Genetic improvement of feed conversion in beef cattle

Jonathon Wright

"Coota Park Poll Herefords", Woodstock via Cowra 2793

Our family has been operating "Coota Park" for 101 years at Woodstock near Cowra. I am the fourth generation to be working with Coota Park and have only been full time on the property for the last two years. My father and I run the property in partnership on 688 hectares in a mixed farming enterprise. We run a Poll Hereford Stud and commercial herd, comprising three hundred cows and also a 40 sow piggery. We crop around 160 hectares supplying grain to our piggery and for fodder. We have a mobile seed cleaning service that operates until sowing time in our district and an on farm Efficiency Testing Facility which we will be discussing in more detail within this paper.

Prior to returning to Coota Park and after finishing my University Degree, I worked as Cattle Manager at the Trangie Research Centre for five and a half years. In this job I worked mainly with the Project Dan 75 "Breeding to Improve Net Feed Conversion Efficiency". It was this time working with the project that I began to develop the idea to incorporate this information into our own cattle enterprises at "Coota Park".

We have developed our own property facility that enables us to record the daily feed intakes of each individual animal and then monitor their weight gain to establish a feed conversion figure and ranking on each animal. The facility is a 48-pen design that we developed ourselves to enable the collection of the necessary data as accurately, time efficiently and as cost effectively as possible. Before I go into too much detail it is essential that we look at the Trangie project and its results to understand the basis of why we have taken the road that we have.

Trangie Research and Results

The project at Trangie is a jointly funded project between NSW Agriculture and the Meat Research Corporation that started in 1993 and will conclude in the year 2001. The project was set up to investigate the range that existed between cattle in relation to feed conversion and then to establish if this feed conversion trait was a heritable one. The Trangie project is designed to test over 1400 weaner cattle from a diverse range of genetics, incorporat-ing 4 different breeds and genetics from around the world.

This weaner test was a 120-day test of both bulls and heifers giving each animal at the conclusion its own efficiency figure and a ranking within each group of animals tested. The project then mated the tested animals according to their efficiency. High efficiency bulls mated to high efficiency heifers and low efficiency bulls to low efficiency heifers. This next generation was then tested to establish how well this trait transferred from one generation to the next. It was the testing of the first generation along with sire group testing that provided the data to establish a heritability figure for feed conversion.

The females were mated twice and then tested again as mature cows to see if this trait of weaner efficiency was highly heritable as in any beef breeding system the cost of feeding our mature cows is the largest cost of all.

The project is also designed to investigate what correlation, both positive and negative, exists between feed conversion and the production traits such as growth, muscularity, meat quality, maternal ability and fertility; all factors that influence the profitability of a grass production system. There is little point in us selecting for this trait if the more efficient animals are inferior in other production areas.

Fortunately the results to date have shown that there is a large range in feed conversion within the cattle population and that this trait is significantly heritable. There also appears at this stage to be no correlation with other traits that could cause potential production loss.

Before showing the results from the Trangie work we need to clarify feed conversion. NSW Agriculture is recommending we select for the trait Net Feed Efficiency (NFE) which put simply is the amount of feed each animal is eating in relation to the amount of weight it is putting on, whilst adjusting for its growth rate and body weight. NFE is calculated as follows:

NFE = Actual Feed Intake (AFI) - Expected Feed Intake (EFI)

Actual feed intake is the amount of feed the animal eats in total over the test period. Expected Feed Intake is the amount of feed we would expect an animal of that particular weight growing at that particular rate should eat. If they eat less than we expected them to, they are more efficient animals, if they eat more than we expect them to they are inefficient animals.

NFE = AFI - EFI

ANIMAL 1 + 100 = 1000kg - 900kg
ANIMAL 2 - 100 = 800kg - 900kg

Results

Table 1 indicates that variation does exist after testing a large population of animals. There was a range in NFE of –205kg of feed to +242 in weaner bulls and -89 of feed to +62 in progeny groups.

Table 2 shows the response observed after one generation of selection of NFE. This suggests that NFE has a high to medium heritability of about 0.4 to 0.5. This figure of heritability is similar to that of growth, which we select for frequently in our own breeding herds.

Other research that has been conducted at Trangie that has not yet been published shows that there appears to be a good correlation between the weaner's test and the mature cow test. Research has shown that the high efficiency cows tend to eat less on pasture than the low efficiency cows, but this is only in preliminary trials to date.

What is happening at "Coota Park"

After looking at the research that has been conducted at Trangie we became confident that there was large difference in the cattle population for efficiency and that it was a trait that could be bred for. How we incorporated this into our program within our herd was the challenge. We knew we had to build a facility of some sort on our property, as testing in any other way was not available at that time. We also knew we had to be able to test around 40 - 50 animals at a time to get an accurate picture of what was happening within our herd. Money was certainly a constraint and time on a day to day basis was also a constraint, so we needed a facility that could enable us to collect the relative intake data as well as not cost too much in the process. It is important to understand that if the cost of collecting the data outweighs the gain we would achieve from testing our cattle then there was little point in starting out.

The gains we hoped to achieve from having the facility were as follows:-

- Start identifying animals that were superior for feed conversion and then breed from these animals to reduce feed costs in our operation.
- To identify bulls with superiority for efficiency that would attract potential purchases of our sale bulls.
- To help lift the profile of our stud within the industry by offering some of the first bulls in Aus-

Table 1: Measure of variation of Net Feed Efficiency and other production traits of male and female and sire progeny groups.

Trait	Sex	Individual animals		Sire progeny groups	
		Range	Mean	Range	Mean
Start of test livewt.(kg)	M	250-467	347	183-380	282
	F	142-407	262		
Ave.daily gain (kg/day)	M	0.87-1.85	1.36	1.00-1.36	1.2
	F	0.71-1.58	1.15		
365 day liveweight (kg)	M	885-571	460	325-486	404
	F	275-524	386		
Feed intake (kg)	M	1107-1881	1477	1003-1594	13.8
	F	850-1867	1254		
Net Feed Intake (kg)	M	-205-+242	0	-89-+6	20
	F	-246-+20	10		
Feed conversion ratio	M	6.8-12.9	8.8	6.3-9.6	8.8
	F	5.7-13.3	8.9		
Rib fat depth at end of test (mm)	M	2.0-16.0	7.2	4.2-13.3	8.0
	F	3.0-18.0	8.2		
Eye muscle area at end of test (cm^2)	M	64-112	82	51-87	70
	F	43-102	66		

Table 2: Performance of progeny of High NFE and Low NFE bulls and heifers.

Trait	High efficiency progeny	Low efficiency progeny	Statistically significant
Number of animals	27	30	
365-day liveweight	384	384	No
Average daily gain (kg)	1.173	1.213	No
Actual feed intake (kg)	1262	1354	Yes
Net Feed Intake (kg)	-19	49	Yes
Fat depth (mm)	7.4	8.1	No
Eye muscle area (cm^2)	66.1	67.7	No

tralia tested for feed conversion.

- To commercialise our facility in other periods of the year offering another enterprise on our farm.
- To make available for sale some of the design and equipment that we developed in our facility including feeders and water troughs.

The design we put together was basically 48 pens made of electric fencing with feeders and water troughs we designed ourselves. It is not relevant for us to go into the design of the items at this stage. The design has worked very well to date with us starting our 4th test at the moment. The test goes for 70 days with a 3-week adjustment period at the beginning. The cattle are fed a 50% lucerne, 50% oats diet that is hammermilled and additive put in to ensure a balanced diet is provided. We feed the animal each morning, weighing the waste left from the previous day and the amount fed that day. To feed the 48 pens takes approximately 45 minutes per day, which is not too much of an intrusion into the daily work plan. The facility provides ad lib access to feed through out each day, access to water and good shade.

Results we have achieved

To date we have completed 3 tests and are presently conducting the 4th test. The 3rd test was for Noonee Angus Stud at Wellington and the 4th test has animals from Yamburgan Shorthorns at Narrabri and Onslow Poll Herefords at Goulburn. The results to date have shown a significant range in efficiency with the most efficient animal having the figure of -119, *ie.* he ate 119 kg less than we would expect an animal of his size and weight gain to eat. The worst had a figure of +152 of 152 kg of feed more than we would expect him to. Both these bulls were about the same weight and grew at the same rate, but a difference of 271 kg of feed eaten in the 70 days. In gross conversion figure the best ate 5.9 kg of feed to put on 1 kg of gain. The worst 1.5 kg of feed to put on 1 kg of gain. It is difficult to compare our results to those at Trangie because we have the shorter new test of 70 days, whereas Trangie tested for 120 days. The figures generated will go towards producing EBV's for feed conversion in the near future.

In looking at the animals tested it was impossible to predict which animal was the better converter, which makes testing essential. The results we have achieved have enabled us to make a more informed decision on which bull to breed with and which bull to cull. The first calves from these tested bulls will be born in July 1998.

The Future for Efficiency Testing

Recently a number of research facilities at Armidale and Trangie in NSW, Rutherglen in Victoria and Vasse in Western Australia have started or indicated that they are willing to conduct commercial tests for stud breeders. There have also been a few studs showing interest in building their own facilities on farm. It is my personal view that on farm testing will be the main direction of the future, as we need to be testing relatively large numbers to identify those superior animals that we wish to breed from. If you only test 3 or 4 animals they may be your best or your worst, it is impossible to know, although facilities like the above mentioned on research farms offer an independent result and allow smaller studs to test their cattle. It may be possible for a number of studs to build one facility on property, as the test only takes 70 days. This means you can conduct 4 tests in the facility per year, hence reducing the initial capital outlay.

Further research and extension work is needed in the future to better highlight the value of efficiency testing to not only stud breeders but to commercial breeders and feedlotters. It is the commercial cattlemen and feedlotters who will be getting the gains from the progeny of superior efficiency tested bulls.

Conclusion

Research has proven that there is a significant range within the population and that the trait is heritable. Facilities like ours and those on research farms are making it possible to start testing our cattle to get the rewards that are achievable. Unfortunately we haven't been able to make the gains that the pig and poultry industry have, as our generation interval is significantly longer. We have managed to improve and increase our production by genetic selection for other traits such as growth, muscling and fertility; the next challenge is in the area of feed conversion. Most other traits have concentrated on increasing outputs, feed conversion concentrates on reducing the cost of the inputs. If we reduce this input cost it will lead to greater overall gains, which will surely enable us to be more competitive with that other stud, breed, marketing group, brand of beef or type of meat that are also working hard to make themselves more competitive.