

EVALUATING BEEF CATTLE RESEARCH RESULTS IN TERMS OF HERD STRUCTURE AND OUTPUT

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SUMMARY

Model herds were constructed to trace the effect of technological change on herd numbers and gross income. These models indicated that a change designed to primarily reduce age of turn-off required a series of managerial actions during the transitional period.

The breeding group had to be increased by 21 percent to maintain the original stocking pressure as the reduction of age at sale became effective. Alteration in herd structure resulting from reduced age at sale indicated that changes in paddock management would be required. Financial planning is required to cope with time lags between implementation of technology and increased cash returns. This indicates that research results need to be evaluated in the context of their result on herd output to allow more efficient implementation of new technology.

INTRODUCTION

Research results are usually presented to show an effect on the production level on a specific class of animal. When an estimate of the effect of a particular piece of technology on the whole herd is presented it is in the context of an equilibrium situation (Rayner 1968; Taylor et al. 1980).

Changes in production in the classes of animals that make up a beef herd alter herd structure. For example, reduction in age at sale will result in a higher proportion of breeders in the herd and a lower proportion of growing cattle when constant grazing pressure is maintained. Time lags in producing slaughter cattle and extra breeding cattle cause a transitional period from one equilibrium point to another. Most technological change depends on capital investment and therefore it is important to know the length of the transitional period and its likely effect on cash flow.

This paper describes the transitional period that follows a genotype change designed to increase productivity through reduction in age at sale and mortality rates. The principles outlined are relevant to other technological changes.

MATERIALS AND METHODS

Model herds were constructed using inputs inferred from central Queensland research collated by Anon ('1976) and Rudder (1978). More recent references include Corlis et al. (1980) and Rudder et al. (1981). The operational objective was to change from *Bos taurus* to *Bos indicus*-*Bos taurus* through the first generation stage holding grazing pressure to approximately 2 000 adult equivalents (AE) in June/July.

Productive levels assumed for *Bos taurus* were as follows: Weaning rates of 76 percent (64 to 84 according to age and lactation status) with breeder herd death rates of four percent (three to eight according to age and lactation status). Steers were sold at the rate of 25 percent by 3½ yr, 50 percent by 4½ yr, 25 by 5½ yr at 560, 570, 550 kg liveweight. Surplus heifers were sold at 50 percent by 3½ yr, 50 percent by 4½ yr at 375 and 400 kg liveweight. Cull cow weights at sale

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were 380 to 460 kg liveweight according to age. Death rates of growing and fattening classes were two per cent annually.

Productive levels assumed for first generation *Bos indicus*-*Bos taurus* were as follows: Weaning rates of 78 percent (68 to 85) with breeder herd death rates of two percent (one to four). Steers were sold at 25 percent by 2½ yr, 50 percent by 3½ yr, 25 percent by 4½ yr at 560, 570, 550 kg live weight while surplus heifers were sold at 50 percent by 2½ yr, 50 percent by 3½ yr at 375 and 400 kg live weight. Cull cow weights were 425 to 510 kg live weight. Death rates of growing and fattening classes were one percent annually. The second and subsequent generations of *Bos indicus*-*Bos taurus* differed from the first generation only in weaning rates which were 72 percent (55 to 85).

Assumptions regarding management policies included:

- . Initial joining to calve at two yr with the constraints of not more than 10, 15, 30, 60 percent of heifers joined from two to five yr and older dams. Yearling heifers that did not conceive were rejoined to calve at three yr. Additional requirements came from the two yr group of heifers and up to 90 percent were joined to calve at three yr.
- . Culling for reproductive failure was implemented in the two yr and older non-lactating; and four yr and older lactating age groups. Younger lactating cows failing to conceive were rejoined. Culling on the basis of physical defects was one to two percent according to age up to nine yr which was the final joining. During the liquidation phase of *Bos taurus*, Cows were culled back to six yr as first generation *Bos indicus*-*Bos taurus* heifers became available.
- . Pregnant cull cows reared the calf in utero to weaning and were fattened the following year. Non-pregnant culls were fattened and sold the year after removal from the breeder herd.
- . *Bos taurus* bulls were replaced with *Bos indicus* bulls in year one. In turn *Bos indicus* bulls were replaced with *Bos indicus*-*Bos taurus* bulls as *Bos indicus*-*Bos taurus* heifers became available.

Factors used to calculate AE were: pregnant cows 1.00; non-pregnant cows .48, .73, .80, .86, .84 for ½ yr, 1½ yr, 2½ yr, 3½ yr, 4½ yr and over; steers .46, .71, .96, 1.16, 1.18 for ½ yr through to 4½ yr; surplus heifers .41, .63, .82, 1.02 for ½ yr to 3½ yr and bulls 1.23.

RESULTS AND DISCUSSION

Figure 1. traces the pathway from the equilibrium for *Bos taurus* to the equilibrium for the *Bos indicus*-*Bos taurus*.

Between years 0 and 24 the proportions of the breeding group (herd replacement heifers, pregnant cows, non-pregnant cows, and bulls), cull cow group (pregnant cows culled for physical defects and age, cows culled for reproductive failure), steer group (aged from ½ yr to sale), surplus heifer group (from ½ yr to sale) change from 33:5:42:20 to 40:7:37:16. In terms of grazing pressure the proportions are 37:5:42:16 and 46:8:34:12 in logical sequence.

To maintain constant grazing pressure the breeding group must be increased by 214 animals (21 percent) as steer and surplus heifer numbers are reduced through earlier age at sale. Surplus heifer sales are reduced until this

expansion phase is completed.

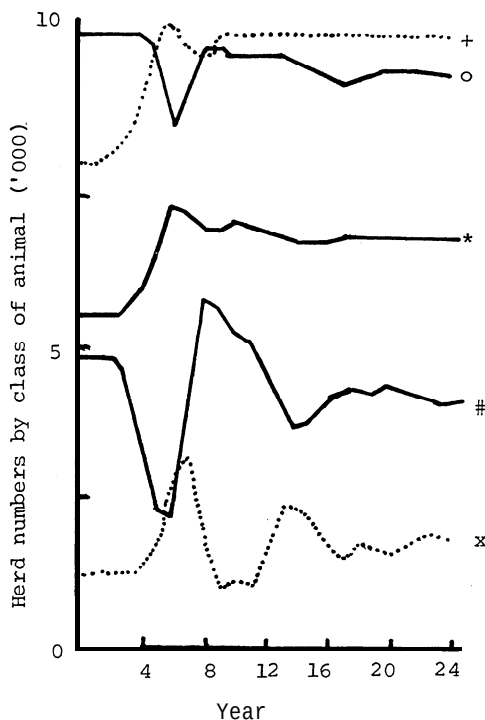


Fig. 1. Closing herd inventory

- + Breeding group
- o Steer group
- * Calves weaned
- # Surplus heifer group
- x Cull cow group

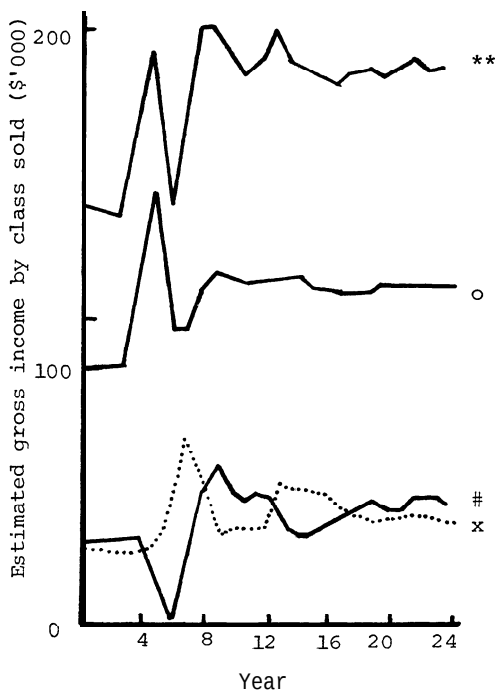


Fig. 2. Estimated annual gross income (\$)

- ** Gross income \$'000
- o Gross income from steers
- # Gross income from surplus heifers
- x Gross income from cull cows

The area previously used for the breeding group has to be expanded to cope with the extra breeders. This area was to come from the area previously used for the steer group because the combined grazing pressure of the cull cow and surplus heifer groups does not alter markedly. A normal approach would be for the breeding group to take the worst of the steer country which is usually considered to be better than breeding country. Thus there could be an overall improvement in the nutrition of both groups. Where this occurs realized improvement would be greater than research results indicate.

Adjusting numbers

Breeding group numbers were increased from year three onwards in anticipation of higher steer sales in years four to six as the first generation Bos indicus-Bos taurus steers reach sale liveweight and the last of the Bos taurus steers are sold. Breeding group numbers reached the target figure in years five and six but were reduced in years seven and eight as the extra calves from

higher reproductive rates of first generation females make an impact on AE.

Liquidation of Bos taurus cows from the breeding group was accelerated in years five and six. Final sales of these cull cows occurred in year eight.

While breeding group numbers remained constant from year nine onwards calves weaned showed a slight annual decline from year ten to year sixteen when they stabilized. This decline was due to passing through the first generation Bos indicus-Bos taurus phase. The final joining of these yearling maiden heifers was in year eight and of mature cows in year sixteen. Owing to the overlapping of generations during the transition and seasonal variation producers do not notice a decline in fertility. This possibly explains why producers are slow to accept research results indicating decline in fertility.

Inspection of Fig. 1. shows that except when breeder group numbers are being increased there is a reserve of potential breeders in the surplus heifer group. The same number of calves can be produced at lower reproductive rates by joining extra surplus heifers and substituting surplus heifer sales for cull cow sales.

Income effects

The final evaluation of technological change is its effect on gross income and/or costs of production. In this case effect on gross income has been considered and is shown in Fig. 2.

There was no effect on gross income until years four to six when duplicate sales of steers occurred due to the reduction in age at sale. Reduction in surplus heifer sales to build up breeding group numbers negated increases in steer sales, so income in year six was back to the initial level. Income from cull cows and surplus heifers reflect management decisions regarding increase of breeding group numbers and liquidation of the basic genotype.

This paper has shown that implementation of improved technology can alter herd structure and that there will be lag time before financial rewards occur. Therefore, research results should be evaluated on the basis of herd output over a number of years.

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