DEVELOPING MULTI-BREED ESTIMATED BREEDING VALUES FOR BEEF CATTLE.

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SUMMARY

A project to develop multi-breed estimated breeding values (EBVs) is being planned for the temperate environment of Southern Australia. Angus and Hereford cows (5,500) will be joined to 90 Angus, Hereford, Limousin and Simmental sires in 1997 and 1998, with the progeny grown out to 2 different liveweights at both pasture and feedlot, and then slaughtered. Progeny performance will be monitored from birth to slaughter, and sire EBV calculated. Sire performance in both a purebreeding and crossbreeding system will be compared, and the data from this project, together with data from existing projects will be used to calculate multi-breed EBVs.

Keywords: Multi-breed EBVs, crossbreeding, purebreeding, southern Australia, beef cattle

INTRODUCTION

The Beef Improvement Association Australia have stressed the importance of developing multi-breed, or non-breed specific EBVs. With the increasing awareness of the development of quality assurance in the beef industry, multi-breed EBVs would be a valuable tool in helping producers meet the required quality standards. The objectives of this paper are to outline the importance of developing multi-breed EBVs, and to describe a project aimed at developing multi-breed EBVs.

It is becoming increasingly important (Johnston *et al.* 1996) to be able to fully describe differences between animals that are to be used in a breeding program, both from a marketing and a breeding aspect. The effectiveness of both purebreeding and crossbreeding programs will be enhanced if an accurate description of the genetic merit of bulls and cows within and across breeds and crosses is available. Currently around 1,500 herds throughout Australia, New Zealand, UK and the USA are using Breedplan, with over 70-75% of Hereford and Poll Hereford and 90% of all Angus seedstock herds producing over 100 calves a year using Breedplan (Sundstrom 1995).

It is now possible to compare an animals genetic merit either within herd, or within breed, using Group Breedplan. However it is not possible to directly compare EBVs between breeds. Accounting for breed differences in the BLUP analysis would allow producers to select bulls, regardless of breed, for the traits they wish to improve. This can be either the desired marketable or maternal traits.

Results from previous breed comparisons and crossbreeding experiments cannot be fully used for this purpose because they used cattle with unknown EBVs and the genetic change has occurred at different rates in each of the breeds. As described by Cundiff (1994) multi-breed EBVs can be used to compare animals on the same fixed scale. In time, with increased experience and use, commercial breeders will be able to decide on the optimum range in multi-breed EBVs for birth weight, direct and maternal weaning and yearling weights, and carcass traits to suit the herd in its production and marketing environment. A simple vision is to be able to compare and select any bull regardless of breed to produce exactly what is needed.

STRATEGY FOR THE DEVELOPMENT OF MULTI-BREED EBVS

The development of multibreed EBVs is likely to proceed through a series of stages . Version 4 of Breedplan, to be released in Nov. 1997, will handle crossbred cattle by defining different genetic groups for different breeds at the top of pedigrees, the analysis being done separately for each breed society database. Unfortunately BREEDPLAN databases have limited data containing head to head comparisons of different breeds and crosses, therefore the second step to develop multi-breed EBVs will be to import information about genetic differences between breeds (to come from the project outlined below, and other projects) into the individual breed society analysis. It would also be possible to import EBVs on individual bulls or cows from other breeds. The best long term solution would be a joint analysis of more than one breed society database.

PROPOSED WORK

The Meat Research Corporation in conjunction with Agriculture Victoria, South Australian Research and Development Institute, and the Animal Genetics and Breeding Unit, are funding a project to supply the data necessary to support multi-breed EBVs. The aim of the project is by 2002, to have multi-breed EBVs, using this data, available for beef sires in Australia.

Sire breeds used will be Angus, Hereford, Limousin and Simmental. Angus and Hereford being the two major breeds in southern Australia (based on herd registrations), followed by Limousin and Simmental. These four sire breeds provide a diversity of genotype, with two representing the most common British breed cattle type and two representing European type cattle. Dam breeds will be Hereford and Angus.

The new MRC funded project will:

(i) Provide links between the breeds used, thus comparing their baseline genetic values

(ii) Provide links between two existing projects (the Southern Crossbreeding, and the Northern Cooperative Research Centre (CRC) crossbreeding projects), so that data from all three programs can be used to estimate the initial genetic correlation between purebred and cross bred performance.

(iii) Examine the EBV ranking for the various traits of sires from the four sire breeds when joined to the two dam breeds

(iv) Examine breed means in fertility, reproductive and maternal traits, and efficiency.

To examine the relationship between the performance of a bull's purebred and crossbred progeny the project will require a total of 90 sires with each having at least 15 steer progeny. Thus a total of 1350 steer progeny must be available for slaughter. The number of sires used and the progeny generated satisfies design criteria, and is also large enough to be perceived as relevant by industry. To test whether correlations between pure and crossbred performance significantly differed from 1, Ponzoni (pers com) found that 104, 55, and 33 sires were needed if the correlation is 0.8, 0.7 and 0.6 respectively. Bulls used in this project need to either have high accuracy EBVs, or be bulls likely to be widely used in industry over the next 2-3 years. They need to represent a range of sire performance within the breed, in order to examine ranking's of sires of different breeds. For example the genetic standard deviation (SD) of 400 day liveweight is around 20kg, and the aim is to use sires that vary by up to 4 SDs, or 80kg. Link sires will be used across this and the other two existing projects so that Breedplan can link the databases and use information from all the existing experiments in a "mega-analysis".

The project will require 5500 cows for mating (over two years). (Allowing for normal losses from mating through to weaning associated with an AI program). Six hundred cows (1200 over 2 years) will be run at the Pastoral and Veterinary Institute, and Struan Research Centre (150 Angus and 150 Hereford at each site), allowing more intensive observations on this subset of animals The remaining 4300 of the cattle required will need to be sourced from private properties. The cow herd does not necessarily need to be performance recorded prior to starting, although this would be useful for adjusting weaning weight, as cows will be randomly allocated to bulls providing a fair comparison of the bulls. Joining will be done using AI, and where possible, all bulls will be used on the one property, thus each management unit will have most sires represented. Mating will take place in June of 1997 and 1998, the project concluding after the final slaughter of the steers in 2001.

At weaning all steer progeny will be purchased and backgrounded in a common system, and on one property if possible, decreasing the variation in the herd as a whole, helping with marketing arrangements, and minimising the effect of pre-weaning management on the animals. They will then be grown out at either pasture or feedlot to 2 different slaughter weights:- probably 270 kg carcass weight for the Korean market, 320 kg carcass weight for the Japanese market.

From weaning onwards, the animals will be scanned regularly for eye muscle area and P8 fat depth, and if the technology is available, marbling. Regular liveweights and scan information will be collected so that these together with two slaughter weights, will be used to construct growth curves for the breeds involved, allowing interpolation to be made and inferences drawn about slaughter at alternative weights and end-points.

All traits currently recorded on Breedplan will be measured (Table 1) on both the steers and heifers produced to weaning. These traits include those likely to be available in the future (such as direct carcass measurements). Also included are traits, such as chemical fat, which are more accurate than AUS-MEAT measurements, and traits, for which simple measurements may be available when the animals are at a stage to be measured. Co-operating producers will be asked to keep pedigree

information, measure birth weight and or calving ease, 200 day and weaning weight. Heifers will be retained at the research stations and joined to examine: age of puberty, days from joining to calving, post-calving anoestrus interval, milk production, calf growth, pelvic size, dystocia, and efficiency.

CONCLUDING REMARKS

Chappel (1994) in his report to the MRC stated that over half the cattle fed for more than 200 days in feedlots fail to meet meat quality objectives, while about a third of cattle fed for 150 days do not achieve the required meat quality and yield standards for the North Asian markets. In feed wastage alone, Australian feedlots lose around 153,000 tonnes of grain or $22.5 million (@$150/tonne) on cattle that do not have the potential to reach specifications. The need for producers to be able to choose breeding stock that accurately meet market requirements is obvious. The development of multi-breed EBVs is seen as an important step in that direction.

Table 1 : Traits to be measured on the dams, heifers and steers, and method of measurement

Measurements	Method	Dams	Heifers	Steers
Birth weight/calving ease	Observation	*	*	*
Fertility - days to calving	Observation	*	*	
Condition score at joining and weaning		*	*	
Liveweight - weaning, 200, 400, 600 days	Scales		*	*
P8 fat, 12/13 fat - weaning, 400, 600 days	Ultra-sound		*	*
Puberty, anoestrus interval	Kmar, tail paint		*	
Milk production	WSW[1]	*	*	
Pelvic size	Pelvimeter	*	*	
Carcass weight, dressing %				*
AUS-MEAT Chiller Assessment, including				*
meat & fat colour P8 fat, 12/13 fat, EMA, VIA, pH	Direct			*
Chemical fat	Laboratory			*
Additional measurements under consideration				
Marbling - live, and other meat quality attributes			*	*
Feed conversion efficiency	Feed intake		*	*
Blood samples for DNA testing			*	*
Mg, Cu, Se, FEC[2] Testing			*	*

[1] WSW = Weigh suckle weigh; [2] FEC=Faecal egg count

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