ADAPTAUR ASSOCIATION OF AUSTRALIA; A BREED ASSOCIATION BASED ON THE PERFORMANCE RECORDING OF ADAPTAUR CATTLE

C.J. O'NEILL[A], G.J. WELDON[A], R.A. HILL[B] and J.E. THOMAS[C]

[A] CSIRO, Tropical Agriculture, Tropical Beef Centre, North Rockhampton, Qld 4701
[B] Qld Beef Industry Institute, DPI, Tropical Beef Centre, North Rockhampton, Qld 4701
[C] 'Boxvale', Builyan, Qld 4680

SUMMARY

In 1997 an association of Queensland beef producers was incorporated with the object of breeding performance-recorded Adaptaur cattle. Adaptaurs were developed at the National Cattle Breeding Station 'Belmont', from a line of Hereford x Shorthorns selected primarily for high tick resistance and high growth rate measured in the presence of tropical stress. In northern Australia, Adaptaur bulls are able to generate, without the need for either supplementary feeding or parasite control, high levels of productivity when used over *Bos indicus* females. This paper provides a background to the formation of the Adaptaur Association of Australia and outlines the performance protocols that have been adopted by the Association so as to maintain high levels of growth, fertility and resistance to environmental stresses in Adaptaur cattle. The protocols could be applied to the selection for tropical adaptation in other breeds of cattle.

Keywords: tropics, tick resistance, adaptation, *Bos taurus,* Adaptaur

INTRODUCTION

Over the last decade there has been a large increase in the number of cattle breeds available to beef producers in northern Australia. Apart from the importation of African breeds, eg Boran and Tuli, the majority of breeds imported have been *Bos taurus* from temperate environments. The relatively high production potentials (for growth, fertility and meat quality) of the European *Bos taurus* are the traits being sought by northern producers. This is especially the case for those producers who have endeavoured to maximize their herd productivity by utilising the well documented heterosis of the F_1 *Bos indicus* x *Bos taurus* cross (Arthur *et al*. 1994; Frisch and O'Neill 1998). However, in the tropics the full benefits of heterosis are not realised because the European *Bos taurus* bulls lack resistance to environmental stresses (Burns *et al.* 1997) and in some regions, and in some years, require special care and attention in order to survive. Furthermore, reductions in herd productivity can also occur because the F_1 progeny from the European *Bos taurus* are not as resistant to environmental stress as the straightbred *Bos indicus* (Lemos *et al*. 1985; Frisch and O'Neill 1998).

In 1997 a group of central Queensland beef producers, who had been cooperating with CSIRO in evaluating bulls from a line of tropically adapted Hereford-Shorthorns named Adaptaurs, formed an incorporated association of Adaptaur breeders. There are approximately 1500 animals recognised by the Association as either half or three-quarters Adaptaur. Animals that are either seven-eighths or full blood constitute another 200 animals. This paper reports some of the background information as to the formation of the Adaptaur Association of Australia and details the performance protocols that have to be followed for the registration of animals with the Association.

BACKGROUND

Northern producers who wish to utilise *Bos taurus* bulls that possess relatively high levels of adaptation to environmental stress could use the African *Bos taurus* (Africander or Tuli), or breeds derived from them (eg Belmont Red). However, additional benefits can be obtained by using adapted European breeds in cross-breeding programs (Frisch and O'Neill 1998). Such breeds do not occur naturally and have to be developed. It was with this intent that the Adaptaur was developed from lines of Herefords and Shorthorns that were introduced on to the National Cattle Breeding Station, 'Belmont' in 1953 (Frisch 1994). In the 1950s Herefords and Shorthorns were crossed to form the HS line which was then closed and not only mated *inter se* but also crossed to Africanders to provide the foundation females for the generation of the Belmont Red. Prior to 1980, the HS line was subjected to various selection criteria, including high pre-weaning growth rate, tick resistance and post-weaning gain, heat tolerance, post-weaning feed intake, and a fertility index of female relatives (see Hetzel *et al.* 1990).

In 1980 evidence began to emerge that a family within the straightbred HS line carried a major gene for extreme resistance to cattle tick (Frisch 1994). Moreover, Hetzel *et al.* (1990) concluded that there was also evidence of natural selection from their multi-trait mixed animal model analysis of growth data from the line. From 1983 onwards, bulls of the HS line were selected for both high tick resistance and high 550 day liveweight and cows were culled for high susceptibility to both cattle ticks and eye disease. O'Neill and Frisch (1998) undertook a respective examination of early published reports of the HS line and contrasted these data with recent (years 1992-96) data of the line. Compared with earlier generations, current animals of the HS line (now called Adaptaur) have significantly increased liveweight at 550 days of age, calving rate and tick resistance but similar birthweight and mature cow weight (Table 1). A detailed explanation of the consequences of the selection process that was applied to the HS line can be found in O'Neill and Frisch (1998).

In 1986 the first Adaptaurs were sold at open auction. The following year, with guidance from CSIRO, a small number of co-operating producers from central and northern Queensland began evaluating Adaptaur bulls and their F_1 Brahman x Adaptaur progeny. Under these conditions Adaptaur bulls were able to survive without the need for any special attention and the heterosis from their F_1 progeny increased herd productivity by over 20%, thus confirming similar findings from Belmont (Frisch and O'Neill 1998).

An Adaptaur users group, consisting of co-operators and producers who had purchased Adaptaurs, was formed in 1994. Two years later this group decided to incorporate as the Adaptaur Association of Australia with the principal aims of further developing and progressing the breed. The constitution and by-laws were drafted in such a way as to maintain the traits for resistance to environmental stress without compromising traits for either growth or fertility. Listed below are the various protocols that have been adopted by the Association.

Table 1. A comparison of data from early (years 1964 to 72) published reports compared to recent (years 1992-96) data of the HS line

Trait	Years 1964 - 72		Years 1992 - 96	
Birthweight (kg)	30.8	(139)[A]	31.1 ± 0.6	(52)
Liveweight at 550 days of age (kg)	244	(110)	265 ± 4	(44)
Mature cow liveweight (kg)	485	(51)	454 ± 6	(72)
Calving rate (%)	67[a]	(515)	89[a]	(179)
Tick count per animal per day	155 ± 16	(13)	32 ± 3	(75)

[A] Number of animals in parentheses.
[a] Difference significant (P<0.01)
Source of data: O'Neill and Frisch (1998)

PERFORMANCE PROTOCOLS

All straightbred Adaptaurs are eligible for registration as foundation animals. The registration of Adaptaurs will require members to submit two forms to the Association. The first form, a 'Calving Report', will list the calves with their date of birth, sex and pedigree and a subjective score for the dam's teat and udder conformation. The second form, a 'Performance Report', provides a summary of the animal's performance for growth, fertility and resistance to environmental stresses. The Association has deemed that certain traits (growth, fertility, tick resistance and resistance to eye disease) be mandatory for recording whilst other traits (coat score, worm resistance and scores for teat and udder conformation) are optional. The traits were given their mandatory status because the Association generally regarded these traits as having the greatest genetic influence on the productivity of Adaptaurs. An explanation of each of the traits that are to be recorded is as follows.

Growth

Animals are weighed and their management group recorded at weaning (WWT), yearling (YWT) and 550 days of age (FWT). WWT and YWT are mandatory and the data are submitted to the National Beef

Recording Scheme (BREEDPLAN) for the generation of within herd Estimated Breeding Values (EBVs) for 200 and 400 days respectively. The FWT data are optional because Adaptaur males are being used as yearling mating bulls and are therefore unavailable for performance recording at later ages.

Fertility

The male fertility trait chosen by the Association is yearling scrotal circumference (SS) and data are submitted to BREEDPLAN for the calculation of EBVs. Measuring SS is mandatory. At this stage the Association is undecided as to which female fertility trait will be chosen. A number of researchers (Ponzoni and Gifford 1994; O'Neill *et al.* 1997) are concerned as to the appropriateness of days to calving as the trait for female fertility and the Association is investigating the use of either calving success or weaning success as a target trait for the tropics.

Resistance to cattle tick

The assessment of an animal's tick resistance is mandatory and is to be undertaken by counting ticks from either a natural or artificial infestation (20,000 larvae) of ticks (see Turner and Short 1972). Tick counting involves counting the maturing ticks on one side of each animal on at least three occasions post-weaning. From these tick counts a tick resistance ratio is calculated within a calf crop, genotype and sex as follows: Ratio (%) = (1 - (mean count of individual / 5 * mean count of the group)) * 100. Ultimately , an EBV for resistance will be developed and linked across herds and to the parent herd at Belmont.

Resistance to bovine infectious keratoconjunctivitis

The incident of Bovine Infectious Keratoconjunctivitis (BIK) ('Pink-Eye' or 'Blight') will be scored using the grading system developed by Frisch (1975). Each eye of each animal must be scored on a scale from 1= clear to 6 = blind. It is mandatory that the animal is scored at least at weaning, yearling and 18 months of age. However, if an animal displays any signs of infection after these initial assessments, they should be recorded and presented to the Association. As with tick resistance, an EBV for resistance to BIK could be developed.

Coat score

The wooliness of the coat is scored from 1 = sleek to 7 = long soft hairy, with a '+' or '-' about each value, thus converting the rating to 21 grades (see Turner and Schleger 1960). Coats need to be assessed three times post weaning (ie winter, spring and summer). EBVs for coat score could be developed. Scoring coats is optional for the purpose of registration.

Resistance to nematodes

The assessment of the animal's burden of worms is from a natural infestation. It is recommended that three to five faecal samples (» 10 g) from each animal are to be taken between weaning and yearling and assessed using the method of Roberts and O'Sullivan (1950). The assessment is optional.

Teat and udder conformation

Within 48 hours of calving the cow's teats and udder are subjectively scored for conformation using a 1 to 9 scoring system developed by O'Neill and Davies (unpublished). Codes for the two scales are as follows:

teats 1 = very small with poor placement, 5 = optimal, 9 = very large ('bottle teats'),
udder 1 = very small and uneven, 5 = optimal, 9 = very large and uneven.

The assessment of teat and udder conformation is optional.

DISCUSSION

The Association has put forward the above protocols, as a basis of registration, to ensure that the collection of data relevant to productivity in the tropics is maintained and that data on performance traits are available for selection of breeding stock. The Association is also aware that genetic improvement within a breed can best be achieved by the appropriate use of EBVs for traits used as selection criteria. However, the economically important traits used to construct the Association's breeding objectives, as distinct from the selection criteria (see Ponzoni and Newman 1989), remain to be formulated. Nevertheless, the Association has commenced contributing data to the Belmont dataset on traits of resistance to environmental stress, data that can be used to generate EBVs for resistance to ticks, BIK and worms and EBV's for coat type. Once these EBVs have been generated, the construction of a selection index (ie an 'Adaptation Index') becomes a viable proposition, which would set the Association apart from all other breed societies. However, the selection protocols developed by the Adaptaur Association could be applied to the selection for tropical adaptation in other breeds of cattle in the tropics.

ACKNOWLEDGMENTS

The authors wish to thank Drs John Frisch, Jay Hetzel and Gerard Davis for helpful comments on the manuscript and to Mr Graeme Halford, Mr John Quilty and Mr Jim Davies of 'Belmont' for their faith in the HS line.

REFERENCES

ARTHUR, P.F., HEARNSHAW, H., KOHUN, P.J. and BARLOW, R. (1994). *Aust. J. Agric. Res*. 45, 783-94.

BURNS, B.M., REID, D.J. and TAYLOR, J.F. (1997). *Aust. J. Exp. Agric*. 37, 399-405.

FRISCH, J.E. (1975). *Anim. Prod*. 21, 265-74.

FRISCH, J.E. (1994). *Proc. 5th Wld. Cong. Genet. App. Livest. Prod.* 20, 293-5.

FRISCH, J.E. and O'NEILL, C.J. (1998). *Proc 6th Wld. Cong. Genet. App. Livest. Prod.* 25, 231-4.

FRISCH, J.E. and O'NEILL, C.J. (1998). *Anim. Sci*. (in press).

HETZEL, D.J.S., QUAAS, R.L., SEIFERT, G.W., BEAN, K.G., ASPDEN, W.J. and MACKINNON, M.J. (1990). *Proc. Assoc. Anim. Breed. Genet*. 8, 451-4.

LEMOS, A.M., TEODORO, R.L., OLIVERA, G.P. and MADELENA, F.E. (1985). *Anim. Prod*. 41, 187-91.

O'NEILL, C.J.,COATES, M. and BURNS, B.M. (1997). *Proc. Assoc. Anim. Breed. Genet*. 12, 466-9.

O'NEILL, C.J. and FRISCH, J.E. (1998). *Proc 6th Wld. Cong. Genet. App. Livest. Prod.* 25, 223-6

PONZONI, R.W. and GIFFORD, D.R. (1994). *J. Anim. Breed. Genet*. 111, 52-64.

PONZONI, R.W. and NEWMAN, S. (1989). *Anim. Prod*. 49, 35-47.

ROBERTS, F.H.S. and O'SULLIVAN, P.J. (1950). *Aust. J. Agric. Res*. 1, 99-102.

TURNER, H.G.and SCHLEGER, A.V. (1960). *Aust. J. Agric. Res*. 11, 645-63.

TURNER, H.G. and SHORT, A.J. (1972). *Aust. J. Agric. Res*. 23, 177-93.