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An economic case study of entire male grain-fed beef from a north-western Queensland production system

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Abstract. Assessing the differences in gross margins for a north-western Queensland beef-production system was undertaken using herd-budgeting software. The analysis reviewed the viability of producing beef for the domestic market from either a steer or bull production system. A hypothetical herd of 1200 breeders was created for the case study evaluation. An integrated beef production system from breeding to feedlot finishing was found to be less profitable for bull beef production than for steers at the current market prices. Although bull production was more profitable than steer production during the feedlot phase, the production of bulls in this phase failed to compensate for the earlier economic losses in the weaning phase of –AU$24.04 per adult equivalent for bulls. During the feedlot phase, bull production systems had lower break-even sale prices than did steer production systems. In reviewing two pricing scenarios for bulls, it was found that marketing bulls at the same price as steers was the most profitable production system. We conclude that the production of bull beef from a north-western Queensland production system can be profitable only if bulls can be sold without discount relative to steers.

Additional keywords: bull, domestic, economics, market, profitability, steer.

Introduction

The production gains that bulls exhibit compared with steers are well documented. Bulls can grow up to 17% faster and convert feed consumed to liveweight gain 13% more efficiently than steers (Cahill 1964; Field 1971; Seideman *et al*. 1982). These production gains have been attributed to the androgenic affect of male hormones, promoting lean tissue growth and heavier final carcass weights. However, bull beef production remains a poorly accepted practise under northern Australian conditions.

A survey of southern Australian beef producers reported that a perception of management difficulties was a common reason for poor acceptance of bull beef systems (Hinch and Thwaites 1984). In listing the reasons for the difficulties, graziers nominated fence damage, the need for early separation of sexes and difficulties in yard handling as being the main reasons for the lack of adoption. This negative feedback, however, was in contrast to specialised bull beef producers surveyed with a minimum of 2 years of experience. The specialised bull beef producers did not nominate handling difficulties as a major problem and had fewer herd injuries than non-bull beef producers (4% *v*. 8%). The low adoption rate of specialised bull beef production in northern and southern Australia suggests that these inherent perceptions still exist.

Furthermore, meat wholesalers have been reported as perceiving bull meat from cast for age animals as having poor meat quality for the domestic retail market (Hinch and Thwaites 1984). The wholesalers surveyed by Hinch and Thwaites (1984) did not list meat quality, defined as toughness, as a problem in beef from young, light-weight bulls producing a carcass less than 250 kg. This would indicate that bull beef produced for the domestic market may be acceptable to wholesalers and subsequently consumers. In support of this, the Australian national meat standard for grain-fed young beef allows for the inclusion of entire and castrated males, providing the carcass, age and dentition specifications are achieved (Ausmeat 2011).

Bull beef production systems could provide significant benefits to the beef industry today by decreasing age at slaughter and decreasing feed costs. If bulls were produced to the same market specification as steers and marketed at the same price, we hypothesised that the advantages associated with bull beef production would yield greater economic returns than a traditional steer production system from north-western Queensland.

Typical of the north-western Queensland region, the mustering of cattle for branding and marking occurs throughout the dry season, usually in two or three intensive mustering periods. The second-round mustered calves are usually smaller in liveweight and younger in age than the first calves mustered for the season and subsequently leave the producer with the task of carrying these animals for another

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wet season. The implications for this are that the marketing options are reduced for these animals, often tying the producer to an industry price cycle of lower prices offered for these animals. We analysed the economics of using entire male cattle from a second-round muster as a production strategy to increase profits within this cohort of animals.

Materials and methods

The difference in gross margins of a *Bos indicus* herd where the male progeny from an annual weaning round was either left entire or castrated was analysed using formulated spreadsheets and Breedcow herd budgeting software (Holmes 2009). A steady-state herd model was used to test the profitability of the alternate management systems. The case study was based on a northern cattle operation supplying grain-finished beef for the domestic market. The production system was integrated into the following three divisions; the breeding, the backgrounding and the feedlot phases. On exit of each of the three sectors, cattle were valued at steer or bull market prices. These exit or sale values were then used as entry or purchasing prices for the subsequent sector of the production system. The breeding-phase prices were sourced electronically from the Gracemere saleyards website (Central Queensland Livestock Exchange 2009). The backgrounding-phase prices were sourced from market reports published electronically by Meat and Livestock Australia (Meat and Livestock Australia 2009). The feedlot-phase exit prices were sourced from a JBS Swift price grid and were based on dressed carcass weights (JBS Swift Australia Pty Ltd 2009). All sources for exit prices in the model were sourced on 11 June 2009.

Herd structure was determined by using findings from a published survey conducted across northern Queensland (Bortolussi *et al*. 2005*a*). The survey compared production parameters, including reproduction rates, calving patterns, and weaner and supplementation practices across various regions (Bortolussi *et al*. 2005*a*). The case study herd was modelled on a hypothetical 1200-cow breeder operation. The assumptions of production parameters for the case study are outlined in Table 1. It was assumed that year-round mating was typical to the region, with the majority of conceptions occurring in either the early or late stages of the wet season (Holroyd *et al*. 1979).

The case study herd had a carrying capacity of 2264 head of cattle and it was assumed that the system was managed as an operation typical of the region. The Breedcow model accounted for an unweaned calf by calculating an adult equivalent (AE) rating for a lactating cow and calf unit of 1.35. It was assumed that there would be no difference in the structure of the herd for the alternate turnoff strategies. The model predicted an annual turn off of 831 weaners, with a heifer retention rate higher than the district average at 76% (Table 2).

Breeding phase

The breeding herd was based on a property within the Gulf of Carpentaria region in far north-western Queensland. There are two distinct spikes in the incidence of cow-conception patterns in northern breeding herds that occur during the start and end of the wet season (Holroyd *et al*. 1979). The present case study sought to evaluate the viability of sourcing bulls and steers from a second-round muster. It was assumed that the second-round muster took

Table 1. Breedcow model assumptions for the breeding, backgrounding and feedlot finishing phases of the *Bos indicus* bull and steer production systems

Parameter	Steers	Bulls
Breeding phase – Gulf of Carpentaria		
Branding[A]		
1st calf heifers (%)	76	76
2nd calf heifers (%)	59	59
Cows (%)	67	67
Herd average (%)	69	69
Breeder death rate (%)	7	7
Weaner death rate[A] (%)	10	10
Maximum male turnoff age (years)	3	3
Cow culling age (years)	9	9
Sale weight, live, traded (kg)	170	170
Sale price/kg, live (AU$)	1.90	1.22
Sale price/head, net (AU$)	323.30	208.09
Backgrounding phase – north-western Qld		
Purchase weight live (kg)	170	170
Purchase price/kg, landed (includes transport) (AU$)	2.09	1.41
Purchase price/head, landed (AU$)	355.00	240.00
Mortality (%)	1	1
No. of days on forage	335	335
Average daily gain (kg/head.day)	0.39	0.39
Sale weight, live, traded (kg)	300	300
Sale price/kg, live (AU$)	1.42	1.04
Sale price/head, net (AU$)	426.00	312.00
Feedlot phase – Western Darling Downs		
Purchase weight – live (kg)	300	300
Purchase price/kg, landed (includes transport) (AU$)	1.63	1.25
Purchase price/head, landed (AU$)	489	375
Mortality (%)	1	1
Dressing %	55	60
No. of days on feed	70	70
Average daily gain (kg/head.day)	1.5	1.75
Yard fees (incl. feed costs/day) (AU$)	3.00	3.00
Market specifications		
Weight, live (kg)	400–450	400–450
Fat cover (P8) (mm)	5–12	0–32

[A]Donaldson (1962).

Table 2. Breeding-herd structure calculated by the Breedcow model at weaning

Variable	Calculated value
No. of total breeders mated	1200
No. of total cattle carried	2264
No. of total adult equivalents[A]	1758
No. of total calves weaned	831
No. of total cows/heifers sold	290
No. of total bulls/steers sold	367
Heifer retention rate (%)	76

[A]An adult equivalent of 1 is defined as a non-pregnant, non-lactating beast of 455 kg carried for 12 months.

place in September/October where calves were to receive a clostridial and botulism vaccine, identification and a NLIS tag, a property brand and be dehorned if required. The case study investigated the profitability of leaving male calves entire or castrating them surgically at this point. Following branding, calves were to be 'mothered up' and be managed in the breeding unit until weaning. Weaning occurred during the subsequent muster or between March and April where the calf is expected to obtain a liveweight of 170 kg (Bortolussi *et al*. 2005*b*). Typical of the region, once weaned, calves were transported by road and grown out on more fertile country. Calves entered the backgrounding phase at this point.

Backgrounding phase

It was assumed that calves would be grown out on the Mitchell grass downs of north-western Queensland, to a target weight of 300 kg at 2 years of age. With expected growth rates of 0.15 kg/day during the dry season and 0.60 kg/day during the wet season, the backgrounding phase was likely to take 334 days to achieve the desired weights (A. McDonald, pers. comm. 2010). Daily liveweight gains were expected to be similar between groups due to no pre-pubertal differences in growth (Wainewright *et al*. 2010). In addition, the liveweight gains used in the model were supported by the data published by Bortolussi *et al*. (2005*b*).

Feedlot phase

The analysis of time spent on feed was undertaken using formulated spreadsheets that accounted for input expenses, a fixed starting price and variable end prices. Following backgrounding, it was assumed that calves were transported 1500 km by road to enter the feedlot phase. The extensive distance travelled between backgrounding and finishing was justified by the feedlot's close proximity to the processing facility. In accordance with domestic carcass specifications, the feedlot model was run assuming that both bulls and steers would be fed for 70 days. On the basis of evidence suggesting that bulls gain faster and convert feed more efficiently than steers (Field 1971), the case study accounted for bulls to gain an extra 0.25 kg/day compared with steers for the same amount of feed consumed. It was, therefore, assumed that feed costs remained constant for the entire feeding period for both groups.

Results

Producing bulls that were marketed at the same price grid as steers was the most profitable production system. However, when bulls were marketed at bull prices, the total enterprise gross margin was less than that for a steer production system (Table 3). The breeding-herd analysis at weaning demonstrated that a steer-producing beef herd under the current pricing model will yield a greater herd gross margin and gross margin per AE than a bull beef system valued at the bull market price (Table 3).

The gross margin per head and gross margin per AE were greater for a bull production system in the backgrounding phase than for a steer production system when valued at current market prices. Under the same induction and feeding regime, bulls marketed at bull grid prices and steer grid prices had lower break-even prices (AU$/kg carcass weight) than did steers. The lower break-even prices of bulls than those of steers were driven by higher carcass yields and lower starting values per head.

Discussion

Bulls produced to a domestic carcass specification and paid under the same price grid as steers yield greater combined gross margins than a traditional steer production system. However, when bulls were valued at bull market prices throughout the growing and backgrounding phases of the operation, they were less profitable than a traditional steer production system. Profitability for all phases of the production system was driven largely by higher-end market values per head. The key variables that have an impact on this profitability are starting and finishing values per head and

Table 3. Economic status of the herd at the breeding, backgrounding and feedlot finishing phases of the production system when bull progeny are valued either at the bull or at the steer market price and steers are valued at the steer market price

AE, adult equivalent; GM, gross margin

Parameter	Steers	Bulls	
		Bull market price	Steer market price
Weaning phase			
Net cattle sales (AU$)	232 765	188 673	232 765
Contribution of bull/steer sales (AU$)	118 614	76 369	118 614
GM for herd (AU$)	166 006	123 751	166 006
GM after interest (AU$)	92 560	54 310	92 560
GM per AE (AU$)	94.44	70.40	94.44
Backgrounding phase			
GM/head (AU$)	66.44	69.18	66.44
GM/AE.year (AU$)	140.58	146.84	140.58
GM for bull/steer backgrounding phase (AU$)	24 117	25 112	24 117
Feedlot phase			
GM/head (AU$)	–124.38	–53.86	–41.36
GM for bull/steer finishing phase (AU$)	–44 652	–19 335	–14 848
Combined GM			
Total GM (AU$)	145 471	129 528	175 275

carcass yield. A contributing factor to the profitability of the bull enterprise when marketed under the steer or bull price grid was higher carcass yields. Bulls produce a carcass that has ~5% greater lean meat yield than that produced by steers (Field *et al*. 1966; Arthaud *et al*. 1969; Purchas Burnham *et al*. 2002). The benefits of entire-male cattle on growth rate may be reduced if the comparison was made with a steer subjected to an aggressive hormonal growth promotant-implant regime. However, the current domestic market push for hormonal growth promotant-free beef would suggest that the carcass gain from an entire-male cattle finishing system will become an important strategy for northern beef production systems.

The current pricing grid that is offered to producers by the meat-processing industry requires the carcass to fit several categories. These categories include carcass weight, dentition, fat depth, muscle shape and a quality grade. The window of acceptance for these parameters is substantially tighter when selling steers than that when selling bulls. For example, a price grid for bulls includes a fat depth of 0–32 mm, dentition of 0–8 teeth and muscle shape of A–D. Whereas the price grid for domestic steers is more specific, requiring a fat depth of 5–12 mm, dentition of 0–2 teeth and a muscle shape of A–C (JBS Swift Australia Pty Ltd 2009) . The resulting difference is a significantly higher price paid per kg for steers. With the fat depth requirement of 0–32 mm for bulls (Table 1), we suggest that once the desired liveweight is achieved, bulls can be turned off, regardless of the level of finish or fatness, if manufacturing beef is the targeted market. However, time on feed constraints such as the 70-day requirement for the domestic grain-fed young beef market may negate an earlier turnoff from the feedlot (Ausmeat 2011). In the current case study, bulls achieved the same target weight 10 days earlier than did steers. This is supported by others who demonstrated that superior gains from bulls resulted in target weights being reached sooner than for steers (Nichols *et al*. 1964). Although still recording a loss during the feedlot phase, bulls outperformed steers in both production and gross-margin indices. The feedlot gross margins for the bull production systems were –$19 335 and –$14 848 when valued at the bull and steer price grids, respectively (Table 3). Although bulls received lower end-market values in this model, the higher margins and lower break-even prices were influenced by superior daily gains and lower entry values to the feedlot than those for steers (Table 4). The superior daily gains in the feedlot by bulls compared with the pasture-based phases of the model are supported by the fact that as the plane of nutrition increases, the androgen activity within the animal also increases, resulting in attributes such as increased growth rates and increased muscle accretion (Mickan *et al*. 1981). The profitability of the feedlot phase is further enhanced through a rapid turnover of animals. However, within the steady-state models used for the present analysis, the degree of profitability as a result of increased livestock turn-over is unknown.

The case study merges the breeding, backgrounding and finishing sectors into one enterprise. Therefore, the opportunity cost of selling and buying animals at market value between sectors is absorbed by the business. In assessing the performance of the sectors individually, it was clear that steers had higher gross margins throughout the breeding phase, yet were outperformed by the bull enterprise in both the backgrounding and feedlot phases under the current pricing model. The superior value of steers compared with bulls and the assumption that there was no difference in mortality rate in the backgrounding sector led to bulls having greater gross margins with current prices. The data suggest that producers could achieve improved gross margins when buying bulls opportunistically to be backgrounded and finished in accordance with domestic market requirements compared with steers. However, the value of steers as yearlings or trade cattle is greater than that of entire-male cattle and subsequently a shortage in supply of entire-male cattle may be encountered in the store cattle market. It is possible that a supply of trade animals may come from young uncastrated bulls in the pastoral regions of northern Australia. In addition, a further opportunity exists for the establishment of a supply chain arrangement for feedlots and meat processors where bull prices could be pitched to equal the profitability of steer production.

The future acceptance of beef from grain-fed entire-male cattle under Australian conditions is largely unknown. The percentage of beef produced from entire males in European and New Zealand industries and the influence of animal-welfare groups suggest that the sustainability of entire-male grain-fed beef will be closely reviewed again in the future. In addition, we conclude that the production of bull beef from a northern Australian production system is profitable if bulls can be sold without discount relative to steers.

Table 4. Break-even analysis on feedlot exit, assuming bulls are marketed either at bull grid prices or at steer grid values and steers valued at steer grid value

Assume feedlot entry prices were $375 for bulls marketed at bull grid prices, $489 for bulls marketed at steer grid values and $489 for steers. Assume induction costs $7/head (no hormonal growth promotants) and transport from the feedlot is valued at $17.78/head for steers and $18.46/head for bulls. End values assume that a steer produces a 222-kg carcass and a bull produces a 253-kg carcass after the 70-day feeding period. cwt, carcass weight

Yard fee (AU$)	Steers		Bulls			
			Bull grid price		Steer grid price	
	Value per head (AU$)	Value per cwt (AU$)	Value per head (AU$)	Value per cwt (AU$)	Value per head (AU$)	Value per cwt (AU$)
2.50	688.78	3.10	573.46	2.27	689.46	2.72
3.00	723.78	3.26	610.46	2.41	724.46	2.86
3.50	758.78	3.42	645.46	2.55	759.46	3.00
4.00	797.43	3.59	685.08	2.70	799.08	3.15
4.50	832.43	3.75	723.08	2.85	834.08	3.29

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