region of Western Victoria. Apart from the Wagyu progeny, there were only small and mostly not significant differences between the various sire type groups for carcase weight. However, the Wagyu progeny had a large effect on the outcomes of these analyses because of their much lower slaughter and carcase weights compared to other groups. Further, the results have demonstrated the effect of using BREEDPLAN EBV's for selection of the most appropriate sires to produce carcases with the best compliance to the targeted market. Selection for individual carcase traits had significant effects in one generation, without detriment to liveweight, and responses were quite consistent under different growth regimes. In this experiment, there was little difference in mean gross margins between Autumn and Spring calving.

6. Grass Finishing and Supplementary Feeding at the South Australian Site[12]

6.1 Implementing the Methodology

The implementation for SA was very similar to that for Victoria, with the same pasture type used (although with a different seasonal pattern) (Appendix Table D.1) and almost the same herd parameters, costs and returns (Appendix Table D.2). However there were some major differences in the experimental design which influenced the economic analyses.

Stock numbers for Autumn calving[13] were set at a district standard of 100 breeding cows and followers on 260 ha of permanent pasture with supplementary feed given to each breed type until the Beef-N-Omics total deficit per hectare during the year was 200 kg/ha. Feed deficits occurred in March and April and it was considered that cows would compensate for this computer calculated lack of feed by losing body weight which would subsequently be regained in the spring.

Due to lack of numbers (Table 6.1) especially for the Euro and Wagyu breed types, the economic analysis was only done for the Angus sire classes (two-thirds of all the cattle slaughtered).

Table 6.1. Breed representation in each kill group*

Group	Angus Both	IMF	RBY	Angus Total	Belgium Blue RBY	Limousin RBY	Wagyu Black IMF	Wagyu Red Both	Total
1	17	6	7	30			7		37
2	18	6	5	29			19		48
3	25	24	13	62	2	2	1	1	68
4	34	33	14	81	16	21	4	6	128
5	30	27	6	63	18	22	3	7	113
Total	124	96	45	265	36	45	34	14	394

* Although Figure 2.1 shows only four mating periods at the SA site, there was an additional Spring calving in the final year, giving five kill groups.

An age adjustment was applied to adjust breed type weight to an average age of kill for each kill group. There were no imposed growth treatments at this site. The weaners were grown to achieve European Union (EU) or heavy domestic carcase specifications on a perennial pasture based system. High grain rations were fed to finish calves for commercial slaughter by 24 months of age when pastures failed.

Meat prices were initially evaluated using the following grids (Tables 6.2 and 6.3). Each carcase was evaluated for weight, P8 fat depth, meat colour, fat colour and dentition and their suitability for certain markets. Note that despite bruising being included in the grid in Table

[12] At the SA site the breed types included were Angus selected for high RBY, Angus selected for high IMF, Angus selected for both high RBY and high IMF, Belgium Blue, Limousin, Black Wagyu and Red Wagyu. There was only one growth path: a Moderate/slow (or conventional) growth path to achieve 0.5–0.6 kg per day from weaning to slaughter.

[13] Autumn calving is the common time of calving in the district.

6.2 it was excluded from the analysis because it was considered that this was likely to be a random event and not correlated to a sire breed or sire class.

Table 6.2. Abattoir price grid, including specifications and discounts (grass fed, $/kg)

Carcase Spec	Grass Japan*	Trade Str/Hfr*	USA Str/Hfr	Manufacturing Cow/Str/Hfr	EU*
Dentition	0–2	0–2	0–8	0– 8	0– 4
Sex	m	m/f	m/f	m/f	m/f
Fat premium	8–22	7–12	8–22	3–12	8–22
Butt shape	ABC	ABC	ABC	ABC	ABC
Meat colour	1A-3	1A-3	1A-4	1A-6	1A-3
Fat colour	0–3	0–3	0–3	0–6	0–3
Bruise	0–4	Nil	0–9	0–9	Nil
Weight	280–400	140–280	180+	140+	240–337
300+	2.75		2.45	2.20	3.15
280–299.9	2.65		2.35	2.15	3.10
260–279.9		2.55	2.20	2.10	3.05
240–259.9		2.60	2.10	2.05	2.95
220–239.9		2.55	2.05	2.00	
200–219.9		2.45	2.00	1.95	
160–179.9		2.35		1.90	
150–159.9		2.25		1.85	
140–149.9		2.15		1.80	

Table 6.3. Discounts applying to P8 fat depths ($/kg dressed weight)

Fat Depth (mm)	Japanese, EU or US steers and heifers	Local trade	Manufacturing
0–3	-0.15	-0.15	-0.15
3–7	-0.15	-0.10	0.0
7–13	0.0	0.0	0.0
13–23	0.0	-0.10	-0.10
23–33	-0.10	-0.20	-0.20
33–43	-0.35	-0.35	-0.35
43–51	-0.50	-0.50	-0.50
51+	-0.60	-0.60	-0.60

Individual carcases were checked by the spreadsheet program to determine if the carcase specification firstly satisfied the highest priced market (EU) and if not, successive lower priced markets were tested for adherence to specifications (Japanese, local trade steer or heifer, USA steer or heifer and finally manufacturing). Penalties applying to P8 fat depth for the various markets are shown in Table 6.3.

It was initially found that the grid prices for Kill Group 3 were much lower than for other groups. This was due to an unexplained increase in the average meat colour in this kill group, sufficient to put a high proportion of the carcases into the manufacturing category. The average of meat colour in Kill Group 3 was 4.2 compared to an average meat colour for the other four groups of 1.9. To compensate for this unexplained difference, the price analysis reduced each individual carcase results in Kill Group 3 by two meat colour units.

6.2 Results

Average prices across breeds for all kills are shown in Table 6.4.

Table 6.4. Average prices based on adjusted carcase results and price grid ($/kg LW)

	Kill Group					
Sire Class	1	2	3	4	5	Weighted average
Both						
Female		1.51	1.38	1.63	1.60	1.55
Male	1.58	1.48	1.33	1.67	1.66	1.55
Average	1.58	1.49	1.35	1.65	1.63	1.55
IMF						
Female		1.66	1.38	1.58	1.49	1.49
Male	1.63	1.70	1.30	1.64	1.69	1.57
Average	1.63	1.69	1.34	1.61	1.56	1.53
RBY						
Female		1.50	1.20	1.62	1.29	1.39
Male	1.60	1.69	1.49	1.59	1.69	1.59
Average	1.60	1.61	1.31	1.60	1.43	1.50
Total	1.59	1.55	1.34	1.63	1.58	1.54

Of interest or concern in Table 6.4 are the following issues:

- ⇒ despite a $0.05 discount, the female carcases in both kill class were the same price as the male progeny because a higher proportion of males were downgraded for reasons such as fat colour.
- ⇒ prices for the RBY females were considerably lower because there were a higher proportion of carcases that were consigned to the lower priced local market because they were not heavy enough for the EU market.
- ⇒ even with a two unit adjustment in meat colour for Kill Group 3, the average price per kilogram was still over $0.20 lower than for other groups.

Prices and weights for Autumn and Spring calving are reported in Tables 6.5 and 6.6, respectively. Results for the first four kill groups were all autumn calving results and group results were generated for each of the classes. In addition, a combined analysis was completed for the Group 5 Spring analysis. These are shown in Table 6.7.

Comparing the gross margins (Table 6.7) using grid generated prices (Table 6.5), the sire classes in order of gross margin performance from best to worst were those selected for both RBY&IMF, then RBY and lastly IMF. Results where meat quality and price were assumed to be the same between breed classes indicated very similar gross margins and sire class rankings.

Table 6.5. Average prices for Autumn calving and Spring calving treatments, by Angus sire class, sex (c/kg liveweight)

Average of Price c/kg LW Sire Class	Sex	Autumn Calving	Spring[a] Calving
Both	Female	1.53	
	Male	1.53	
IMF	Female	1.50	
	Male	1.54	
RBY	Female	1.41	
	Male	1.58	
Angus, all classes	Female	1.49	1.51
	Male	1.54	1.67

[a] One calving only, thus seasonal conditions that actually occurred in this season will influence results significantly.

Table 6.6. Age adjusted liveweight (kg) for Autumn and Spring calving treatments, by Angus sire class, sex

Age adjusted liveweight Sire Class	Sex	Autumn Calving	Spring[a] Calving
Both	Female	469	
	Male	523	
IMF	Female	459	
	Male	487	
RBY	Female	455	
	Male	526	
Angus, all classes	Female	462	454
	Male	512	505

[a] One calving only, thus seasonal conditions that actually occurred in this season will influence results significantly.

Table 6.7. Gross margins ($) using weights from Table 6.6 and prices from Table 6.5

	Angus RBY&IMF	Angus IMF	Angus RBY	Angus All
Autumn Calving – 100 breeding cows and yearlings per 260 ha				
$/cow	357.71	333.20	340.66	343.84
$/ha	145.66	128.15	131.02	132.25
Spring Calving – 74 breeding cows per 260 ha				
$/cow				304.18[a]
$/ha				86.58[a]

[a] One calving only, thus seasonal conditions that actually occurred in this season will influence results significantly.

Table 6.8. Gross margins ($) using weights from Table 6.6 and weighted average prices of $1.50 for female progeny and $1.57 for male progeny

	Angus RBY & IMF	Angus IMF	Angus RBY	Angus All
Autumn Calving – 100 breeding cows and yearlings per 260 ha				
$/cow	360.58	339.30	355.58	352.18
$/ha	138.68	130.50	136.76	135.45
Spring Calving – 74 breeding cows per 260 ha				
$/cow				281.09
$/ha				80.00

If one price was used for all steers ($1.57/kg LW) and another price was used for all heifers ($1.50/kg LW), the same ranking would result (Table 6.8). However, Autumn calving would become more profitable and Spring calving less profitable. This was because the Spring calving group were on average meeting specifications better than the Autumn calving groups but as there was only one Spring calving the results may not be replicated with another season of results. As shown in Table 6.5, prices for the Spring calving group averaged $1.67/kg for steers and $1.51 for heifers compared to $1.54 and $1.49 respectively for the Autumn calving groups. Spring calving returns were less than for the Autumn calving because the lower weights, lower carrying capacities and higher supplementary feeding costs outweighed the higher price received.

6.3 Discussion and Conclusions

Local opinion is that on average Spring calving cows are 40 kg lighter than Autumn calving cows because they have their peak feed requirement when they are pregnant but still lactating during the feed-limited Autumn period and they never recover in the Spring feed surplus. Despite the lower maintenance requirement of lighter breeding cows, and despite the Spring born calves in the trial attaining market weight in 21 months compared to an average for the Autumn calves of 24 months, the BNO modelling indicated that the same 260ha could only carry 74 breeding cows compared to 100 in the Autumn scenario. This was because both cow and yearling peak requirements are more in line with pasture growth in an Autumn calving cycle. In contrast to the VIC site, where Spring calving produced higher gross margins per cow, the shorter growing season at the SA site meant that proportionally the reduction in the number of cows was greater for Spring calving and as a consequence the pasture costs were spread over fewer breeding cows. Firm conclusions cannot be drawn from seasonal results based on one season, but if these carrying capacity estimates are accurate, prices would need to rise by $0.45/kg LW to obtain the same gross margin per hectare for Spring calving.

One key finding is that a 25 per cent reduction in the number of Spring calving cattle is required for a similar amount of feed to be available in the critical early Autumn period.

Another finding is that many carcases were rejected from the highest priced (EU) market for a variety of reasons. Realised prices were some $0.20/kg LW less than the theoretically achievable price. Greater compliance would significantly improve the gross margin received.

Non-compliance occurred across all sire classes and hence average price received for carcases were similar for all classes. Thus the third finding is that the greatest difference in gross margin performance between sire classes was weight gain.

7. Time of Calving at the Western Australian Site[14]

7.1 Implementing the methodology

At the Western Australian experimental site, the target market was a heavy domestic steer of around 500kg liveweight, and the steers were all Angus Cross. 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.

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, 149 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.

Two types of finishers are assumed: breeders who finish their own steers; or specialist finishers.

The specific input assumptions made for the WA analyses are given in Appendix E. The pasture data (for Vasse) is given in Appendix Table E.1. The growth path assumptions for a breeder/finisher are given in Appendix Tables E.2 and E.3, and the growth path assumptions for a specialist finisher are given in Appendix Table E.4. The costs and returns are taken from the earlier study of Della Bosca et al. (2004) (see also Appendix 9.4 of McKiernan et al. (2007) for greater detail)[15].

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 7.1 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

---

[14] Further detail is available in Davies, Della Bosca and Griffith (2009).

[15] 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).

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 progeny are 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. The monthly feed budgeting indicates that despite the Winter calving delaying feed demand due to pregnancy, there is more feed demanded from Winter calving options in the early summer because of the additional numbers of cows and progeny, and this effectively depletes the body of standing dry feed quicker, resulting in supplementary feed being required in February compared to March for the Autumn calving system.

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 marginally higher than the Autumn calving option. However, when fodder is valued around the opportunity cost of $100/tonne, the base Autumn calving option was superior. At the same stocking rate the Autumn calving system was always superior by around 10 per cent. An additional consideration is that the Autumn calves are assumed to put on an extra 80 kg over the extra two months they are on pasture (1.33kg/day), and this overrides 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.

Table 7.1. Trading off stocking rate, feed deficit, hay production and profit

Time of Calving	Autumn	Winter, same stocking rate	Winter, higher stocking rates
Number of breeders run on 350 hectares	250	293	325
Amount of supplementary feeding	March 122t, April 97t, total 219t	Feb 73t, March 96t, April 51t, total 220t	Jan 44t, Feb 98t, March 107t, April 63t, total 312t
Area set aside in for haymaking	44 ha	44 ha	62 ha
Age and weight when steers sold	9 mths, 360 kg	7 mths, 280 kg	7 mths, 280 kg
Total income from enterprise	$126,714	$120,741	$134,032
Enterprise gross margin when fodder costs 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

7.2 Results

Time of calving results

Using the Beef-N-Omics methodology (where a proportion of 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 7.1). 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 differences demonstrated. 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 graziers 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.

Growth path results

Weights and prices for each of the post-weaning growth path treatments are given in Table 7.2. 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.

Table 7.2. Weaning weights, slaughter weights and prices received for time of calving and growth treatments

	Autumn, Fast Growth	Winter, Fast Growth	Autumn, Slow Growth	Winter, Slow growth	Autumn, loss then gain	Winter, loss then gain
Weaning Liveweight (kg)	348	283	348	283	343, 304	273, 248
Slaughter Liveweight (kg)	485	495	512	500	498	482
Slaughter Price ($/kg LW)	1.71	1.73	1.59	1.62	1.59	1.61

Results for the breeder/finisher option are given in Table 7.3.

Table 7.3. 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
Breeders carried (no.)	140	149	116	132	129	139
Steers grown out (no.)	62	66	52	59	57	62
April feed deficit (kg/ha)	-54	-47	-55	-53	-53	-56
Total Gross Margin, excl. labour ($)	44,521	40,504	42,168	45,848	44,249	44,644
GM/ ha ($)	234.32	213.18	221.94	241.31	232.89	234.97

It would appear on the basis of these results that several options are very close. The Winter calving, Slow growth strategy produced the highest gross margin but other options would be higher with a change in the liveweight price of only $0.04/kg. The Winter calving, Fast growth option is lower than other options because of the high grain costs. 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 profit 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) stacks up pretty well.

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 feeding out costs and conservation 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 fed. 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 7.4.

Table 7.4. 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 ($)	-911	4,013	6,784	12,348	7,815	9,859	5,702
Per steer ($)	-9.11	40.13	104.38	220.52	39.47	164.32	21.44
Per 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.

At the feed prices assumed, fast finishing of Autumn born steers using a feedlot was uneconomic because of a higher maintenance requirement than the steers born in the Winter. Fast finishing of Winter born steers also produced very modest results.

The Winter calving, Slow growth path produced the best returns. 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, is 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 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 IMF%.

7.3 Discussion and Conclusions

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 not economic 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 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.

8. Discussion and Conclusions

Using the adjusted NSW data, there was a huge difference between the Fast and Slow treatments favouring the Fast grown in the on farm analyses (gross margin of $68/cow and $176/ha advantage over the Slow grown), even after accounting for the higher cost of producing pasture capable of sustaining faster growth. This was primarily due to steers being sold earlier, allowing more cows to be run on the pastures for the Fast growth treatment, whilst still maintaining the same annual and monthly pasture deficits[16].

Although the average difference between Fast and Slow growth treatments was $176/ha, within breed types this difference varied with the Charolais the highest at $182/ha and the Angus IMF the lowest at $172/ha with the other breed types intermediate. It is postulated that this is a reflection of the growth potential of the various breed types and when a potentially faster growth type is given the opportunity to grow it performs better under those more favourable conditions.

The biggest driver of profitability between breed types was weight and weight gain achieved within treatments. The Charolais breed type, even within the slower growth treatment, outweighed and outperformed all other breed types. The Angus and Wagyu types, slower growing, performed worse. This clear advantage to Fast growth over Slow (on average and across breed types), and its magnitude, suggest there is considerable margin for even greater costs (supplementary feeding, pasture improvement, etc) to be absorbed to achieve a faster pre-feedlot growth.

During the feedlot phase, using the unadjusted data, those steers entering the feedlot at heavier weights also exited at heavier weights and were considerably discounted for being overweight at the end (a function of the research design requiring feedlot entry at the mean target entry averaged over all types). Therefore breed types like Charolais were heavily discounted on exit ($3.738/kg and $3.761/kg in the Slow and Fast treatments compared to the treatment averages of $3.813/kg for both). Despite this, the Charolais type in the Slow treatment still had the highest gross margin due to a substantial benefit in overall carcase value where their total weight advantage compensated for the price per kilogram disadvantage. The Charolais weight advantage was considerably enhanced by the higher than treatment average Compensatory effect in feedlot gain in the Slow growth group.

Within the Fast growth group, this growth advantage did not occur, reducing the overall weight advantage of the Charolais, allowing the discounts to have more of an effect, and resulting in them being ranked near the average compared with the other breed types.

There was a considerable advantage in weight gain to the Slow growth groups (2.54 kg/day) compared to the Fast groups (2.39 kg/day), occurring across all breed types and resulting in an average advantage at finish of 13 kg of carcase weight and hence dollar value. This was the major factor in the higher gross margin of the Slow treatment group compared to the Fast.

The highest gross margins in the pre-feedlot phase were produced by the Fast growth treatment groups, whereas the Slow growth treatments performed better in the feedlot.

[16] Although not reported, this advantage also shows in the return per $100 of livestock capital because, with faster growth, there is less money tied up in stock on hand.

However, the magnitude of the economic advantage pre-feedlot, combined with the improvements in carcase traits reported above, certainly favour the Fast growth option.

Results from the VIC site further demonstrated the importance of finishing cattle on a Fast growth path to enable quicker turnover, ensuring that periods of higher stocking rates while finishing cattle prior to slaughter are kept to a minimum. The highest gross margin per hectare was achieved using a Fast growth treatment post weaning.

Economic analyses of post weaning production for the WA experiments were heavily influenced by finishing regime, since Fast growth treatments were feedlot finished compared to pasture fed for the others. 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.

Changing calving time from autumn to winter in the WA experiment did not affect reproductive rates. Profitability to weaning was decreased when stocking rate was unchanged, but was increased when the stocking rate was increased by 10 per cent. This clear economic advantage in production to weaning for the winter calving system was due to better alignment of animal requirements to feed availability, which had a major effect on the cost of production through reduced supplementary feed costs. The profitability post weaning was driven by the cost of finishing rather than costs related to season of calving (see below).

For the VIC site, autumn born calves were 30 kg heavier at weaning than spring born, but 19 kg lighter at slaughter. However there was little difference in the gross margins for post weaning production due to time of calving.

Spring calving returns at the SA site were less than for the Autumn calving because the lower weights, lower carrying capacities and higher supplementary feeling costs outweighed the higher price received. The shorter growing season at the SA site meant that proportionally the reduction in the number of cows was greater for Spring calving and as a consequence the pasture costs were spread over fewer breeding cows.

High growth breed types 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. The WA economic analyses confirmed these findings with the RBY sired animals having an advantage in overall value through their greater HSCW. The VIC site analyses also showed the importance of producing cattle with heavier slaughter weights, highlighted when comparing the Wagyu ($376/ha) to the other breeds ($412/ha).

Overall, the results suggest two broad conclusions. First, that there are, as expected, significant regional differences in the financial implications of cattle producers using different combinations of growth paths, time of calving, and breed types. These differences reflect the different physical and climatic environments across southern Australia and in particular the different types of pastures and growth rates through the year. The availability and cost of supplementary feed also varies across regions. These differences imply different optimal production systems and different ways of achieving targeted market specifications.

Second, within regions, that regional cattle producers need to have a good understanding of their whole farm system when considering the appropriate combinations of breed type, time of calving and growth path that is best for them. For example, while there were large experimental differences found in mean NSW gross margins between Fast and Slow treatment groups prior to feedlot entry, and little experimental differences found in mean Victorian gross margins between traditional Autumn calving and Spring calving, there may be significant differences in individual farm businesses in relation to labour requirements and availability, and pasture types and growth rates through the year and consequent implications for stocking rates at different growth rates. Sale weights and prices received for both weaners and finished cattle will also vary through the year for individual producers, as will supplementary feed requirements, availability and price. A specialised software package like Beef-N-Omics makes consideration of all these various factors formal and explicit.

In Griffith (2009), the results from the representative farm models were aggregated up to the level of the Australian cattle and beef industry and then projected forward over a number of years into the future. An existing model of the world beef market was used.

The aggregate economic analyses suggest that both the Fast growth rate technology and the time-of-calving technology have the potential to generate significant economic benefits for the Southern Australia cattle and beef industries. The cumulative present values of each technology are around $70 million over a 15-year time horizon at a 7 per cent real discount rate, with benefits in the first year of around $2–3 million and benefits after five years of around $9–10 million. Although not valued formally, it is evident that individual producers running specific breed types could also achieve greater returns by better targeting their cattle to appropriate markets that reflect the growth and carcase types they produce.

9. References

ABARE (2007), *Commodity Statistical Bulletin*, ABARE, Canberra.

ABARE (2008), *Australian Beef 08.1*, ABARE, Canberra.

Alford, A., Cafe, L., Greenwood, P. and Griffith, G.R. (2007), *The Economic Effects of Early-Life Nutritional Constraints in Crossbred Cattle Bred on the NSW North Coast,* Economic Research Report No. 33, NSW Department of Primary Industries, Armidale, May. Available at: http://www.dpi.nsw.gov.au/research/areas/health-science/economics-research/reports

Davidson, B.R. and Martin, B.R. (1965), "The relationship between yields on farms and in experiments", *Australian Journal of Agricultural Economics* **9**(2), 129-140.

Davies, B.L., Alford, A.R. and Griffith, G.R. (2009), "Economic effects of alternate growth path, time of calving and breed type combinations across southern Australian beef cattle environments: feedlot finishing at the New South Wales experimental site", *Animal Production Science* 49 (5&6), 535-541.

Davies, B.L., Carberry, P.M., Graham, R.P., Mullen, J.D. and Meaker, G.P. (2007), *StockPlan®: A Decision Aid for Management of Livestock During Drought and Other Times,* Economic Research Report No. 34, NSW Department of Primary Industries, Paterson. Available at:
http://www.dpi.nsw.gov.au/research/areas/health-science/economics-research/reports

Davies, L., Della Bosca, T. and Griffith, G. (2009), "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", *Australasian Agribusiness Review* (under review).

Della Bosca, T.J., McIntyre, B.L., Read, D., Smart, W.L., Taylor, E.G. and Tudor, G.D. (2004), "Optimising feed supply, reproductive efficiency and progeny growth to meet market specifications. 5. Economic analysis of Autumn and Winter calving", *Animal Production in Australia* **25,** 228.

Dillon, J.L. and Anderson, J.R. (1990), *The Analysis of Response in Crop and Livestock Production,* Third edition, Pergamon Press, Oxford.

Dobos, R.C., Carberry, P.J., Vleeskens, S., Sangsari, E., Johnston, B. and Oddy, V.H. (1997), "An age and herd structure model for beef breeding enterprises", *Proceedings of the International Congress on Modelling and Simulation,* Hobart, Tasmania, pp.1080-1085.

Dobos, R., Carberry, P. and Davies, L. (2006), *Beef-N-Omics for Windows, User's Manual*, NSW Department of Primary Industries, Orange, July.

Egan, A.F., Ferguson, D.M. and Thompson, J.M. (2001), "Consumer sensory requirements for beef and their implications for the Australian beef industry", *Australian Journal of Experimental Agriculture* **41,** 855-859.

Farquharson, Bob (2006), "Production response and input demand in decision making: nitrogen fertilizer and wheat growers", *Australasian Agribusiness Review*, **paper 5**.
Available at: http://www.agrifood.info/review/2006/Farquharson.html

Graham, J.G., Quinn, H., Davies, L. and Griffith, G. (2009), "Economic effects of alternate growth path, time of calving and breed type combinations across southern Australian beef cattle environments: grass finishing at the Victorian experimental site", *Australian Farm and Business Management Journal* (under review).

Griffith, G.R. (2009), "Economic effects of alternate growth path, time of calving and breed type combinations across southern Australian beef cattle environments: industry-wide effects", *Animal Production Science* 49 (5&6), 542-547.

Griffith, G.R., Rodgers, H.J., Thompson, J.M. and Dart, C. (2009), "The aggregate economic benefits from the adoption of Meat Standards Australia", *Australasian Agribusiness Review* (revised and resubmitted).

McKiernan, W.A., Wilkins, J.F., Barwick, S.A., Tudor, G.D., McIntyre, B.L., Graham, J.G., Deland, M.P.D. and Davies, L. (2005), "CRC "Regional Combinations" Project – effects of genetics and growth paths on beef production and meat quality: experimental design, methods and measurements", *Australian Journal of Experimental Agriculture* **45 (7-8),** 959-969.

McKiernan, W.A., Wilkins, J.F., Graham, J.F., Tudor, G.D., Deland, M.P.B.., McIntyre, B.L., Orchard, B., Walkley, J.R.W., Davies, B.L., Griffith, G.R. and Irwin, J. (2007), *Regional Beef Systems to Meet Market Specifications*, Final Report on Project SBP.006V2, Meat & Livestock Australia Limited, North Sydney, May.

NSW Agriculture (1996), *Prograze: profitable, sustainable grazing,* NSW Agriculture, Orange.

NSW DPI (2006), Beef gross margins budgets for 2006.
Available http://www.dpi.nsw.gov.au/agriculture/farm-business/budgets

NSW DPI (2006), Crop and pasture budgets for 2006.
Available http://www.dpi.nsw.gov.au/agriculture/farm-business/budgets

NSW DPI (2006), Guide to tractor and implement costs.
Available http://www.dpi.nsw.gov.au/agriculture/farm-business/budgets

Pannell, David (2006), "Flat Earth Economics: the far-reaching consequences of flat payoff functions in economic decision making", *Review of Agricultural Economics* **28(4),** 553-566.

Pethick, D.W., Harper, G.S. and Oddy, V.H. (2004), "Growth, development and nutritional manipulation of marbling in cattle: a review", *Australian Journal of Experimental Agriculture* **44**, 705-715.

Polkinghorne, R., Watson, R., Porter, M., Gee, A., Scott, A. and Thompson, J.M. (1998), "Meat Standards Australia, a "PACCP" based beef grading scheme for consumers. 1. The use of consumer scores to set grade standards", in *Proceedings of the International Congress of Meat Science and Technology* **45**, 14-15.

Robinson, D.L., Ferguson, D.M., Oddy, V.H., Perry, D. and Thompson, J.M. (2001a), "Genetic and environmental influences on beef tenderness", *Australian Journal of Experimental Agriculture* **41**, 997-1003.

Robinson, D.L., Oddy, V.H., Dicker, R.W. and McPhee, M. (2001b), "Post–weaning growth in northern New South Wales. 3. Carry-over effects on finishing, carcase characteristics and intramuscular fat", *Australian Journal of Experimental Agriculture* **41**, 1041-1049.

StockPlan® NSW Department of Primary Industries (2005), Orange, NSW, 2800.

Verbyla, A.P., Cullis, B.R., Kenward, M.G. and Welham, S.J. (1999), "The analysis of designed experiments and longitudinal data by using smoothing splines", *Applied Statistics* **48,** 269-311.

10. Appendices

Appendix A: Beef-N-Omics

The Beef-N-Omics computer package (Dobos et al. 2006) 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 financial gross margin budgets for beef cattle breeding herds.

User inputs are required on aspects of the beef enterprise such as herd size, liveweight, calving times, age and weight at turn off, market prices, seasonal pasture growth, 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 herd size, monthly pasture growth, months of calving, age and weight of turn off, sale prices, variable costs, cow size, weaning percentage, or other aspects of herd management can be made to assess their impact on feed requirements and subsequently on herd gross margins. Adjustments to any of those parameters will be reflected in changes in monthly feed consumption and herd gross margin from which the principles of beef cattle management can be reinforced.

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.

Beef-N-Omics is not a FULL biological model. Local estimates can be used, but if accurate information is available, then more precise reports are generated. 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.

Appendix B: Assumptions used in the NSW BNO analyses

Table B.1: Areas of pasture required to achieve desired growth rates, NSW site (hectares)

Type	Fast	Slow
Native Pasture	40	100
Dryland Lucerne/Sub Clover	50	50
Irrigated Lucerne	20	
Forage Oats	10	
Total	120	150

Table B.2: Pasture species growth rates, NSW site (kg/ha/day)

Month	Irrigated Lucerne (Winter Active)	Lucerne/Sub Clover	Native	Forage Oats
January	94	3	0	0
February	83	3	0	0
March	62	6	0	0
April	44	17	1	0
May	27	16	10	8
June	22	14	18	27
July	22	14	19	24
August	29	19	32	32
September	43	31	46	46
October	55	48	40	60
November	68	21	0	0
December	81	4	0	0

Table B.3: NSW herd parameters, costs and returns

Parameter	Slow	Fast
Age at last joining before cows culled for age	9 years	
Month when dry cows sold	April	
Proportion of dry cows sold	100%	
Month when other culls sold	April	
Proportion of other herd sold as culls	1.5%	
Heifers kept in herd	No	
Age at joining heifers (months)	15 months	
Replacement heifers (cows) 100% of total replacement as:	Heifers empty & dry	
Month of purchase	May	
Price	$1,000/cow +calf	
Age at purchase	3 years	
Working life of bulls	4 years	
Cost of replacement bulls	$5,000/bull	
Freight on sales:	$8/hd	
Freight on purchases:	$20/hd	
Yard dues and fees:	$5/hd	
Commission: sales	4%	
Transaction levy:	$3.50/hd	
Health Costs		
Bulls	$10/hd	
Cows and calves	$13/hd	
Weaners	$6/hd	
Yearlings	$10/hd	
Pasture maintenance	$2,000/year	$12,000/year (includes some irrigation costs)
Forage oats		$140/ha
Total area grazed	150 ha	120 ha
Cows joined	67	116
Calves weaned	90%	
Number of bulls	3	
Weight of mature cows	470 kg	
Month when calves weaned	April	
Minimum age of calves at weaning	8 months	
Weight of calves at minimum weaning age	200 kg	
Price of heifers at weaning	$1.65/kg LW	
Annual death rate: Weaning-18months	1%	
Annual death rate: Adults	1%	
Calving calendar	Aug(60):Sep(30):Oct(10)	
Steer Age	21 months	16 months
Percent sold	100%	
Steer Sale weight	383 kg LW	376 kg LW
Steer Sale price	$1.80/kg LW	
Culled cows: weight	470 kg LW	
Culled cow Price	$1.50/kg LW	
Culled bulls: weight	800 kg LW	
Cull bull Price	$1.55/kg LW	

Various prices taken from NSW DPI (2006) *Beef gross margins budgets* for 2006 (including herd health costs) for southern NSW herds, http://www.agric.nsw.gov.au/reader/beefbud (Viewed 6 Dec 2006).

Table B.4: NSW feedlot parameters, costs and returns

Feedlot entry/induction weights were those applicable to the scenario, with price/value of the steers at entry set at a constant $1.80/kg.

Feed consumed was based on 2.6 per cent of average bodyweight. This calculation aligned closely with actual feed usage from information supplied by the feedlot.

Live and carcase weights used were from actual data or those predicted from the spline analysis, in the case of the adjusted scenario. The following formulae applied:
Average body weight = (induction weight + (carcase weight ÷ carcase yield) ÷ 2
Dressing percentage was calculated as carcase weight ÷ exit weight x 100

A price of $300 per tonne was assigned for feed prices. Other costs included Medicine ($12/hd), Labour ($10/hd), Interest on steers and feed (8% p.a.), Transaction levy ($3.60/hd), and Freight ($10.00/hd).

Appendix C: Assumptions used in the VIC BNO analyses

Table C.1: VIC Pasture Carryover and Growth Rate (Hamilton)

Month	Feed carried over to following month (%)	Growth rate (kg DM/ha/d)
January	50	2
February	75	3
March	55	5
April	50	13
May	40	20
June	10	12
July	10	12
August	10	22
September	30	44
October	60	73
November	70	65
December	80	9

Month when least kilograms DM available = May

Table C.2. VIC herd parameters, costs and returns

Parameter	Autumn (Slow)	Autumn (Fast)	Spring (Slow)	Spring (Fast)
Age at last joining before cows culled for age	10 years			
Month when dry cows sold	Jan		May	
Proportion of dry cows sold	100%			
Month when other culls sold	Jan		May	
Proportion of other herd sold as culls	2%			
Heifers kept in herd	No			
Age at joining heifers (months)	15 months			
Replacement heifers (cows) 100% of total replacement as:	Heifers empty & dry			
Month of purchase	May		Sept	
Price	$800/cow			
Age at purchase	1 year			
Working life of bulls	4 years			
Cost of replacement bulls	$5,000/bull			
Freight on sales:	$8/hd			
Freight on purchases:	$20/hd			
Yard dues and fees:	$5/hd			
Commission: sales	4%			
Transaction levy:	$3.5/hd			
Health Costs				
Bulls	$10/hd			
Cows and calves	$13/hd			
Weaners	$6/hd			
Yearlings	$10/hd			
Pasture maintenance	$14,000/year			
Total area grazed	200 ha			
Cows joined	100			
Calves weaned	90%			
Number of bulls	3			

Parameter	Autumn (Slow)	Autumn (Fast)	Spring (Slow)	Spring (Fast)
Weight of mature cows	600 kg	600	560	560
Month when calves weaned	Dec		May	
Minimum age of calves at weaning	8 months		8 months	
Weight of calves at minimum weaning age	200 kg			
Annual death rate: Weaning-18months	2%			
Annual death rate: Adults	2%			
Calving calendar	Feb(22): Mar(62): Apr(16)		Aug(41): Sep(50): Oct(9)	
Steer Age	27 months (27.2 PVI analysed data)	23 months (22.8 PVI analysed data)	29 months (28.5 PVI analysed data)	22 months (21.5 PVI analysed data)
Percent sold	100%			
Steer Sale weight	562 kg (PVI analysed data)	556 kg (PVI analysed data)	589kg (PVI analysed data)	570 kg
Steer Sale price	$2.00/kg			
Heifer Age	27 months (27.2 PVI analysed data)	23 months (22.8 PVI analysed data)	29 months (28.5 PVI analysed data)	22 months (21.5 PVI analysed data)
Percent sold	100%			
Heifer Sale weight	518 kg (PVI analysed data)	506 kg (PVI analysed data)	537 kg (PVI analysed data)	530 kg (PVI analysed data)
Heifer Sale price	$1.95/kg			
Culled cows: weight	600 kg LW	600 kg LW	560 kg LW	560 kg LW
Culled cow Price	$1.50/kg LW			
Culled bulls: weight	800 kg LW			
Cull bull Price	$1.55/kg LW			

Stocking rate was determined by adjusting breeding cow numbers until the total feed deficit was 200 kg DM/ha.

Table C.3. Grass fed price grid from Cargill Beef showing specifications and discounts for the traits HSCW, butt shape, P8 fat depth, bruising, dentition, fat and meat colour

DATE:

CARGILL BEEF AUSTRALIA
BOX 166. WAGGA WAGGA, N.S.W. 2650
A DEPARTMENT OF CARGILL AUSTRALIA LTD.
A.B.N. 42 004 684 173

GRID

BUYER : QUOTE ENDS:

VENDOR: PVI Hamilton

YEARLING HOW	GRID No. STEERS	HEIFERS		YEARLING CODE	BUTT SHAPE	FAT MM	BRUISE CODE	DENT	FAT COLOUR	MEAT COLOUR	PREM.' DISC
396 +	2.96	2.92									
356 - 395.9	3.4	3.36	Base	1	A-C	6 -17	NIL	0-2	0-3	1A-3	0.1
300 - 355.9	3.46	3.42		D02	A-C	6 - 22	1-4	0-2	0-3	1A-7	0
275 - 299.9	3.4	3.36		D03	A-C	23 - 32	1-4	0-2	0-3	1A-7	-0.05
250 - 274.9	3.32	3.28		D04	A-C	33 - 42	1-4	0-2	0-3	1A-7	-0.15
230 - 249.9	3.16	3.12		D05	A-D	4 - 17	1-4	0-2	0-3	1A-7	-0.05
200 - 229.9	2.36	2.32		D06	A-D	18 - 22	1-5	0-2	0-3	1A-7	-0.2
<199.9				D07	A-D	0 - 50	1-9	0-2	0-3	1A-7	-0.4
PRIME							PRIME				
HOW				M01	A-C	6-17	1 -4	4	0-3	1A-4	0.2
396 +	2.5	2.45		M02	A-C	6 -22	1 - 4	4	0-3	1A-7	0.1
356-395.9	2.7	2.65	Base	M03	A-C	6-17	1-7	4-7	0-4	1A-4	0.05
300-355.9	2.75	2.7		M04	A-D	4-22	1-7	4-7	0-4	1A-7	0
275-299.9	2.7	2.65		M05	A-D	23-32	1-9	4-7	0-5	1A-7	-0.1
250-274.9	2.6	2.55		M06	A-D	33-42	1 - 9	4-7	0-6	1A-7	-0.3
230-249.9	2.45	2.4		M07	A-D	43-49	1-9	4-7	0-7	1A-7	-0.4
200-229.9	1.9	1.85		M08	A-E	0+	1-9	4-7	0-7	1A-7	-0.65
<199.9											
No. HEAD											

Appendix D. Assumptions used in the SA BNO analyses

Table D.1: SA Pasture Carryover and Growth Rate (Hamilton)

Month	Feed carried over to following month (%)	Growth rate (kg DM/ha/d)
January	70	
February	70	
March	65	
April	75	4
May	80	14
June	80	11
July	80	14
August	80	21
September	60	42
October	60	56
November	70	34
December	80	

Month when least kilograms DM available = May

Table D.2: SA herd parameters, costs and returns

Parameter	Autumn	Spring
Age at last joining before cows culled for age	10 years	
Month when dry cows sold	Jan	May
Proportion of dry cows sold	100%	
Month when other culls sold	Jan	May
Proportion of other herd sold as culls	2%	
Heifers kept in herd	No	
Age at joining heifers (months)	15 months	
Replacement heifers (cows) 100% of total replacement	Heifers empty & dry	
Month of purchase	May	Sept
Price	$600/cow + calf	
Age at purchase	1 years	
Working life of bulls	4 years	
Cost of replacement bulls	$5,000/bull	
Freight on sales	$10/hd	
Freight on purchases	$20/hd	
Yard dues and fees	$3.5/hd	
Commission: sales	5%	
Transaction levy	$5/hd	
Health Costs – Bulls	$10/hd	
Health Costs – Cows and calves	$7/hd	
Health Costs – Weaners	$0/hd	
Health Costs – Yearlings	$10/hd	
Pasture maintenance	$14,000/year	
Total area grazed	260 ha	120 ha
Cows joined	100	116
Calves weaned	90%	
Number of bulls	3	
Weight of mature cows	580 kg LW	540 kg LW
Month when calves weaned	Dec	May
Minimum age of calves at weaning	6 months	6 months
Weight of calves at minimum weaning age	200 kg	
Price of heifers at weaning	$1.65/kg LW	
Annual death rate: Weaning–18months and Adult	2%	
Calving calendar	Mar(60): Apr(40)	Aug(37): Sep(63)
Steer Age	24 months	21 months
Percent sold	100%	
Steer Sale weight	383 kg LW	376 kg LW
Steer Sale price	$1.80/kg LW	
Heifer Age	24 months	21 months
Percent sold	100%	
Heifer Sale weight	383 kg LW	376 kg LW
Heifer Sale price	$1.80/kg LW	
Culled cows: weight	550 kg LW	
Culled cow Price	$1.10/kg LW	
Culled bulls: weight	850 kg LW	
Cull bull Price	$1.10/kg LW	

Appendix E. Assumptions used in the WA BNO analyses

Table E.1: WA Pasture Carryover and 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

Two types of finishers are assumed:

⇒ Breeders who finish their own steers.

⇒ Specialist finishers.

Table E.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 per ha = 125 tonnes
Hay has been used as follows. Firstly the quantity required for the steers is 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 is allocated to partially cover the April feed deficit.
Breeding cow numbers and resultant steer progeny are adjusted until the April feed deficit as close as possible to 50 kg/ha which is a way to allow for some weight loss in the breeding cows during this period.
The Fast growth treatments are fed a grain component in their ration which is assumed to cost $180/tonne as fed.
Breeding cow numbers were adjusted so that BNO feed budget deficit in April is approximately equal to 50 kg/ha. All steers are retained and are grown out using three strategies:

- Fast growth
- Slow growth
- A period of weight loss followed by a period of compensatory gain

Heifers assumed sold at weaning
Components of the diet under each growth strategy are as follows:

	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				

Table E.3: 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 10ha shut up in June to allow for hay production in November. The yield assumed for the hay area is 5 t/ha and this is fed in Autumn. Stock are purchased in January and depending on the growth and time of calving option, the time that stock are on the property varies from 8 to 10 months. For the remaining period, pasture is assumed 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 is predominantly completed on grain and thus a feedlot situation was assumed. Grain prices as fed where assumed to be $180 per tonne for the grain and $100 per tonne as fed for the hay. 100 steers were assumed.

NSW Department of Primary Industries Economic Research Report Series

(All available at
http://www.dpi.nsw.gov.au/research/areas/health-science/economics-research/reports)

Number

1 Brennan, J.P. and Bantilan, M.C.S. 1999, *Impact of ICRISAT Research on Australian Agriculture*, Report prepared for Australian Centre for International Agricultural Research, Economic Research Report No. 1, NSW Agriculture, Wagga Wagga.

2 Davies, B.L., Alford, A. and Hollis, G. 1999, *Analysis of ABARE Dairy Data for Six Regions in NSW 1991-92 to 1996-97*, Economic Research Report No 2, NSW Agriculture, C.B. Alexander College, Paterson.

3 Brennan, J.P. and Singh, R.P. 2000, *Economic Assessment of Improving Nutritional Characteristics of Feed Grains*, Report prepared for Grains Research and Development Corporation, Economic Research Report No. 3, Wagga Wagga.

4 Zhao. X., Mullen, J.D., Griffith, G.R., Griffiths, W.E. and Piggott, R.R. 2000, *An Equilibrium Displacement Model of the Australian Beef Industry*, Economic Research Report No 4, NSW Agriculture, Armidale.

5 Griffith, G., I'Anson, K., Hill, D., Lubett, R. and Vere, D. 2001. *Previous Demand Elasticity Estimates for Australian Meat Products*, Economic Research Report No 5, NSW Agriculture, Armidale.

6 Griffith, G., I'Anson, K., Hill, D. and Vere, D. 2001. *Previous Supply Elasticity Estimates for Australian Broadacre Agriculture*, Economic Research Report No 6, NSW Agriculture, Armidale.

7 Patton, D.A. and Mullen, J.D. 2001, *Farming Systems in the Central West of NSW: An Economic Analysis*, Economic Research Report No. 7, NSW Agriculture, Trangie.

8 Brennan, J.P. and Bialowas, A. 2001, *Changes in Characteristics of NSW Wheat Varieties, 1965-1997*, Economic Research Report No. 8, NSW Agriculture, Wagga Wagga.

9 Mullen, J.D. 2001, *An Economic Perspective on Land Degradation Issues*, Economic Research Report No. 9, NSW Agriculture, Orange.

10 Singh, R.P., Mullen, J.D., and Jayasuriya, R. 2005, *Farming Systems in the Murrumbidgee Irrigation Area in NSW: An Economic Analysis*, Economic Research Report No. 10, NSW Department of Primary Industries, Yanco.

11 Brennan, J.P., Aw-Hassan, A., Quade, K.J. and Nordblom, T.L. 2002, *Impact of ICARDA Research on Australian Agriculture*, Economic Research Report No. 11, NSW Agriculture, Wagga Wagga.

12 Alford, A., Griffith, G. and Davies, L. 2003, *Livestock Farming Systems in the Northern Tablelands of NSW: An Economic Analysis*, Economic Research Report No. 12, NSW Agriculture, Armidale.

13 Alford, A., Griffith, G. and Cacho, O. 2003, *A Northern Tablelands Whole-Farm Linear Program for Economic Evaluation of New Technologies at the Farm Level*, Economic Research Report No. 13, NSW Agriculture, Armidale.

14 Mullen, J.D. and Vere, D.T. 2003, *Research and Extension Capabilities - Program Economists in New South Wales Agriculture*, Economic Research Report No. 14, NSW Agriculture, Orange.

15 Farquharson, R.J., Griffith, G.R., Barwick, S.A., Banks, R.G. and Holmes, W.E. 2003, *Estimating the Returns from Past Investment into Beef Cattle Genetic Technologies in Australia,* Economic Research Report No. 15, NSW Agriculture, Armidale.

16 O'Donnell, C.J., Griffith, G.R., Nightingale, J.J. and Piggott, R.R. 2004, *Testing for Market Power in Multiple-Input, Multiple-Output Industries: The Australian Grains and Oilseeds Industries*, Technical Report for the Rural Industries Research and Development Corporation, Economic Research Report No. 16, NSW Agriculture, Armidale.

17 Brennan, J.P., Martin, P.J. and Mullen, J.D. 2004, *An Assessment of the Economic, Environmental and Social Impacts of NSW Agriculture's Wheat Breeding Program*, Economic Research Report No. 17, NSW Agriculture, Wagga Wagga.

18 Griffith, G.R., Davies, B.L., Alford, A.R., Herd, R.M., Parnell, P.F. and Hegarty, R.S. 2004, *An Assessment of the Economic, Environmental and Social Impacts of NSW Agriculture's Investment in the Net Feed Efficiency R,D&E Cluster*, Economic Research Report No. 18, NSW Department of Primary Industries, Armidale.

19 Scott, J.F. and Farquharson, R.J. 2004, *An Assessment of the Economic Impacts of NSW Agriculture's Research and Extension: Conservation Farming and Reduced Tillage in Northern NSW*, Economic Research Report No. 19, NSW Department of Primary Industries, Tamworth.

20 Scott, J.F., Farquharson, R.J. and Mullen, J.D. 2004, *Farming Systems in the Northern Cropping Region of NSW: An Economic Analysis*, Economic Research Report No. 20, NSW Department of Primary Industries, Tamworth.

21 Crean, J., Shaw, A., Singh. R. and Mullen, J.D. 2004, *An Assessment of the Economic, Environmental and Social Impacts of NSW Agriculture's Advisory Programs in Water Use Efficiency*, Economic Research Report No. 21, NSW Department of Primary Industries, Orange.

22 Mullen, J.D. 2004, *Evaluations in 2003 of Five Areas of Investment by NSW Agriculture: Summary*, Economic Research Report No. 22, NSW Department of Primary Industries, Orange.

23 Vere, D.T., Jones, R.E. and Dowling, P.M. 2004, *An Economic Evaluation of Research into the Improved Management of the Annual Grass Weed Vulpia in Temperate Pastures in South-Eastern Australia*, Economic Research Report No. 23, NSW Department of Primary Industries, Orange.

24 Jones, R.E. and Dowling, P.M. 2004, *Sustainability, Externalities and Economics: The Case of Temperate Perennial Grazing Systems in NSW*, Economic Research Report No. 24, NSW Department of Primary Industries, Orange.

25 Brennan, J.P. and Quade, K.J. 2004, *Analysis of the Impact of CIMMYT Research on the Australian Wheat Industry,* Economic Research Report No. 25, NSW Department of Primary Industries, Wagga Wagga.

26 Brennan, J.P., Sykes, J.D. and Scott, J.F. 2005, *Trends in Pulse and Oilseed Crops in Winter Cereal Rotations in NSW,* Economic Research Report No. 26, NSW Department of Primary Industries, Wagga Wagga.

27 Vere, D.T., Griffith, G.R. and Silvester, L. 2005, *Australian Sheep Industry CRC: Economic Evaluations of Scientific Research Programs*, Economic Research Report No. 27, NSW Department of Primary Industries, Orange.

28 Singh, R.P., Brennan, J.P. Lacy, J. and Steel, F. 2005, *An Assessment of the Economic, Environmental and Social Impacts of the Ricecheck Program,* Economic Research Report No. 28, NSW Department of Primary Industries, Yanco.

29 Jones, R., Saunders, G. and Balogh, S. 2005, *An Economic Evaluation of a Pest Management Control Program: "Outfox the Fox"*, Economic Research Report No. 29, NSW Department of Primary Industries, Orange.

30 Griffith, G.R., Parnell, P.F. and McKiernan, W. 2005, *An Evaluation of the Economic Benefits to NSW from Investment in the CRC for Beef Genetics Technologies,* Economic Research Report No. 30, NSW Department of Primary Industries, Orange.

31 Khairo, S.A., Mullen, J.D., Hacker, R.B. and Patton, D.P 2006, *Farming Systems in the Western Division of NSW: An economic Analysis*, Economic Research Report No. 31, NSW Department of Primary Industries, Trangie.

32 Griffith, G., Vere, D., and Jones, R. 2006, *Sheep CRC Renewal Proposal: Economic Evaluation of the Proposed Scientific Themes,* Economic Research Report No. 32, NSW Department of Primary Industries, Armidale.

33 Alford, A.R., Cafe, L.M., Greenwood, P.L. and Griffith, G.R. 2007, *The Economic Effects of Early-Life Nutrition in Crossbred Cattle Bred on the NSW North Coast*, Economic Research Report No. 33, NSW Department of Primary Industries, Armidale.

34 Jones, R. and Aluwihare, P. 2007, *A bioeconomic model for measuring the opportunity costs of water sharing plans in unregulated river systems: the Mooki river catchment*, Economic Research Report No. 34, NSW Department of Primary Industries, Orange.

35 Davies, B.L., Carberry, P.M., Graham, R.P., Mullen, J.D. and Meaker, G.P., (2007) *StockPlan®: A Decision Aid for Management of Livestock During Drought and Other Times*, Economic Research Report No. 35, NSW Department of Primary Industries, Paterson.

36 Gibson, T.S., Allan, G.L., File, G., Mullen, J.D., Scott-Orr, H., 2005, *Priorities and Principles for Investment in Aquaculture Research by NSW Department of Primary Industries*, Economic Research Report No. 36, NSW Department of Primary Industries, Orange.

37 Mounter, S., Griffith, G., Piggott, R., Fleming, E. and Zhao, X. (2007), *Composition of the National Sheep Flock and Specification of Equilibrium Prices and Quantities for the Australian Sheep and Wool Industries, 2002-03 to 2004-0*5, Economic Research Report No. 37, NSW Department of Primary Industries, Armidale, September.

38 Mounter, S., Griffith, G., Piggott, R., Fleming, E. and Zhao, X. (2007), *An Equilibrium Displacement Model of the Australian Sheep and Wool Industries*, Economic Research Report No. 38, NSW Department of Primary Industries, Armidale, September.

39 Davies, L., Quinn, H., Della Bosca, A., Alford, A. and Griffith, G. (2009), *The Economic Effects of Alternate Growth Path and Breed Type Combinations to Meet Beef Market Specifications across Southern Australia*, Economic Research Report No. 39, NSW Department of Primary Industries, Armidale, May.

40 Orr, L., McDougall, S. and Mullen, J. (2008), *An Evaluation of the Economic, Environmental and Social Impacts of NSW DPI Investments in IPM Research in Lettuce*, Economic Research Report No. 40, NSW Department of Primary Industries, Orange.

41 Orr, L., Stevens, M. and Mullen, J. (2008), *An Evaluation of the Economic, Environmental and Social Impacts of NSW DPI Investments in IPM Research in Invertebrate Rice Pests*, Economic Research Report No. 41, NSW Department of Primary Industries, Orange.

42 Alford, A.R., McKiernan, W.A., Cafe, L.M., Greenwood, P.L. and Griffith, G.R. (2009), *The Economic Effects of Using Heterozygotes for a Non-functional Myostatin Mutation within a Commercial Beef Production System*, Economic Research Report No. 42, NSW Department of Primary Industries, Armidale, June.