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CALCULATION FOR BULL-COST OF CALF PRODUCTION IN CENTRAL AUSTRALIA

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SUMMARY
Evaluation of costs for calf production in an extensive beef cattle enterprise facilitates management decisions. In a case discussion based on a long-term cattle herd study, plus industry-based figures from the Alice Springs district, the calculated 'average bull-cost per calf branded' (+/– standard error) is $36.75 +/– $14.77. The discussion provides district beef cattle herd information and highlights issues for collecting cattle herd data under extensive grazing conditions in Central Australia.

Keywords: bull-cost per calf, calves per bull lifetime, bull-cost, branding rate, bull rate, bull lifetime

INTRODUCTION
The cost of inputs for calf production in an extensive beef cattle enterprise is not often quantified, even though evaluation of these inputs is vital for cost-effective management decisions. A lack of basic biological data from beef cattle herds in the Alice Springs district (Holroyd and O'Rourke 1988) has limited discussion about production costs on district properties. This paper presents a case discussion, highlighting methodology for a bull-cost per calf (BCC) calculation and incorporating figures from a herd study on an Alice Springs cattle property.

Definitions

Bull-cost per calf (BCC): Bertram (2000) has discussed multiple factors that influence BCC, including sub-components of the BCC calculation: calves per bull lifetime (CBL) and bull-cost (BC). A wide range of BCC is quoted—from $10 up to $100 per calf in tropical Australia (Fordyce *et al.* 1998). Reduction of BCC can be achieved in three ways: by selecting bulls with high fertility and physical soundness, to maximise retention in the herd; by increasing the cow : bull mating load; or by utilising yearling bulls, controlled use of which may extend the average bull breeding lifetime (Bertram 1994; Kasari *et al.* 1996; Cumming 1999).

Calves per bull lifetime (CBL): CBL can be averaged by using branding rate (BRAND%) as an approximation of the calving rate in extensively managed herds (Smith 1998), together with bull rate (BULL%) and an approximated bull lifetime (BL). BRAND% has ranged between 45% to 90% in the Alice Springs district, depending upon the landtype and season (Bertram *et al.* 1996b). The range of optimal BULL% previously recommended in northern Australia was 3% to 5% bulls (Niethe 1997). Recently the optimal range recommended has been 2.5% to 3% bulls (Holroyd *et al.* 2000), under specific conditions of bull soundness, dispersion and monitoring (Chenoweth 1986; Fordyce *et al.* 1998; Braithwaite and de Witte 1999). BL is the period in a bull's life when it is used for breeding. The average BL in Australia may be as short as three years, but up to five years in northern Australia (Queensland Beef Genetic Improvement Program 1992; Franklin 1998). Poor physical and reproductive soundness are two core reasons for a bull's breeding life to terminate (McGowan *et al.* 1995).

Average CBL is a measure of bull herd efficiency and has historically, on account of low BRAND% and high BULL%, been low under extensive grazing conditions with multiple-sire mating (Queensland Beef Genetic Improvement Program 1992). Under these conditions, the average number of calves produced per bull in a season is not representative of individual herd bulls since a low percentage of bulls can sire a high percentage of the calves (Holroyd *et al.* 2000).

Bull-cost (BC): BC is the nett cost of bull acquisition, including expenses to purchase and retain a bull (e.g. bull sale price, freight, feeding, insurance, interest, yarding, treatments) and salvage to reduce the overall BC at the end of a bull's breeding life (Economou 2000). The largest expense, the sale price paid for a bull, is an issue considered for bull selection (Bertram 1994).

METHODS

Study parameters

Location and cattle herd: The study area was centered 200 km northeast of Alice Springs (23^0S, 134.5^0E). Pastures in its major land systems (Perry 1962) enabled an estimated average stocking rate of 2.6 Animal Equivalents per square kilometer (Bertram *et al.* 1996b). The Alice Springs district is an arid region (Bertram *et al.* 1996a). Annual recorded rainfall ranged from 110 mm to 446 mm during the study. The study was undertaken over five years (1991 to 1996) in a Poll Hereford breeder-herd. Herd management practices included year-round phosphorus and urea supplementation, continuous mating, annual herd bull replacements, breeder cow culling on reproductive performance, twice yearly musters to brand and wean calves, plus activity to enhance calf survival.

Number of breeder cows: Breeder cows (n = 2,014) were individually identified with numbered eartags. Presence of each cow at muster was recorded over periods of 6 to 30 months. Muster percentage was less than 100% so the number of cows mated was approximated, based on records of individual cow presence at one or more of three musters within a 12-month period. Error values (0.5% to 1%) accounted for the annual eartag loss prior to double tagging all cows.

Number of calves and branding rate (BRAND%): Cattle station management recorded the number of freshly branded young stock (calves and weaners). For calculation purposes, the number of freshly branded weaners was added to the number of calves freshly branded at the previous muster. Using the adjusted annual sum of freshly branded young stock, together with the number of breeder cows mated to produce these calves, BRAND% averaged (+/– standard error (s.e.)) 81% +/– 7%.

Number of bulls and bull rate (BULL%): Herd bulls (n = 118) were identified with combined methods (numbered eartags, firebrands, freeze-brands, ear-tattoos) in order to maintain individual identification if bulls lost their eartags. Presence at muster and details of culling or death were recorded for each bull over periods of 6 to 30 months. Muster percentage was less than 100% so the effective number of bulls was approximated, based on records of individual bull presence at one or more of three musters within a 12-month period. Given the combined identification methods, the effective number of bulls was not adjusted for potential eartag loss. Using approximated herd bull and mated cow numbers, BULL% averaged (+/– s.e.) 5.0% +/– 0.1%.

Age of bulls and bull lifetime (BL): The age of herd bulls (range: 2- to 11-years old) was determined by station records of purchase, firebrands, ear-tattoos plus number and wear on incisor teeth. The average age of bulls introduced, culled or dead was calculated using records of bull age. BL for this case discussion is refined as 'average effective bull working lifetime'. It is calculated as the difference between the average age (+/– s.e.) at which bulls effectively left the breeding herd through death or culling (8.7 +/– 0.3-years old), and the approximated average age (+/– industry 'best-bet' standard error (b.e.)) at which new bulls effectively entered the herd (2.5 +/– 0.3-years old). The approximated age of entry takes into account annual purchase of 2- to 2.5-year old bulls from Poll Hereford studs, plus acclimatisation to a new environment and herd social structure.

Case discussion calculation

For this case discussion, the following refined definitions are also used:

1. CBL is refined as 'average number of calves branded per effective bull working lifetime'.

   Average number of calves branded per effective bull working lifetime

   $$\cong \left\lceil \frac{\text{BRAND\%}}{\text{BULL\%}} \right\rceil \times \text{BL}$$

2. BC is refined as 'average nett bull acquisition-less-salvage cost'.

   Average nett bull acquisition-less-salvage cost

   ≅ [Average nett bull purchase expense] + [Average nett bull retention expense] – [Average nett bull salvage value]

Expenses of individual bull purchase (+/– b.e.) ($2,850 +/– $250) and annual retention (+/– s.e.) ($234 +/– $41) are based on 2001 figures from an Alice Springs livestock agency, district surveys (ABARE 1997-2000) and Commonwealth bond rates. The error values allow principally for volatility in market prices. A nett bull salvage value (+/– s.e.) ($625 +/– $50) is based on Alice Springs 2001 records of heavyweight-bull liveweight sales, plus a cattle transport company quote for freight.

3. BCC is refined as the 'average bull-cost per calf branded'.

'Average bull-cost per calf branded'

$$\cong \frac{\text{[Average nett bull acquisition-less-salvage cost]}}{\text{[Average number of calves branded per effective bull working lifetime]}}$$

RESULTS

Table 1. Herd parameters, industry-based figures and the case discussion calculation

Parameter and figures	*Source*	Average	Unit
Annual branding rate	*5-year study*	80.8 +/– 7.0	percent
Annual bull rate	*5-year study*	5.0 +/– 0.1	percent
Annual number of calves branded per bull	*based on above*	16.1 +/– 1.8 *	calves
Age of bulls culled or found dead	*5-year study*	8.7 +/– 0.3	years old
Age of bulls entering herd	*5-year study*	2.5 +/– 0.3	years old
Effective bull working lifetime	*based on above*	6.2 +/– 0.6 *	years
Number of calves branded per effective bull working lifetime	***based on above***	**100.0 +/– 24.4 ***	**calves**
Nett bull purchase expenses	*industry figures*	2,850 +/– 250	dollars
Nett bull retention expenses per effective bull working lifetime	*survey & finance figures*	1,450 +/– 400	dollars
Nett bull salvage value	*industry figures*	625 +/– 50	dollars
Nett bull acquisition-less-salvage cost	***based on above***	**3,675 +/– 700 ***	**dollars**
'Average bull-cost per calf branded'	*based on above*	36.75 +/– 14.77 *	dollars

* propagated errors as per Simanek (1996)

Table 1 shows calculation of the 'average bull-cost per calf branded', using 5-year study averages, industry-based figures and indeterminant error values (i.e. standard errors, industry 'best-bet' standard errors, propagated errors).

Figure 1 models the effect of BC and CBL on BCC, with reference to a benchmark range of figures (Queensland Beef Genetic Improvement Program 1992) and the calculated 'average bull-cost per calf branded' ($36.75 +/– $14.77).

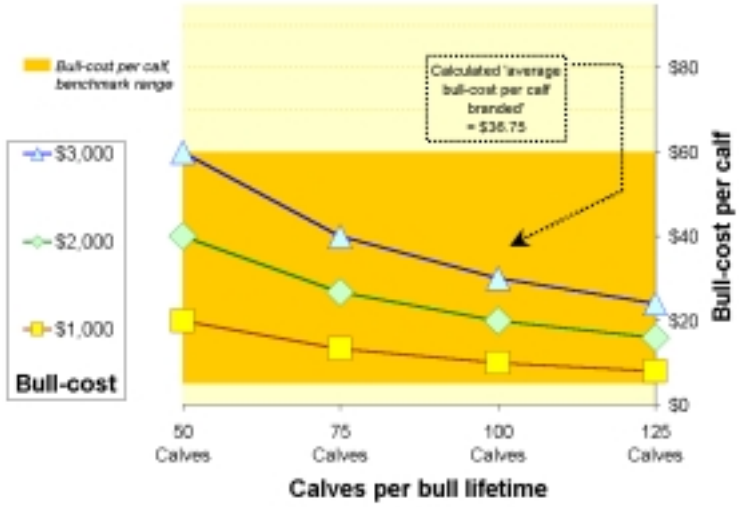

Figure 1. Model of bull-cost per calf (BCC)

DISCUSSION

The calculated 'average bull-cost per calf branded' lies within a benchmark range of given BCC figures. The calculation has a large relative error (40%), reflecting variability in BRAND%, BL and market prices. This case discussion provides beef cattle herd information in the Alice Springs district and highlights a number of interrelated issues: for calculating and assessing a BCC figure; for maintaining the representative nature of a calculated figure; and for collecting cattle herd data under extensive grazing conditions in Central Australia.

Assessing a bull-cost per calf (BCC) figure: On a herd basis, a BCC figure is assessed on whether the cost is acceptable, and on where unacceptable cost can be reduced. Reduction in BCC can be achieved by decreasing the BC or BULL%; or by increasing the BL or BRAND%. In Central Australia, options to decrease BCC may include: increased culling and salvage of aged herd bulls; improved selection and acclimatisation of introduced bulls; or improved breeder cow productivity through reduced cow deaths, optimised seasonal stocking rates or cost-effective mineral supplementation. As shown in Figure 1, if more calves are produced per bull lifetime, this will reduce the BCC.

Representative nature of a calculated figure: To be representative, a calculated figure needs to be based on unbiased data with low variability (Thrusfield 1995). To limit data bias and manage data variability that is typical for extensive grazing conditions, the following techniques were used for this case discussion: objective herd data collection in a longitudinal study; data collection and calculation using recognised, repeatable methods such as averaging; and stated use of assumptions to manage challenges in cattle data collection and calculation. Challenges for this case discussion included muster percentages less than 100%, eartag losses, herd bull losses and definition of the bull lifetime.

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