Research into Feed Efficiency and its Implementation in BREEDPLAN

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- The CRC has a major research program on feed efficiency. There are links to many other projects such as breed society progeny tests and gene marker research.
- For genetic evaluation in Australia, feed efficiency is measured as Net feed Intake (NFI). NFI is the feed consumed by cattle under (-) or over (+) that expected for their weight and gain. ie: efficient cattle of any size can be selected.
- NFI EBVs are now available in BREEDPLAN for breeders doing the required testing. Negative EBVs indicate lower feed intakes.
- NFI has similar heritability to growth, so good selection progress is possible once practical testing options are widely available.
- Testing currently involves the costly procedure of feed intake measuring for 70 days. Several studs are now successfully doing this on farm, or at central test stations.
- A blood test for IGF1 (Insulin growth factor) has been shown in CRC research to be a promising early predictor of NFI and some fatness measures. This research is continuing and already being used by some studs in anticipation of incorporation into BREEDPLAN.

Introduction

The CRC has had a major stream of research into feed efficiency. This includes the selection line experiments at NSW Agriculture's "Trangie" research centre, steer and bull testing at "Tullimba" feedlot, and co-operation with several other industry projects around Australia

Feed efficiency is 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 having even 5% more grazing days in a paddock or for feedlots to reduce feed costs 5% without changing output. This is quite possible and innovators are already implementing early stages via BREEDPLAN, as discussed below.

Like many of the CRC genetics research programs, delivery of the results to industry is best done through BREEDPLAN. This allows progress across the main stud breeding industry and then their bull buying clients, be they straight breeders or crossbreeders.

The incorporation of feed efficiency tests into BREEDPLAN, has had to wait for very detailed research on how to measure, interpret and report the trait, then sufficient bull breeders to carry out testing. This finally culminated in three breeds releasing BREEDPLAN Estimated Breeding Values (EBVs) early in 2002.

I will now refresh on the feed efficiency trait being used, early results in the market place and a promising new blood test being researched. This IGF 1 blood test may be able to improve the accuracy of these EBVs and the scale on which they are adopted.

Net Feed Intake (NFI) - the trait used

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 NFI is currently being measured

Feed intake tests are either conducted on studs or, more commonly, at central test stations. Various feed intake measuring systems have been developed, including the Tullimba self feeder developed by CRC staff and commercialised by Ruddweigh.

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/kg DM) is offered free choice. Young bulls are most commonly tested, but some steer and heifer data is also used to give information on their sires and relatives. Test cattle are weighed regularly and their intakes compared with their performance, to determine if they have eaten more (+) or less (-) than expected.

Table 1. Some examples of NFI 2002 BREEDPLAN EBVs for industry sires

	NFI EBV (kg / day)
Angus	
Ardrossan P Master	-0.9
GAR Precision	-0.8
Future Direction	-0.4
New Design 036; New Trend 315	0.0
Rambo JRS	+0.4
Kelp	+0.4
Hereford	
Coora Essex	-0.5
Hotshot RHHR	0.0
IHM Domino	+0.3

Data used for the first BREEDPLAN EBVs 2001/2002

From 1995 to 2002 some progressive studs sent young bulls to the government and private test stations listed above. These results were combined with steer data from "Tullimba" feedlot and "Trangie" research data, using pedigree links.

By early 2002 only two breeds - Angus and Hereford/Poll Hereford had sufficient, well linked data, to have their results analysed by the Animal Genetics and Breeding Unit (AGBU) to produce across herd GROUP BREEDPLAN EBVs. These have been published in these Breeds' Sire summaries and websites and in individual breeder's sale catalogues. 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 positive or negative 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 Average 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 gain the same, but eat 0.6 kg 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 trait, as measured on young bulls and heifers, is of similar heritability to weight gain. Several experimental lines of steers, sired by High and Low NFI EBV Sires, have demonstrated this by showing the predicted changes in NFI in the feedlot. Ie: when given ad lib access to a similar diet to that on which their parents were selected.

A fair question is therefore: "would these results hold under grazing?" Steers from the High and Low efficiency lines from "Trangie" have been grown out on pastures of varying quality. In one experiment their intakes were measured via slow release rumen capsules. Both lines had similar intakes, but the High line grew faster and therefore had better feed efficiency.

Continuing CRC research will among other things, determine the relationship with some other traits 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 and lower marbling). 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.

Heifers retained for breeding in research herds, in early results, have to date shown no effect on fertility or other production traits. As cows, the negative NFI EBV lines appear to also be more feed efficient under grazing.

New research – Insulin like Growth Factor (IGF-1)

The CRC research group is also looking for gene markers or physiological tests that may be able to assist in testing. 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 AGBU's PIGBLUP genetic evaluation program (equivalent to BREEDPLAN). The blood test is conducted by Primegro Pty Ltd, which has the exclusive right to commercialise this Australian owned IP.

AGBU geneticists early this year analysed Feed Efficiency data from Trangie 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 the fatness measures, 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.

The most appropriate age at which to test the IGF levels is still being determined, but weaning appears to be a starter. This means that if submitted along with 200 day

weights, informed decisions could be made about fattening, marbling and NFI at an early age. AGBU has therefore started a major trial, with NSW Agriculture and other CRC researchers, to hopefully confirm this, and fine-tune methods for recording IGF-1 in seedstock herds.

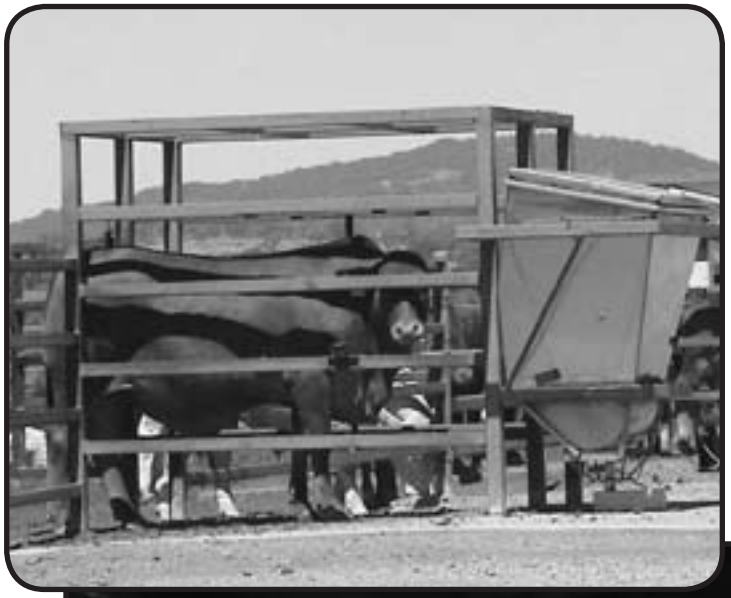
With funding support from MLA, AGBU is leading a project which started in autumn 2002, to collect blood samples from 8,000 weaner bulls and heifers in BREEDPLAN herds.

Hans Graser, Director of AGBU, says "*Our current feeling is this IGF-1 test will not totally replace actual feed intake measurements. It has the potential to allow a better selection of the bulls to enter the feed intake test and to significantly add accuracy to EBVs at a young age*".

In the interim, breeders wanting to quickly progress this trait have to conduct feed intake tests. These are unfortunately quite expensive and time consuming for the studs involved, but detailed economic studies show they will deliver net benefits to the industry. There are already indications of bull buyers recognising this in their support for some of the pioneering studs with NFI EBVs.

At the time of writing these notes (October '03), some stud breeders believing the IGF test will come into widespread use are collecting samples and storing the results for later entry to BREEDPLAN.

Feed intake recording



IGF1 blood test samples are collected on these sample cards.


RANGERS VALLEY
1996 LOT FEEDER OF THE YEAR
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NATIONAL GRAIN FED BEEF COMPETITION 2000 JAPAN B3 + FEEDLOT CATEGORY WINNER
NATIONAL GRAIN FED BEEF COMPETITION 2000 JAPAN B3 + FEEDLOT CATEGORY RUNNERUP