BREEDPLAN - latest developments

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Session 6b

Adoption Rate in Australasian Seedstock Herds

BREEDPLAN membership is mainly composed of bull breeding, seedstock herds. (Commercial herds use the information in their bull buying, and only the most intensive operations would need to actually enrol their herds). There are currently around 2,150 members in Australia and 1,350 in NZ. Most of this is through corporate membership arrangements with Breed Societies. BREEDPLAN is increasingly dealing with Breed Societies rather than individual members. The Societies have control of their databases and decide policy on such things as which traits they will provide EBVs on, and accuracy levels needed for publication. Societies also decide fee structures for their members, particularly the costs of conducting GROUP BREEDPLAN analyses.

Participation rates in most of the major temperate breeds are now very satisfactory, with virtually all the larger bull breeding herds enrolled in BREEDPLAN. The participation of these large herds is, of course, critical. In the Hereford breed for example, approx 75% of bulls sold, come from the largest 10% of herds, all of which are in BREEDPLAN. As further indication of the involvement of bigger herds, it is interesting to look at the five main British breeds in more detail: In late 2000, around 60% of registered cows in these breeds, were in herds of 100 or more. 87% of these cows were on BREEDPLAN. (See Table 6b-1.) The total numbers of recorded animals and records processed, therefore, has continued to rise satisfactorily with this participation by large herds. An area of concern has been with some Tropical and European breeds, where there is still a need for greater participation. (See Table 6b-2.) Some Tropical breeds now have up to 35 - 70% of their registered females recorded with BREEDPLAN. This is a very significant rise since 1998 and there are definite signs of further rapid progress. The appointment of a Tropical Breeds Technical officer late in 1998, has greatly helped in this area (currently Christian Duff - Rockhampton 07 4927 6066).

Overseas Involvement

Overseas business is important as it allows BREEDPLAN overheads to be spread over more herds. It also assists international evaluations and the exchange of genetics. The use of BREEDPLAN overseas is very significant, particularly in New Zealand and North America. This is for both individual herds and particularly Breed Associations. BREEDPLAN now conducts Trans-Tasman analyses for ten breeds (See Table 6b-3) and Murray Grey also include complete UK, US and Canadian Society data bases in their analysis. Devon include US data with their Aust/NZ analysis, and several other Breeds are in various stages of planning international BREEDPLAN evaluations with their overseas counterparts. These include Shorthorn, Hereford/Poll Hereford and Belmont Red/Bonsmara. The US Salers, Shorthorn and South Devon analyses have been conducted by BREEDPLAN for several years. In major developments in 2001, the North American Hereford analysis was conducted by BREEDPLAN, and analyses for the South African Simmental, Brahman and Simbrah breeds. Business is steadily building in Argentina with 17 Angus and two Poll Hereford herds currently enrolled. Most of the Argentine Angus herds are linked, and combine for a group analysis. Individual herds are enrolled in Brazil, Thailand, Mexico, Canada, Namibia and the Philippines. The Canadian Angus and US Braunvieh pedigree systems are also run by BREEDPLAN. Currently there is significant interest in the UK.

Breeds and Traits in GROUP BREEDPLAN

GROUP BREEDPLAN, which compares animals across herds within a breed, is now by far the most widely used system. Within-herd analyses are used only by a small number of genetically-unlinked herds in the main breeds and by members of some smaller breeds. Some of the new Composite herds are also in this category. Table 6b-3 shows the breeds, average EBVs and their traits currently recorded in GROUP BREEDPLAN.

Table 6b-1. Participation in 5 main British Breeds in BREEDPLAN 2001

Herd Size	No. of cows	% cows in BREEDPLAN	Cumulative %
250 +	47,500	95.0	95.0
150-250	28,500	85.5	91.5
100-150	21,000	70.0	87.0
50-100	29,000	62.5	81.0
25-50	18,500	46.0	76.5
< 25	17,000	28.0	71.5
	161,500		

Table 6b-2. Participation of Breed Groups in BREEDPLAN 2001

	% registered seedstock in industry	% cows on BREEDPLAN
5 main British breeds	60	73
Continental European	12	40
Tropical Breeds	25	44

Latest version of BREEDPLAN - Version 4 since 1999

BREEDPLAN Version 4.1 was introduced by most breeds in 1999. Major improvements were made to the carcase EBVs, including introduction of an intra muscular fat (IMF%), EBV These have created interest in southern areas, as did the new mature cow weight EBV. Some northern breeders also appreciate these features while others have found more use for the better Fertility EBVs, ways of evaluating stock from lower growth rate situations and potential to develop multibreed EBV's. Version 4.2 was released in early 2002. Most of its features other than Net Feed Intake (appendix 1) are not so immediately evident, but include important fine tuning such as: Revised heritabilities and correlations, particularly for carcase EBVs, resulting in more accurate and a bigger range - high and low - of EBVs; Improved calculation of Mature cow weight EBVs; (many of these improvements have come from CRC research, refer paper 6d) a link between fat depth and female fertility; Docility EBVs added to the main model; Scrotal measurements accepted up to 700days; A very brief summary of key Version 4.1and 4.2 features is given below.

The Carcase EBVs

BREEDPLAN EBVs for fat depth (FD), eye muscle area (EMA) have been available since 1990, and Yield% since 1996. Until 1999 they were calculated only from ultrasound scans of live stud cattle, mostly bulls.

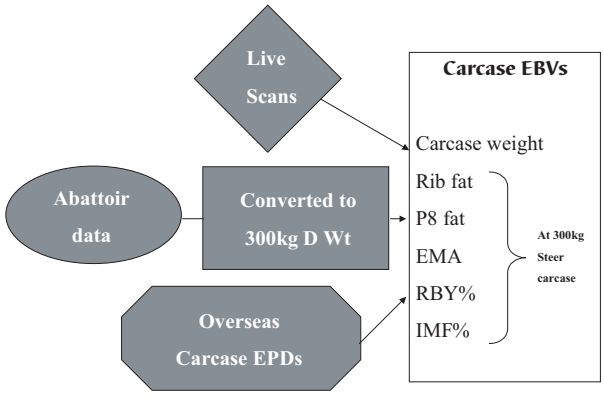


Figure 6b-1.

Demand for a wider range of EBVs, including marbling, and the need to also use abattoir data, led to the major enhancements mentioned above. This was possible through work by the Cooperative Research Centre for Cattle and Beef Quality (CRC) linking BREEDPLAN herds with progeny tests, scanning and detailed abattoir measurements. This enabled the merging of such inputs as bull and heifer scans from studs, steer scans from feedlots, steer abattoir carcase results and overseas data such as US EPDs (see Figure 6b-1).

Carcase EBVs can also be expressed in a variety of ways. Until 1999 these EBVs were expressed at a constant age of 450 days, and the units (mm of fat, cm^2 of EMA) largely reflected differences in bulls, as they were the main animals scanned. With steer (and heifer) abattoir information being merged with scans (mainly of bulls, some heifers and steers), it was decided that a steer carcase endpoint was more logical. Scanning had also progressed, and was becoming increasingly useful for evaluating genetic merit for IMF%. Heifer scanning is particularly effective here (refer paper 5c). BREEDPLAN (V4) therefore:

- Epresses EBVs on a 300kg steer carcase equivalent
- Combines abattoir carcase measurements with live scans
- Imports overseas EBVs/EPDs and converts these to Australian equivalents for inclusion in the analysis.

Imported Animals

Figure 6b-1 shows how carcase EPDs developed overseas on imported animals are incorporated into the analysis. The same concept is used for other traits e.g. using growth EPDs of imported US Brahmans.

Mature Cow Weight

Optimum cow size is an important ingredient for profitable breeding herd management. Most commercial breeders do not want really big cows, yet need steers with adequate growth

rate. The mature weight EBV introduced in 1999, assists breeders balance these potentially conflicting needs. Since 1999 mature weight data has gradually accumulated in some breeds, enabling an improved method of analysis to be introduced in 2002. Studs need to record cow weight at weaning to obtain these EBVs accurately. Cow condition or fat score of course also effects cow weight, and hence Mature WT EBVs. Currently this is not used in the analysis, but studs are asked to collect the information for future possible further enhancement of this EBV.

BreedObject

With increasing numbers of EBVs available, and the desire for balanced genetics, demand for methods of combining EBVs into an economically weighted index has been slowly building. Foreseeing this requirement, the Animal Genetics & Breeding Unit (AGBU), with MLA funding, has for several years been developing the concept, marketed as BreedObject (Breeding Objective). Options include a bureau service through the Breed Societies and BREEDPLAN, now seen widely on some breed websites and in sale catalogues (refer; a PC version for consultants to develop customised indices for breeders, societies etc; and a junior version for individual breeders to do indices for clients, and their own selection. BreedObject is also used in assisting the judging of performance classes at shows. The latest version now uses all the Version 4 EBVs, except Docility and NFI. A website version with access for bull buyers was launched in 2000 (http://breedobject.com). See paper 6c for detail.

Links to the Beef CRC

BREEDPLAN had strong links with the genetics program of the Beef CRC I (1993-2000) and CRC II (2000-2006) and also several other large commercial and research progeny tests. The CRC I straight breeding program involved the Angus, Hereford, Murray Grey, Shorthorn, Brahman, Santa Gertrudis and Belmont Red breeds. Studs of these breeds generated progeny for CRC use, from associated commercial herds.

Prominent link sires were used in these stud and commercial herds and the growth and carcase data has been fed into BREEDPLAN (over 10,000 steers).

The CRC I Northern Crossbreeding experiment involved Brahman cows joined to the above breeds except Murray Grey, but with Charolais and Limousin added.

In all the CRC I work, half of all progeny were finished on grain and half on grass. There were common sires for both programs, and slaughter at three weights. This has allowed the comparison of EBVs for straight and crossbreeding, grain or grass finishing and Northern and Southern environments (paper 6d). This data is also gradually being used to assist in the generation of Multibreed EBVs, and possibly a common EBV base for breeds which desire this.

CRC II does not have a genetics program of this type. There are, however, major field studies on marker assisted selection for carcase traits, and other genetics work with 3000 Brahman and Composite cows in Northern Pastoral Co herds. This is also investigating the effect of selection on carcase traits, on fertility. CRC II also has major demonstration herds in southern NSW, Victoria and Western Australia testing genetic and nutritional pathways to various markets. All sires in these projects are well linked to BREEDPLAN, and provide valuable extra data as the research progresses.

Price Differential at bull sales

In most breeds, which have a mix of BREEDPLAN users and non users, there are very positive price premiums for bulls with EBVs. Clearance rates are also much better.

In breeds with very widespread use of BREEDPLAN, premiums are now more seen for bulls with a full range of EBVs which are balanced. Accuracy also attracts bull buyers in some situations e.g. birth weight.

Other Traits and Services

- Calving Ease. Several breeds now publish EBVs on sires, for Direct Calving Ease and Daughters Calving Ease. These are computed from birth weight, calving ease score and gestation length data. Breeds which have calving difficulty and do not have these EBVs, need to expedite data collection.
- Multibreed EBVs. Progress is being assisted by a recently commissioned multibreed database. This will initially store progeny test data from industry and government crossbreeding experiments (e.g. CRC; Hamilton. A challenge is to now get this data from the various organisations!) Breed Societies wishing to do so, will be able to use relevant portions of this information in their analysis. This data base was initially funded by MLA, and developed by BREEDPLAN.

  Several breeds have started accepting crossbred or composite data, and some have included this in their main analysis and produced EBVs on the crossbreeds, set

against the breed base. Some major tropical composite breeders are conducting their own group analysis. (A discussion paper on performance recording composites is on the website of Composite Beef Breeders Australia: http://www.compositebeef.com.au)

- Multiple sire joinings and marking to weaning options. These innovations are designed for larger herds and those not able to collect birth dates. While both are now incorporated in the main BREEDPLAN model, their use awaits Breed Society and ABRI initiatives to customise the data input and reporting software.
- Temperament. There are some important initiatives in the area of temperament. The Limousin society has been offering Docility EBVs since 1999. These have been based on temperament scores in yard and crush situations. The analysis was initially done by AGBU, but is now part of the main BREEDPLAN V4.2 model, and any Society collecting the data in this format , will be able to obtain EBVs. Recent research by the CRC has shown flight speed, as recorded by a light beam on cattle leaving the crush, will be a good way to measure this trait, in Tropical breeds. The flight speed data also shows favourable links to tenderness. Major field trials in northern studs are planned.
- Feed efficiency research has now reached the stage where Angus, Hereford/Poll Hereford have sufficient data to provide the first trial BREEDPLAN EBVs. (see detail Appendix1)
- Electronic data transfer options by disc or Email are expanding, as are Animal Selection and Sale cataloguing search services on Breed Society websites.

  The BREEDPLAN website (http://breedplan.une.edu.au) has links with most Breed Societies. All the BREEDPLAN Technotes are on this site, including some in Spanish for South America. Newsletters and a set of Powerpoint slides explaining BREEDPLAN are among other items found here.
- Incorporation of Gene Marker information. With the first marker for a commercial trait -GeneStar marbling - released last year, and more to follow soon, the incorporation of such information into BREEDPLAN is currently a major area of research at AGBU. An important point, is that it will add to, rather than replace current genetic evaluations such as BREEDPLAN. Take carcase EBVs for example. We currently calculate them from scans, abattoir data and overseas EPDs (Figure 6b-1). Marker data will be another source, (Figure 2). The importance of this source will depend on factors such as the proportion of a trait's variation explained by the marker, and what other data is available on the trait. Research on this requires large unbiased data sets(not just the results from positive "tests"). It will therefore take some time before widespread usage in BREEDPLAN. There is currently discussion as to whether first "BREEDPLAN use" of markers may be to build the information into BreedObject $Indices, or TGRM mating recommendations, rather than straight into EBVs. While this research is progressing, other initiatives can be undertaken. For example, once a Breed has significant numbers of animals tested, there will be benefits in pooling this data, as predictions can be made on relatives without testing all animals. There will also be some interesting decisions to be made as pedigrees are 'challenged'.

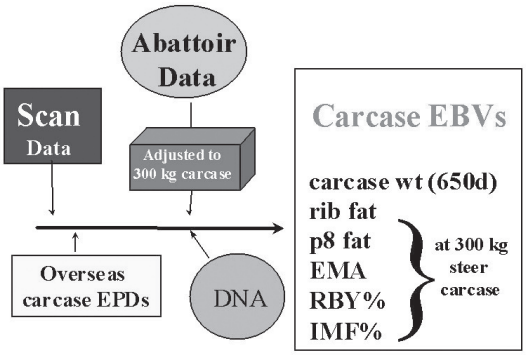


Figure 6b-2.

Extension Activities

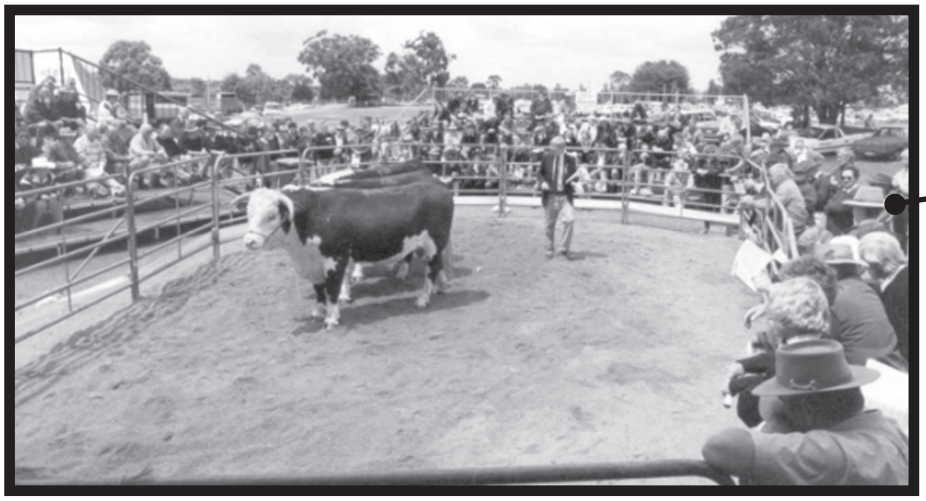
Extension support in Australia continues to be delivered by a mix of State extension services, and increasingly, Breed Society technical staff. State extension staff vary greatly in their ability to support BREEDPLAN. While the overall trend is to wind these services down, most states still have some active, well trained people. Victoria, and NSW have several new young beef extension officers. A major extension initiative in the "public sector", has been a series of Field Days - "Better Bull Buying to Target Markets". These teach the applied use of BREEDPLAN with a market orientation. Similar initiatives have been conducted by some Breed Societies with their technical staff. Some of the larger breed associations run major series of field days and meetings updating members on new developments. MLA has developed a major education program, the Edge Network, which includes genetics modules.

A full time BREEDPLAN extension co-ordinator position at ABRI was jointly supported by the States in rotation and with MRC financial help, until 1992. Since then, NSW Agriculture has provided an officer part time (myself) with ABRI paying a consultancy fee for that portion of the work which is National. This facility provides some support for State and Breed Society extension staff. With the latter group, there is considerable co-operation such as sharing extension literature, joint field days etc.

In September 1998 a full time Tropical Breeds Technical officer was appointed. This Rockhampton based position is supported by 9 Tropical Breeds, ABRI and MLA.

Some Challenges For the Future

- Ensuring continuing industry/govt. funding of Research and Development.
- Maintaining a balance of Breed Society and independent extension.
- Implementing Multibreed EBVs.
- Educating members in the correct use of management group codes, and the need for full herd recording.
- Implementing female fertility EBVs for more Tropical breeds.
- Increasing the use of feed efficiency EBVs.
- Developing techniques to utilize information from molecular genetics. (DNA/Gene marker tests).
- Working towards a common base for some breeds (see also paper S6).



Performance classes at shows are one of the many continuing extension efforts to promote BREEDPLAN. In this one, at Hamilton, the author (arrowed) gives out Performance points (50%) while the visual judge allocates his 50%.

Table 6b-3. Breed average EBVs for the breeds and traits in Group BREEDPLAN 2002/2003

		Calving Ease			Growth & Maternal					Fertility		Carc		
BREED	Aust & NZ	Calving Ease DIR (%)	DTRS (%)	Gestation Length (days)	Birth Weight (kg)	200-Day Weight (kg)	400-Day Weight (kg)	600-Day Weight (kg)	Mature Weight (kg)	Milk (kg)	Scrotal Size (cm)	Days to Calving (days)	Carcase Wt (kg)	Eye Muscle Area (sq. cm)	Rib Fat (mm)
Angus	**Y**	-0.1	0.0	-1.3	+4.0	+28	+52	+67	+65	+9	+0.8	-0.6	+33	+1.2	-0.1
Belmont Red (2002)	**-**	-	-	-	+1.6	+7	+10	+14	-	+1	+0.3	-	+9	+1.5	0.0
Blonde d'Aquitaine (2002)	**Y**	-	-	-	+0.0	+3	+5	+7	-	+1	+0.2	-	+5	+0.4	+0.3
Braford (2002)	-	-	-	-	-	+6	+11	+15	+16	+2	0.0	-	-	-	-
Brahman (2002)	**-**	-	-	-	+1.5	+11	+16	+20	+20	-1	+0.4	-0.4	+11	+1.7	+0.1
Brangus (2002)	**-**	**-**	**-**	**-**	-0.5	+4	+6	+8	+9	+1	+0.1	-	+4	+0.7	+0.1
Charolais (2002)	**Y**	0.0	-0.9	-0.5	+0.7	+6	+12	+15	-	+3	+0.3	-	+10	+0.9	0.0
Devon (2002)	-	-	-	-	+0.9	+5	+8	+10	+9	+1	+0.1	-	+6	+0.7	0.0
Droughtmaster (2002)	**-**	-	-	-	-0.2	+1	+2	+3	+4	0	0.0	-	+2	+0.3	-0.1
Gelbvieh (2002)	**-**	-	-	-0.4	+0.9	+9	+14	+19	+20	+3	+0.2	-	+12	0.0	0.0
Hereford/Poll Hereford	**Y**	-1.0	0.0	0.0	+4.1	+21	+33	+48	+48	+8	+0.9	-0.9	+27	+1.8	+0.1
Limousin	**Y**	-0.8	0.0	-0.5	+1.3	+12	+19	+25	+24	+2	+0.3	-0.2	+16	+0.4	0.0
Murray Grey	**Y***	-0.4	-1.1	0.0	+2.0	+11	+18	+27	+27	+3	0.0	-0.5	+15	+0.7	0.0
Red Angus	-	-	-	-	+2.2	+20	+30	+41	+40	+7	+0.6	-	+24	+0.6	-0.1
Salers (2002)	**Y**	-	-	-	0.0	+4	+5	+6	+7.0	+2	+0.1	-	-	+0.3	-0.1
Shorthorn	**Y**	-	-	-0.5	+2.7	+17	+23	+32	+32	+4	+0.7	-	+22	+2.2	-0.6
Simmental (2002)	**Y**	-0.6	-0.6	-0.3	+1.6	+14	+22	+24	+24	+7	+0.3	-1.0	+15	+0.8	0.0
South Devon (2002)	**Y**	-	-	-0.3	+0.4	+6	+10	+14	+14	+1	+0.4	-	+9	+0.3	0.0
Santa Gertrudis (2002)	**-**	-	-	-	-	+1	+3	+3	+3	0	0.0	-	+1	+0.7	0.0

(2002) indicates 2002 GROUP analysis and EBVs refer to average EBVs for 2000-drop calves

*** Murray Grey GROUP BREEDPLAN analysis includes data from Australia, New Zealand, America and Canada**

This table has been compiled from the 2003 Sire Summaries and GROUP herd reports of the various breeds as an aid to bull buyers.
The average EBVs for the 2001 calf drop is an indication of the current genetic level of the breed based on the latest calf crop with a potentially complet

Steven Skinner, ABRI
7-January-2003

You CANNOT make between-breed assumptions from these figures. You can only compare GROUP BREEDPLAN EBVs within a breed.
There has been no attempt to standardise the EBVs across breeds.

Appendix 1
Net feed intake EBVs - a feed efficiency measure

Introduction

Since its inception, BREEDPLAN has progressively increased the range of traits breeders can choose to record. To the initial growth and milk traits, have been added calving ease, fertility and carcase traits, and now in 2002 - Net Feed Intake, a measure of feed efficiency.

Feed efficiency is recognised as one of the most economically important production traits. It particularly affects profitability of feedlots, but is also significant for grazing enterprises. Imagine the benefits of being able to run even 5% more stock in a paddock or for feedlots to reduce feed costs 5% without changing output. The incorporation of feed efficiency tests into BREEDPLAN, has had to wait for detailed research on how to measure and interpret the trait, then sufficient bull breeders to carry out testing. The NSW Agriculture research team at Trangie, with MLA (Meat and Livestock Australia) funding assistance, has been conducting a major experiment since 1993 to gather the required information. Results from the Cooperative Research Centre for Cattle and Beef Quality (Beef CRC) at Armidale, using facilities at its "Tullimba" feedlot, have increased our understanding of the trait and added to the numbers of cattle tested.

Net Feed Intake

Following extensive industry consultation, the research teams have recommended that BREEDPLAN uses the measure NET FEED INTAKE (NFI). In simple terms, this is **the amount of feed an animal eats, under or over, that expected for its weight and gain**. **This measure has the important benefit of being independent of the animal's weight and gain.** By contrast for example, the common measure of FCR (Feed Conversion Ratio, calculated as feed intake / weight gain), was rejected because of its close link with gain and mature size. Selection on FCR would rapidly increase mature weight. With NFI, more efficient cattle can be found within any desired cattle size range, and selection will not increase mature size.

How is NFI Measured?

Feed intake tests can either be conducted on farm or, more commonly, at central test stations. Individual feed intakes are currently measured over a set test period of 70 days. (Investigations are continuing into ways of shortening the test. This will depend on the facilities and particularly how often cattle are weighed). While manual feeding systems can be used, most results have come from automated self feeders and cattle with electronic I/D. A standard, medium energy hay and grain ration (10 MJ ME/kgDM) is offered free choice. Young bulls are most commonly tested, but some steer and heifer data is also used. Test cattle are weighed regularly and their intakes compared with their performance, to determine if they have eaten more (+) or less (-) than expected. Test protocols are set out in an accreditation manual, and only data from accredited systems is accepted by BREEDPLAN. This is on the recommendation of Performance Beef Breeders Association the body representing Breed Societies in GROUP BREEDPLAN.

Data Used for the First BREEDPLAN EBVs 2001/2002

In recent years some progressive studs have sent young bulls to government and private test stations in NSW, Vic and WA. These results have been combined with steer data from "Tullimba" feedlot and "Trangie" research data using pedigree links.

At this stage only two breeds - Angus and Hereford/ Poll Hereford have sufficient, well linked data, to have their data analysed by the Animal Genetics and Breeding Unit (AGBU) to produce across herd trial GROUP BREEDPLAN EBVs. These are published in these Breeds' Sire summaries and websites. As other breeds accumulate data, they will also be able to publish EBVs.

Reporting and Interpreting NFI EBVs

NFI EBVs are reported as Kg of feed eaten per day. Like most EBVs they can be + or - relative to breed average. The more negative, the less feed eaten and the more efficient. For example, two bulls with these EBVs: -

Bull A + 0.5 kg/day (Breed Av is 0)
Bull B – 0.7kg/day

A simple interpretation, is that Bull B having more negative NFI EBVs, would be expected to breed 'more efficient' progeny, than Bull A or a breed average bull. If the two bulls were similar in weight EBVs and joined to average cows, progeny of B would eat 0.6kg less per day than the progeny of A (half the difference of 1.2 between the Sire EBV, as the cows contribute half the genes).

Research Results and Correlations with other Traits?

The research outlined above is continuing, and will among other things, determine if there are any other traits significantly affected by selecting for NFI. To date the only significant finding is a small link with leanness (cattle with lower NFI EBVs, being slightly leaner). While this needs to be watched, the correlation is quite low e.g. less than the birth to final weight link, and can therefore

be managed by selecting on both traits. For this 2001/2002 EBV release, AGBU has used a single trait model. As the correlations with other traits become better known, NFI will be incorporated into the full multi trait BREEDPLAN model.

Several experimental lines of steers, sired by High and Low NFI EBV Sires, have shown predicted changes in NFI in the feedlot.The trait, as measured on young bulls and heifers, is of similar heritability to weight gain. Heifers retained for breeding in research herds have to date shown no effect on fertility or other production traits As cows, the negative NFI EBVs lines appear to be more feed efficient under grazing. The CRC research group is looking for gene markers or physiological tests that may be able to assist in identifying feed efficiency. The most promising lead at present is the blood hormone IGF-1 (Insulin like Growth Factor). IGF-1 is correlated to feed efficiency in pigs, and has been used for several years in the PIGBLUP genetic evaluation program (a 'stablemate' of BREEDPLAN). The blood test is conducted by Primegro Pty Ltd, which has the exclusive right to commercialise this Australian owned IP.

AGBU geneticists led by Dr David Johnston, early this year analysed Feed Efficiency data from Trangie research station and the "Tullimba" feedlot. They were very encouraged to find a favourable correlation between IGF-1 and Net Feed Intake. There were also genetic correlations with fat depth and IMF%. Genetically fatter animals have higher IGF-1 concentrations. i.e. the one measure has the potential to provide very valuable information about three important traits at a relatively low cost and at an early stage of the animal's life.

With funding support from MLA, AGBU is leading a project which started this autumn 2002, to collect blood samples from 8,000 weaner bulls and heifers in BREEDPLAN herds. To minimise costs, this work is being concentrated on the East Coast and in herds that scan. They are also conducting more detailed tests on some research herds such as "Trangie", the Durham Shorthorn research herd at Orange, which had its first weaners through "Tullimba" mid year and Australian Angus Alliance steers through Rutherglen feedlot this spring. All animals in the CRC-2 Northern breeding project are also being recorded repeatedly for IGF-1. This will provide answers such as best age to measure.

Reg Woodgate, NSW Agriculture at Armidale has collected most of the 7,500 blood samples to date.

The blood is collected on simple absorbent paper cards.