New cattle breeds: how do we use them?

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Traditionally, beef production in Australia has been based on a few of the many breeds that developed in the United Kingdom. Pedigree breeding was used to maintain these breeds and was probably a sound policy, when combined with selection on performance, to maintain and concentrate merit in stud herds. Pedigree breeding seems to have been taken too far in some countries which prohibit the use of crossbred males. Emphasis on pure breeding has caused many prejudices against the practices of mixing and selection which were the original bases of breed formation.

Most breeds were developed by crosses or mixtures of other types or breeds and this crossbred foundation was selectively bred towards an "ideal" which the breeder progressively developed. Inevitably, a new breed was also a reflection of the environment in which it developed. The expansion of beef production in Australia meant that British breeds were moved into difficult environments as settlement of the continent progressed. There were specific adaptations of breeds of beef cattle to particular environments as in Western Australia, where a strain of Shorthorn predominates in the northern areas while the Hereford is the most numerous beef breed in the south.

Despite the adaptation of British breeds to the various environments in Australia there was, and still is, continuous interest in introducing other breeds of cattle to improve beef production. The problems in adaptation of British breeds to northern tropical parts of Australia forced an investigation of breeds of cattle from tropical Asia and Africa (the Zebu breeds). The Brahman breed was first introduced from the United States in 1932 and after initial use in North Queensland was followed by further importations in the 1950's. These introductions were the basis of the so-called "Zebu revolution" in northern Australia. Other Zebu breeds introduced were the Africander, Red Sindhi and Sahiwal, while the Santa Gertrudis, a stabilised Zebu
British crossbred was also imported.

More recently, the importation into the United Kingdom of a range of western European cattle breeds has been of great interest in Australia. Semen from some of these breeds is available to Australian importers. Recent changes in semen importation requirements have opened sources of new breeds in Canada also. All over the beef-production world the interest in new cattle breeds is very active and Australia must use these various types to ensure that its beef industry is kept at the highest productivity level possible.

The table at the end of this article lists the breeds of cattle at present available in Australia together with breeds that might have potential value to the Australian beef industry.

**BREED CHARACTERISTICS**

Most breeds are readily identified by heritable characters such as coat colour or polledness which are usually controlled by a single gene. However, the characters of real economic importance are not so simply controlled and are less readily identified until they are measured in performance recording schemes. Furthermore, the segregation of the single gene effects has been one of the main reasons for emphasis on pure breeding and the supposed difficulty of new breed development. Economically important characters are controlled by many genes and the development of breeds based on these characters is a blending of these characters and then selection of those animals showing improved performance. These were the practices used by Bakewell with Leicester sheep and the Colling brothers with Shorthorn cattle, and by many others since then in the development of our domestic animal breeds. The thoroughbred horse, Corriedale sheep, Australian Illawarra Shorthorn and Santa Gertrudis cattle are all examples of breeds based on mixing and the practice of mating the best males to the best females without attention to pedigrees or much concern with inbreeding.

We have many more aids now than were available to the breeders
who developed our existing breeds. The National Beef Recording Scheme has been introduced to assist breeders to improve characters such as growth rate, mothering ability, reproductive performance and carcass quality. This, combined with the move to sell beef and cattle on the objective measurement of economic characteristics, will enable the development of animals more suited to particular markets. It will also reduce the need for the incorporation of distinctive characters unrelated to economic merit as markers of particular breeds.

**BREEDING PRINCIPLES**

Faced with the bewildering list of cattle breeds that are available to him, how does the producer make a decision on which breed or breeds to use?

His first step is to identify within each breed those production characters which he wishes to have in his own herd. We are all aware that the phenotype or actual character seen and measured is a combination of the genotype, the genes controlling that character, and the effects of the environment in which the animal was raised. Consequently, the results of evaluations done in one environment do not necessarily apply in another environment. Most of the reported evaluations have no common control breed and the samples used can be criticised as not representative of the breed. Despite these limitations, evaluations have been made and have defined considerable differences between breeds. The differences between breeds in characters such as growth rate, milk production and maturity type are an important source of genetic variation for improvement in efficiency of beef production. In fact, we find that most of the genetic improvement in beef production that has occurred in recent times comes from introduction of new breeds and the changing of breeds rather than from improvement within breeds.

If we assume that, at least in general terms, the producer can identify a breed or breeds to use, his second step involves the choice of two different breeding principles.

**Pure breeding**

Pure breeding is used if he decides that one particular breed has special merit for his production system and market and he then uses animals of this breed only.

If his herd is already composed of the breed he wants, then he applies performance recording to his herd to improve performance by selection within the herd and by purchase of tested animals from other herds of the same breed.

If his present herd is not the breed he wants, then the farmer uses a grading-up programme until the new breed is at the level where the herd is considered pure. The success of the grading-up pro-
gramme will depend on the farmer's ability to choose suitable bulls for his purposes. These are the traditional methods of pure breeding that have been used for some time, although they do not take into account the strict pedigree breeding of the stud industry. Grading up has been used in most breed-development programmes especially where only a limited introduction of animals or semen of the breed is possible. The Brahman, Santa Gertrudis and Murray Grey breeds all use this grading-up principle.

**Crossbreeding**

Where no single breed embodies all the many characters required for efficient beef production, the principle of crossbreeding is used. All contemporary breeds have had a period of initial crossbreeding to produce the blending of characters and the variation on which selection could be practised. With crossbreeding, there are two major possibilities—

**Systematic crossbreeding**

We can use two breeds and mate first to one breed of bull and then back to the second breed. This is usually called criss-cross mating. If we use three breeds mating first to one bull breed, then to the second bull breed, then to the third bull breed and then back to the first and so on, it is called rotational crossbreeding. In fact, we could use any number of breeds in the rotation.

With such continuous crossbreeding we are looking for more than just the combining of desired characters of each breed because we are aware of the phenomenon of hybrid vigour. This phenomenon is seen especially in those characters of low heritability that are associated with fitness or maternal ability, such as reproduction, survivability, or milk production. Hybrid vigour is where the performance of the progeny is greater than the mean performance of its parents. It is seen especially where the relationship between breeds is most distant. For example, in crosses between British and Zebu breeds there is a high level of hybrid vigour but in crosses between British beef breeds, say, Short-

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**BREEDS OF CATTLE AVAILABLE IN AUSTRALIA AND BREEDS WHICH MAY HAVE POTENTIAL VALUE TO THE AUSTRALIAN BEEF INDUSTRY**

**A. European breeds (Bos taurus) previously imported into Australia now well established**

- Angus
- Ayrshire
- Devon
- Friesian
- Galloway (a late introduction (1940) Shorthorn—both beef and dairy types

**B. European breeds (Bos taurus) available through importation of semen from the United Kingdom and Canada**

- United Kingdom
- Canadian Holstein
- Charolais
- Limousin
- Lincoln Red
- Meuse-Rhine-Yssel (MRY)
- Simmental
- South Devon
- Sussex

and all the breeds listed under A above

**C. Zebu breeds (Bos indicus) previously imported into Australia**

- Africander
- Brahman
- Santa Gertrudis—a crossbred of Bos taurus and Bos indicus developed in United States of America
- Red Sindhi
- Sahiwal

**D. Breeds developed in Australia**

- Australian Illawarra Shorthorn—from Shorthorn and Ayrshire breeds
- Belmont Red—from Africander, Hereford and Shorthorn breeds
- Braford—from Brahman and Hereford breeds
- Brangus—from Brahman and Angus breeds
- Droughtmaster—from Brahman and Shorthorn breeds
- Murray Grey—from Angus and Shorthorn breeds
- Tasmanian Grey—from Angus and Shorthorn breeds

A number of crossbred types including a dairy animal using the Red Sindhi, Sahiwal and Jersey breeds, and beef animals using Red Sindhi and Sahiwal breeds crossed with Shorthorn or Hereford have also been developed more recently.

**E. Breeds of European origin (Bos taurus) which may have potential for use in Australia (not listed in any particular order)**

- France
- Charolais
- Limousin
- Blonde d'Aquitaine
- Maine Anjou
- Normandy

- Germany
- Simmental (Fleckvieh)
- German Yellow (Gelbvieh)
- Friesian

- Italy
- Chianina
- Romagna
- Marche

- Switzerland
- Brown Swiss
- Simmental

- The Netherlands
- Meuse-Rhine-Yssel (MRY)
- Friesian

- Denmark
- Danish Red

- Sweden
- Swedish Red and White (SRB)
Failure to maintain the hybrid vigour in systematic crossbreeding systems, the breeds can be chosen to exploit hybrid vigour but since it is expressed particularly in reproductive characters the dams of commercial progeny should be crossbred.

**Formation of new breeds**

New breeds result from the mixing of diverse breeds and the selection from within this crossbred foundation for animals with desirable characters. There are many examples of this process. In Australia, the Droughtmaster was developed from Brahman and Shorthorn and the Murray Grey from Angus and Shorthorn. Both these new breeds had only two old breeds in their makeup. The Belmont Red has three breeds, Africander, Shorthorn and Hereford.

Both the Droughtmaster and the Belmont Red result from the interbreeding of first generation crossbreds between Zebu and British breeds with selection on performance being applied in subsequent generations. This means that crossbred bulls are used which is contrary to the views of traditional stud breeders. In their view, as crossbreeding continues there is a failure to maintain the hybrid vigour of the first cross and a depression of fitness characters from inbreeding in small populations. However, we know that interbreeding first cross animals produces greater variation in the next generation, and selection can exploit this variation either upwards or downwards. In the second generation, wide phenotypic variation in characters of economic merit such as growth rate, fitness and carcass quality is not likely and if selection for these is maintained there should be little risk that the fears of traditionalists will be realised. Some degree of inbreeding is inevitable and this has certainly played an important part in the development of all existing breeds. Its use has a positive role in breed formation to maintain high selection intensities on the desired characters for the breed.

**BREED EVALUATION**

All the decisions that have been discussed presume that the producer is first of all aware of the characters he needs to combine in his cattle for efficient beef production, and secondly that the merit of the available breeds in these characters is also well known. This second point reveals an area where much more work is required on the evaluation of both established and new breeds. Often with new breeds, the industry will make its decisions on their use before any detailed experimental evaluation has been completed. Evaluation at the research level is an expensive and long-term operation and as a source of definitive information is most essential. But the need for rapid comparative information on breeds in the field situation is even more important.

Producers who decide to introduce new breeds into their herds must be encouraged to participate in “on-farm” performance testing such as the National Beef Recording Scheme and to make their herds available for collection of information on the breeds they are using. In doing this, it is essential that data on the existing breed is obtained through contemporary comparisons. The quality of this information will vary considerably with the interest and application of different producers but each piece of information will be valuable as part of the sum total of data on a new breed. By using field situations the evaluations will be done on a wide range of environments and under commercial conditions. This, combined with work on research stations, will provide the most rapid and complete evaluation of new breeds.

The introduction of Charolais into the U.K. was carried out under close control using both research stations and commercial herds. Its duration was considerably shortened by the use of artificial breeding and because of the specific use of the breed as a sire of calves for beef production from the dairy herd. The important fact was that evaluation at the industry level was carried out from the very first introduction and the assessment by the farmers who used the breed was a significant factor in the results of the evaluation.

The Charolais study could well serve as a model for the introduction of new breeds into Australia. The present relatively uncontrolled semen importations of Charolais, Limousin, Simmental and other western European breeds into Australia will result in much less adequate evaluation of these breeds for Australian conditions.