FACTORS INFLUENCING ADOPTION OF TECHNOLOGICAL INNOVATIONS FOR BREEDING BEEF CATTLE IN CENTRAL QUEENSLAND

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SUMMARY

Traditional selection criteria for breeding programs have a long history of support, both within the industry and by technical advisers to the industry. Recommendations to replace these criteria with weight for age is a relatively recent development.

Selling stud and herd breeding cattle attracts premium prices. Therefore, studmasters are more likely to support the traditional breeding programs than technological innovations that may jeopardize the earning capacity of their herds. Thus, the normal adoption process of influential producers spreading technological developments does not operate in this case.

The widespread change from *Bos taurus* herds to *Bos indicus Bos taurus* herds demonstrates that producers will accept change when real benefits follow. Genetic principles present a strong case for altering currently used breeding programs, but few producers, extension officers and other personnel associated with the industry can relate to these principles. Therefore, until further industry evidence is available to clearly demonstrate both long and short term effects, change is unlikely to be widespread.

INTRODUCTION

The majority of beef cattle breeding programs are based on visual appearance with little thought to separating environmental, nutritional and genetic effects. This has led many scientists to suggest that objective assessment for only heritable and economically important traits, e.g. live weight for age would be preferable (e.g. Seifert, 1981).

The beef industry appears to lag behind other livestock industries in the use of objective selection criteria. Ryan (1979) reported that the poultry and pig industries were making improvement through the application of objective selection methods. The dairy industry is making increased use of breeding cattle that have been selected for their genetic productive capacity.

An excessive time lag between development and adoption of technological innovations represents lost profitability to the industry and inefficient use of research and extension resources. The purpose of this paper is to discuss factors that may influence acceptance and adoption of improved techniques for breeding beef cattle.

EVOLUTION AND STABILIZATION OF ESTABLISHED BREEDING PROGRAMS

An understanding of how the traditional system of assessing and breeding cattle was established will give an appreciation of why cattle producers are firmly entrenched within it.

The use of pedigrees in breeding programs began in England late in the eighteenth century and the first herd book recording pure bred cattle appeared early in the nineteenth century (Lush, 1949). Gordon (1910) detailed standards of excellence for Shorthorn cattle and these standards still bear a striking resemblance to those current in most Breed Societies. Burnage (1922) reported that the Gindie stud herd was established by the Department of Agriculture and Stock (now the Department of Primary Industries) to supply good quality stud bulls to service commercial herds. Acceptance of phenotypic assessment is illustrated by Arbuckle (1966) who outlined feeding rations and management to ensure that bulls reveal their potential.

Until the mid-1950's the approach by advisers to the beef industry was to leave breeding of cattle to the studmasters. The few references that appeared gave direct or indirect support for the established selection criteria. Secondary and tertiary agricultural institutions have taught students breeding techniques based on the established methods used by conventional studmasters. There has been a more enlightened approach taken during recent years, but most of these institutions maintain established stud herds as do research institutions operated by CSIRO and QDPI. This gives tacit support for stud breeding.

Attitudes developed during the past century have led to a widespread belief that stud cattle are superior to commercial cattle in production, and standards of excellence detailed by the Breed Society are the best basis for selection.

REASONS FOR BREEDING STUD CATTLE

The stud cattle industry is, to a large extent, a separate section within the beef industry. The reasons producers breed stud registered cattle can be detailed under four main headings.

1. Greater economic return. An example of the potential monetary advantage accruing to the production of stud and herd bulls is implicit in a study by Venamore *et al*, (1982). In this study, the average price paid for stud and herd bulls was approximately seven times the current value of slaughter steers of comparable live weight. Registered stud bulls were 1.6 times the value of herd bulls. Not all studs receive margins of this magnitude, but there is an obvious incentive for this section of the industry to persist.

2. Product merchandising. Establishment and maintenance of breeds that have individual characteristics results in a readily identifiable product that can be promoted.

3. Breed improvement. Many people in the beef industry believe that they can improve the productivity of their cattle by selecting and culling on the basis of the standards of excellence of their breed. They continually try to move their herds towards the currently popular breed ideal in the belief that failure to achieve this is likely to result in lower beef production and reduced sale prices.

4. Social aspects. Participation in breed societies, agricultural shows and stud cattle sales provides opportunities to meet and interact with people who have similar interests. Activities of this nature receive wide media coverage and provide a venue for the recognition of their contributions to the industry as well as enhancing their potential sales.

It can be seen that this section of the beef industry has little reason to support change in breeding technology. Many of the studmasters are leaders in the beef industry and change in breeding technology represents a threat to financial interests and to some of their social needs. Therefore, the normal adoption process of influential producers spreading new technology to others does not operate in this case.

CHANGES IN BEEF CATTLE BREEDING

While there has been little change in relation to within breed selection techniques, producers have accepted and adopted a major change to breeding programs during the past 25 years through crossbreeding. In the early 1950's *Bos taurus* cattle accounted for practically all cattle in Queensland (Beattie, 1956). By 1977 the proportion of *Bos taurus* in Queensland had been reduced to 40 percent of all beef cattle (Anon. 1977). The change was more dramatic in central and northern Queensland than in southern and western Queensland.

Naturally there was, and still is, resistance to this change. However, for the past 10 to 15 years extension and research officers have had reliable information to support their case. Research showed that use of *Bos indicus Bos taurus* cattle increased productivity through higher growth and survival rates and comparable reproductive rates (Rudder 1978). This increase in productivity has been shown to increase gross income (Taylor *et al*, 1980). The review by Wythes and Ramsey (1979) showed that carcase composition and meat quality from *Bos indicus Bos taurus* cattle is comparable to that of *Bos taurus* cattle. Research has been valuable in convincing those producers who had strong reservations concerning a change of this type and magnitude.

FUTURE BREEDING PROGRAMS

During the mid-1950's extension and research officers began advocating the use of either live weight gain or age corrected live weight at 18 to 20 months as the primary selection criterion (Alexander 1956, Daly 1971). Seifert (1975) estimated that heritability of live weight for age at 18 months was 0.50 in *Bos taurus Bos indicus* cattle and Mayer *et al*, (1980) demonstrated that this estimate was a reliable indicator of the breeding value of bulls. To date, only a small proportion of producers are using quantitively measured traits as primary selection criteria, and only a limited number of buyers are prepared to pay premiums for higher live weight for age bulls (Venamore *et al*, 1982).

The reasons for the lack of adoption of this technology have not been determined, but it is possible that the following factors may have an influence.

(1) Most producers require empirical evidence to be convinced that selection on quantitively measured traits is better than selection on conventional criteria. Because this evidence is lacking, there is a need to compare progeny of bulls selected for conventional criteria with progeny of bulls selected for weight for age.

(2) The long term effect of selection for live weight for age has not been assessed in terms of its effect on reproduction, growth and carcase characteristics. There is a need to design and implement trials that will demonstrate likely trends.

(3) Any technological innovation must be effective and simple to implement. Articles on objective selection tend to leave the impression that it is a difficult and time consuming practice. In reality, most benefits can be derived from a simple program. For example, the program used at Banana for the past 12 years involves recording the age of calves which are to be kept as bulls, identifying these calves, weighing them at approximately 18 months of age, ranking them on weight for age and effecting final selection. Bulls that have the highest live weight for age ratios are used in the Banana herds. These bulls have had acceptable conformation and there has been no reason to reject any bulls selected for live weight for age. It follows that recommendations should be presented with commercial requirements in mind.

(4) Because traditional breeding methods have a long and well publicised history, many officers from research, extension and educational institutions have some traditional background knowledge and discuss the subject in traditional terms. Additionally, pastoral house agents, meatworks buyers and rural journalists have contact and influence in the industry. It follows that there is a need to ensure that these groups are kept informed of technological developments.

Changes to breeding and selection programs are a major cause for concern to many producers. The normal adoption process of influential producers spreading technological innovations is not widespread because these producers are making money and satisfying social needs using conventional approach. Extension and research institutions will have to develop a strong case based on comparative information before widespread change will occur.

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