MURRAY GREY Technical

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INFORMATION FOR MURRAY GREY SOCIETY MEMBERS

Improving efficiency in herds

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In a world first, Australian researchers have provided a system to reduce the cost of beef production through genetic improvement of feed efficiency. This system, which will enable seedstock producers to select cattle with reduced feed intake without affecting the level of performance, comes in the form of a Trial BREEDPLAN Estimated Breeding Value (EBV) called Net Feed Intake (NFI).

The NFI EBV, expressed as a plus or minus figure, is calculated as the difference between an animals actual daily feed intake, and its expected intake after allowing for the requirements for growth and live-weight. Because an efficient animal eats less than expected, it will have a negative EBV, while an animal that eats more than expected, will have a positive EBV. It is important to remember, that when we refer to a "Low-NFI" animal, we are dealing with an animal with relatively low intake, hence it is more efficient.

For the purpose of making genetic comparisons of feed efficiency in beef cattle, NFI has been identified as being of greater all-round potential benefit to the commercial Australian beef industry than the traditional measure of feed conversion ratio (FCR). This is because FCR is highly correlated with growth rate, and so higher growth animals will tend to be more efficient. However, higher growth animals also tend to have larger mature size, and so if we selected on the basis of FCR we would increase cow size and cow feed requirements. Thus while we would have very efficient animals in the feedlot, the breeding sector would pay the penalty in terms of reduced cow numbers carried per hectare. Similar changes could be achieved by simply selecting for growth rate.

On the other hand, NFI is largely independent of the component traits, growth rate and bodyweight, so selecting for NFI will produce little change in growth and mature size, while feed intake will decrease. Of course, in practice we may select for both NFI and growth, and improve both traits simultaneously. Selecting a high growth bull with good (negative) NFI will produce animals with superior FCR as well. However, the advantage of NFI over FCR is that it allows different breeders to place different emphasis on growth and feed efficiency. NFI also has much better statistical properties than FCR, making the use of NFI for calculating EBVs much more desirable.

Implications of selecting for lower NFI

Research by NSW Agriculture at Trangie, and by the Cooperative Research Centre (Beef Quality) have shown that there is genetic variation in feed efficiency in the Australian cattle population. The heritability of NFI is calculated to be 0.39, the same as actual feed intake, and higher than feed conversion ratio (0.29) and daily gain (0.28) indicating that genetic improvement is possible through selection for NFI. At Trangie, young bulls and heifers from Angus, Hereford, Poll Hereford and Shorthorn breeds were measured for NFI. Substantial variation between individuals was found, with the best animal eating 4.6 kg/day less feed than the worst animal when compared at the same level of performance.

Differences between High and Low NFI animals following two generations of selection for NFI are consistent with the premise that NFI is independent of liveweight and growth, as there was no correlated response in either yearling weight or average daily gain. Results are shown in Table 1. Correlated responses with feed intake, feed conversion ratio and subcutaneous fat depth were significant.

Of possible concern in some sectors of the industry is this relationship between NFI and fatness, with more efficient (lower NFI) animals tending to be slightly leaner. For the technically minded, the genetic correlation between these traits during the Trangie postweaning tests were 0.17 (rib) and 0.06 (rump), which are slight to negligible. Steer progeny of parents selected for one generation for high and low NFI, grown on pasture then finished for slaughter in a feedlot also showed a slight association with subcutaneous fat.

TRAIT	LOW NFI (more efficient)	HIGH NFI (less efficient)	DIFFERENCE IS SIGNIFICANT
365-day liveweight (kg)	384.3	380.7	No
Average daily gain (kg/day)	1.44	1.40	No
Actual feed intake (kg/day)	9.4	10.6	Yes
Net feed intake (kg/day	-0.54	+0.71	Yes
Feed conversion ratio	6.6	7.8	Yes
Rump (P8) fat depth (mm)	6.7	8.0	Yes

Table 1. Performance of progeny of high NFI and low NFI bulls and heifers following two generations of selection.

Low NFI (more efficient) steers had slightly less fat over both rib and rump (rib 10.2 mm vs 11.6 mm, rump 13.3 mm vs 14.8 mm).

Results also suggest there is an association with marbling score, or intramuscular fat (IMF) %. As with subcutaneous fat, the association is weak, with genetic correlation estimates ranging from nothing to 0.17, depending on the type of test and age and maturity of the animals. Continued selection for lower NFI might lead to significantly lower levels of fat and subsequently alter market suitability and value of steer progeny. On-going selection for animals with improved NFI should therefore be conducted in conjunction with careful monitoring of these other traits.

Industry testing for NFI has identified a number of sires as having significantly lower than average NFI (more efficient) and significantly higher than average marbling. As numbers of industry animals tested increases, the number of sires identified as being genetically superior for both traits is also expected to increase

Four Angus bulls identified as having exceptional figures for both NFI and IMF are shown in Table 2. Two of these, CA Future Direction 5321 and GAR Precision 1680 are recognised AI sires identified through testing of their progeny. Two, Bald Blair New Design V86 and Ythanbrae GAR New Design 036 V599 were born in 2000 and tested postweaning for NFI.

Selection indexes combine individual EBVs to provide an economic ranking, for individual bulls for specific markets. Table 2 also shows EBVs for NFI and IMF, Japanese B3 $Index and percentiles for each of these four bulls.

High efficient steers perform better when pasture availability is limited.

Steer progeny of Low and High NFI parents following a single generation of selection showed a significant performance advantage when pasture availability limited potential animal growth rates to an average of 0.46 kg/day. Angus steers were grown at Glen Innes over Spring/Summer 1998, during a period of restricted pasture growth. Pasture intake was assessed using intra-ruminal controlled release alkane capsules. Low NFI (low intake: more efficient) steers grew 22% faster than High NFI (high intake: less efficient) steers, and had 25% better FCR. Results are shown in Table 3.

Estimated Breeding Values for NFI

Information on feed intake and efficiency forms the basis of the Trial BREEDPLAN EBV for NFI that has been available since early 2002. To date, only three breeds - Angus, Hereford and Poll Hereford have sufficient, well-linked data, to have their data analysed by the Animal Genetics and Breeding Unit (AGBU) to produce across herd EBVs. These are published in their Breeds' Sire summaries and websites. As other breeds accumulate data, they will also be able to publish EBVs.

NFI EBVs are reported as kg of feed eaten per day. The lower (more negative) the figure, the less feed eaten (after adjusting for liveweight and growth rate), the more efficient the animal.

For example, two bulls with the following EBVs:
Bull A: +0.6 kg/day
Bull B: -0.8kg/day

A simple interpretation, is that Bull B (having more -ve NFI EBVs) would be expected to breed "more efficient" progeny than Bull A. If the two bulls had similar EBVs for growth and were joined to average cows, progeny of Bull B would gain the same, but eat 0.7 kg less per day than the progeny of Bull A (half the difference of 1.4 kg between the Sire EBV, as the cows contribute half the genes).

Trial BREEDPLAN EBVs currently available:
FOR ANGUS
· EBVs are available for 4,496 animals from 2,294 individual feed intake records:
· EBV's ranged from -1.41 to +1.23 with accuracy's to 87%
FOR HEREFORD AND POLL HEREFORD
· EBVs are available for 1,491 animals from 601 individual feed intake records:
· EBVs ranged from -0.80 to +0.88 with accuracy's to 78%

Testing a proportion of bulls, selected on relevant information available at weaning, is theoretically profitable on an industry wide basis, for most production systems, and including most grass-fed and grain-finished markets. Commercial breeders should, over a reasonable period of time, be able to achieve economic benefits from incorporating NFI in their breeding criteria. It is not surprising, however, that the greatest potential benefits are available to those breeders targeting the markets where feed costs are greatest, such as the high quality Japanese grain-fed markets. Initial selection of suitable bulls to meet the strict requirements for these markets is essential, and cannot be overlooked when including NFI in breeding programs.

NOTE: Cattle numbers available for NFI Testing to-date have only been for the breeds quoted.

BULL	NFI EBV	PERC.	IMF EBV	PERC.	JAPAN B3 INDEX EBV	PERC.
CA Future Direction 5321	-0.46	Top 10%	2.4	Top 1%	$97	Top 1%
GAR Precision 1680	-0.83	Top 1%	1.1	Top 10%	$100	Top 1%
Bald Blair New Design V86	-0.58	Top 5%	1.7	Top 5%	$77	Top 5%
Ythanbrae GAR New Design 036 V599	-0.98	Top 1%	1.1	Top 10%	$97	Top 1%

Table 2. EBVs, Japanese B3 Index and Percentiles for industry identified bulls.

	LOW NFI (more efficient)	HIGH NFI (less efficient)	BENEFIT
Growth (kg/day)	0.50	0.41	22%
FCR	6.4 : 1	8.5 : 1	25%

Table 3. Steer progeny of Low and High NFI parents grazing limited pasture.

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