ECONOMICS OF ALTERNATIVE PROCEDURES FOR DEVELOPING A BRAHMAN CROSSBRED BEEF HERD

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Summary

The financial consequences of four alternative procedures for developing a Brahman crossbred type herd from one of British breed were estimated. The ultimate crossbred herd gave a substantial improvement in net income. Present values of changes in net income during the transition period were large and positive and did not differ substantially between the alternatives examined. Non-financial factors affecting the choice of procedure are also discussed.

I. INTRODUCTION

An estimate derived from a survey of the Australian Beef Cattle Industry (Anon 1970) indicated that Brahman *(Bos indicus)* cattle or their crosses were in use on 27 per cent of Queensland properties. There can be little doubt that their use is continuing to increase.

In the majority of studies, Brahman crossbred cattle have demonstrated superiority over British breed animals in specific performance characters. This evidence, together with their apparently successful use by commercial producers, leaves little doubt of the improved productivity of crossbreds under conditions of high temperatures, cattle tick *(Boophilus microplus)* infestation and recurring nutritional stress.

Information is lacking on questions such as the profitability of Brahman crossbred herds under various conditions, the comparative profitability of alternative breeding programmes and the economics of alternative methods of developing crossbred herds. This situation exists despite the fact that many producers have made decisions on these matters while many others face such decisions.

This study attempts an economic assessment of alternative procedures for developing a crossbred herd.

II. METHODS

(a) Comparisons

It was assumed that it was desired to develop and maintain a herd of approximately half Brahman breeding starting with a British breed herd. The following alternatives were compared:-

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(i) Immediate replacement of existing bulls with Brahmans ($\frac{3}{4}$ or higher grade). Half Brahman type bulls purchased as required and used for all matings with crossbred females.

(ii) As for (i) but Brahman bulls introduced only gradually-at the normal bull replacement rate.

(iii) Immediate replacement of existing bulls with half Brahman type bulls and progressive grading-up to a half Brahman type herd.

(iv) As for (iii) but half Brahman type bulls introduced only gradually at the normal bull replacement rate.

(b) Analytical Procedure

Herd composition changes and financial implications of each of the alternative breeding programmes, compared with continuing to maintain a British herd, were estimated for a hypothetical breeding and fattening property supporting the equivalent of 3000 adult cattle in the Charters Towers region of Queensland. In this area stock are subject to high summer temperatures, cattle tick infestation and recurring nutritional stress.

Adult equivalents of the various classes of cattle were calculated using Rayner's (1968) factors. In cases where the herd size of 3000 adult beast equivalents would otherwise have been exceeded, adjustments were made by marketing some steers as 23 year old stores.

Purchase of all required bulls was provided for.

Changes from the values for the British herd in annual costs and returns during the 20 year transition period were discounted to present value using a discount rate of 6.5 per cent as an approximation to bank overdraft rate, e.g. the present value of changes in gross returns is the sum which invested now at 6.5 per cent would exactly pay the annual changes over the 20 years. Breeding programmes were compared on the bases of present value of changes in net property income and an equivalent annuity, i.e. the constant annual return for 20 years which has the same present value.

III. ASSUMPTIONS

Performance estimates for the various breeds and generations of animals were inferred from many published reports. Those cited are representative or principal sources. Assumed performance rates of British and half Brahman type animals and first generation crossbreds are set out in Table 1.

The simplifying assumption was used that improved performance due to heterosis occurred only in first generation crossbreds. The improved mothering ability of first cross cows was reflected in lower first year mortality rates of their second generation calves, viz 7 per cent and 6 per cent for $\frac{3}{8}$ Brahman and $\frac{1}{2}$ Brahman calves respectively. Assumptions regarding heterosis effects were largely based on Mason (1966).

Survey data for the Charters Towers region (Davidson 1967) formed the basis for British breed animals' performance. Calving rates were derived from "Belmont" studies (Lampkin and Kennedy 1965) and survey data of Donaldson (1962). Studies reported by Kelley (1959) were used in estimating differential mortality rates. The assumed carcass weights and ages of marketing are supported

TABLE 1

Animal performance assumptions

Animal Type		British	1st Generation	Crossbred	½ Brahman Type
Sire		British	½ Braham	Brahman	½ Brahman
Performance —					
Calves:					
Mortality					
(birth-1 year)	(%)	10	8	7	8
Heifers:					
Mortality					
(1-2 years	(%)	4	3.5	3	3.5
Breeding Cows:					
Mortality	(%)	10	8	6	8
Calving rate	(%)	65	70	74	68
Carcass Weight	(kg/lb)	181.8/400	155.5/430	209.1/460	195.5/430
Steers:					
Mortality					
(1-2 years)	(%)	4	3.5	3	3.5
Marketing age	(years)	4.5	3.5/4.5*	3.5	3.5/4.5*
Carcass weight					
(3.5 years)	(kg/lb)	—	264/580	273/600	274/580
(4.5 years)	(kg/lb)	273/600	273/600	—	273/600

* Half at each age

by Shelton (1956), Dowling (1960) and McCarthy and Hamilton (1964), while the less frequent dipping requirement of Brahman crossbred cattle has been demonstrated by Wharton et *al.* (1969).

Performance factors assumed to be constant for all breds of animals were:—

Heifers —
Age at first mating: 2 years
Age of marketing surplus animals: 2½ years
Mortality rate from 2 years of age: 2% per annum

Breeding Cows —
Culling of animals with disabilities: 3 % per annum
Age of culling remaining cows: 8½ years

Steers —
Mortality rate from 2 years of age: 2% per annum

Mating Intensity —
Bulls to breeding cows: 5%
Those factors assumed to differ between British and animals with some

Brahman content were :—
Bull mortality rate: British 5%, Brahman 4% per annum
Bull working life: British 5, Brahman 6 years
Dipping frequency: British 6, Brahman 4 treatments per annum

Cattle prices were derived from Townsville abattoir prices and market reports for the area for the years 1967-68. Values of cattle sold for slaughter were based on 48.5 cents per kg ($22/100 lb) carcass for steers and 46.3 cents per kg ($21/100 lb) carcass for cows. Heifers and steers sold at 2⅓ years were valued at $80 and $74 per head respectively in the basic estimates, but the effect of a differential of $5 per head favouring Brahman crossbreds was also examined. Purchase prices of British, half Brahman and Brahman bulls were $250, $400 and $800 respectively. The salvage value of all bulls at the ends of their working lives was taken as $165, but the value of bulls sold earlier was estimated assuming straight line depreciation.

Marketing costs were based on standard rates assuming transport of 209 kilometres (130 miles) to abattoir and dipping costs were based on 10 cents per adult animal per treatment.

Assuming that the concurrent use of different breeding groups and the handling of Brahman crossbred stock may impose extra demands, additional labour costs were used in the basic estimates. The Queensland award rate for a station hand was applied to the following arbitrary allowance of extra labour:—

Procedure 1: 1.0 man-year for years 1 to 7 and 0.5 man-year for years 8 to 10
   2: 1.0 man-year for years 1 to 10
   3: 0.5 man-year for years 1 to 10
   4: 1.0 man-year for years 1 to 4 and 0.5 man-year for years 5 to 10

IV. RESULTS

The financial effects of developing a Brahman crossbred herd by each procedure are summarised in Table 2. Present values of major components of the changes are set out for the estimates derived from the basic assumptions. Present values of increases in annual net incomes are also shown for the case where Brahman crossbred steers and heifers attain a price advantage as stores.

The relationship between Brahman and half Brahman bull prices are such that procedures 1 and 3 yield the same present value of increases in net income (on basic assumptions and including labour cost) is $B = 407 + 0.83 H$ where B = Brahman bull price and H = half Brahman bull price. For half Brahman bull prices of $200, $300, $400 and $500, the Brahman bull prices for equivalent financial effects are $573, $656, $739 and $822 respectively.

Fluctuations in annual income changes were greatest for procedure 1 where the initial purchase of a full complement of Brahman bulls resulted in a reduction of net income by $45,608 in year 1. This was partially offset by an increase of $26,197 in year 5 when the sale of the last draft of British bullocks coincided with that of the first Brahman cross animals. Subsequent fluctuations were much smaller. Annual income variations for procedure 3 followed a similar pattern but were much smaller. Net income was reduced by $17,768 in year 1 and increased by $17,803 in year 5. For procedures 2 and 4, a series of negative income changes occurred from years 1 to 4 ranging from $10,327 to $7,383 for procedure 1 and from $4,327 to $3,363 for procedure 4.

From year 22, when stable half Brahman type herds had been derived by all procedures, annual net income was increased by $8,400.

TABLE 2

Present value of changes in annual returns and costs

Item	Procedure			
	1	2	3	4
(a) With basic assumptions —				
Gross returns (excluding bull sales)	112,145	96,468	77,030	64,934
Net cost of bulls	58,155	40,519	27,202	19,625
Costs — excluding labour	1,465	747	− 982	−1,099
Labour costs	13,180	14,953	7,476	11,039
Net income — without labour costs	52,525	55,202	50,810	46,408
Net income — with labour costs	39,345	40,249	43,334	35,369
Equivalent annuity	3,573	3,655	3,935	3,212
(b) With prices $5 per head higher for Brahman cross stores — Net income —				
without labour costs	60,781	64,084	54,762	50,255
with labour costs	47,601	49,131	47,286	39,216

V. DISCUSSION

These estimates leave little doubt of the improved profitability of half Brahman type herds over British herds grazing unimproved pastures in the tropical spear grass region of Queensland.

All procedures examined yielded satisfactory increases in the present value of annual net incomes during the transition from a British to a stable Brahman crossbred herd. However, procedure 4 was consistently the least profitable. For the other procedures; factors specific to the particular case may invalidate a general recommendation derived from these estimates. Thus, while procedure 3 was most profitable under the basic assumptions, smaller additional labour costs and/or a slightly higher sale price for Brahman-cross store cattle would make procedure 2 a better proposition. It is also apparent that if relative prices of Brahman and half Brahman bulls become slightly more favourable to Brahmans than the values assumed for these estimates, the financial advantage shifts to procedure 1. However, it could be expected that with sufficient knowledge of the comparative economics of their use and limited supplies of both Brahman and half Brahman type bulls, a price relationship which favoured the use of either would tend to be eliminated by the market mechanism.

Factors other than profitability must also be considered. The relatively high initial outlays for bulls in procedures 1 and 3 would tend to favour the other alternatives in cases where funding was a problem. Herd management is, however, least complex for 3, with only one breed of bulls used throughout, and most complicated for 2 where three separate breeding groups, with Shorthorn, Brahman and half Brahman bulls respectively, are necessary in some years.

It appears that estimates of this type could be used to define the most appropriate procedure for developing a Brahman crossbred type herd in any particular case.

VI. ACKNOWLEDGMENTS

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