THE POTENTIAL TO SHORTEN THE FEEDING PERIOD WHEN MEASURING THE NET FEED CONVERSION EFFICIENCY OF CATTLE USING AN AUTOMATED FEEDING AND ANIMAL WEIGHING SYSTEM.

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SUMMARY

A pelleted *ad libitum* ration was offered to 24 yearling stud bulls. Feed intake and liveweight was automatically recorded. Feed intake and net feed efficiency (NFE) was calculated. The bulls were fed 71 days, this being the recommended period for NFE testing in beef cattle (Exton 1998). Through using the liveweight and feed intake data collected automatically at each feeding event, and regressing liveweight change over time, we deduced that the feeding period needed to establish sire differences in NFE could be reduced from 71 days to 57 days. Further work is warranted to determine whether this may be reduced even further.

Keywords: Net feed efficiency, feed intake, feeding period, beef cattle

INTRODUCTION

Feed input costs are a large component of the total cost of beef production, in both the feedlot and grazing industries. Recently there has been heightened interest in the potential to decrease feed costs by selecting cattle for improved feed conversion efficiency (FCE). The opportunity to be able to select animals that are genetically superior for the trait of feed conversion would substantially reduce feeding costs. Research at Trangie Research Centre (Arthur *et al.* 1997) indicates that genetic variation in NFE exists in Australian beef cattle and is moderately heritable.

Archer *et al* (1997) examined the optimum duration of a test for measurement of growth rate, feed intake and NFE. Their results indicated that a 70-day test with liveweights collected every 2 weeks was required to measure growth rate and NFE. Little loss in accuracy occurred when weights were collected every 2 weeks compared to once weekly. A 35-day test was sufficient for measurement of feed intake alone.

Decreasing the testing time could substantially reduce the cost of the test, and enable the limited testing resources to be available to more users. The objective of this paper is to provide information on automated feeding systems that utilise automatic liveweight weighing, with the view of being able to shorten feeding time necessary to obtain accurate NFE estimations.

MATERIALS AND METHODS

Animals and data. Twenty four yearling Hereford bulls 407± 40.6 kg liveweight (mean ± S.D.) that had previously been introduced to an *ad libitum* pelleted ration prior to receival at the test station were used in the study. The pellets were made commercially and were comprised of approximately 70 % lucerne hay and 30 % grain with 13.4 % crude protein, 9.9 MJ/kg dry matter metabolizable energy and 90.5 % dry matter. After a training period of 12 days, 12 bulls that had fully adjusted to the automated system were assigned to one feeder (feeder 1) and fed for an additional week prior to the start of the test. The remaining bulls were fed in feeder 2 for an additional 8 days prior to their test commencing. All cattle were given *ad libitum* access to feed. A daily allowance of 1 kg/animal of oat straw (3.2 % crude protein, 4.9 MJ/kg dry matter metabolizable energy and 79.2 % dry matter) was provided in open troughs. Individual intake of straw was not recorded, but the low energy content of the straw compared with the pelleted ration meant that the error in energy intake measurement through straw consumption was minor. The test continued over a period of 71 days, with each group of cattle being weighed manually at the commencement and conclusion of the test. Each animal wore an ear tag containing an electronic chip and a unique identification number. When the animal went into the feeder to eat, the computer recorded which animal was feeding, the time and date of entry and the animal's liveweight. On completion of feeding the computer registered the amount of feed eaten, and the time spent eating.

Weight change of the cattle was modelled by linear regression of weight against time, and the regression coefficients were used to describe the growth of each animal. This method enables all information collected to be used, and decreases the chance of liveweight measurement errors such as changes in gut fill affecting results.

The liveweight at day 0 and day 71 was predicted using a separate regression for each animal and liveweight change calculated. This liveweight change was used to calculate net feed efficiency (NFE) for each animal. The difference between feed eaten and that predicted to be eaten (calculated using energy balance equations derived from metabolic liveweight, liveweight change and feed energy values) was the NFE of each animal. The predicted liveweight was used for calculating metabolic liveweight.

Analyses. The bulls were ranked in order of NFE using the 71-day feeding period. NFE for different lengths of feeding test was also calculated for each animal at days, 36, 43, 50, 57 & 64 and the rankings were compared with day 71. A comparative statistical test (Jorgenson 1985) was done to determine if the NFE of the shorter feeding times were similar to those predicted by the 71-day test.

RESULTS

Over the feeding period, the automatic taring device of the scales on feeder 2 tended to drift slightly, and had to be manually tared occasionally, which meant that the variation around the liveweight regressions were slightly larger than those of feeder 1. The results from feeders 1 and 2 are presented in Table 1 and Table 2 respectively.

Table 1. Mean NFE (kg) and statistical data for feeding test periods of, 36, 43, 50, 57, 64 and 71 days for feeder 1

Measure	Day 36	Day 43	Day 50	Day 57	Day 64	Day 71
Mean NFE (kg)	-1.651	-1.469	-1.454	-1.346	-1.228	-1.129
variance	2.690	2.362	2.014	1.941	1.772	1.646
correlation (r)	0.925	0.944	0.947	0.971	0.991	
t (precision)	2.061	1.741	0.999	1.089	0.851	
t probability	0.066	0.112	0.341	0.302	0.415	
t (bias)	-2.714	-2.210	-2.455	-2.201	-1.843	
t probability	0.020	0.049	0.032	0.050	0.092	

Table 2. Mean NFE (kg) and statistical data for feeding test periods of, 36, 43, 50, 57, 64 and 71 days for feeder 2

Measure	Day 36	Day 43	Day 50	Day 57	Day 64	Day 71
Mean NFE (kg)	-0.311	-0.347	-0.289	-0.219	-0.155	-0.219
variance	1.050	0.877	0.599	0.474	0.433	0.373
correlation (r)	0.896	0.889	0.898	0.956	0.982	
t (precision)	3.850	3.047	1.714	1.297	1.244	
t probability	0.003	0.012	0.117	0.224	0.242	
t (bias)	-0.584	-0.924	-0.699	-0.006	1.678	
t probability	0.571	0.375	0.499	0.995	0.121	

The NFE values obtained for day 36, 43, 50, 57 and 64 were compared with day 71 NFE values for equality of precision and bias, and t values and probabilities are shown in tables 1 and 2, using the procedure of Jorgensen (1985). High correlation is evidence that the measurement errors at each time are small in comparison to the variation of the bulls (a high value is a satisfactory result).

There was a high correlation between the 71-day test and the test at days 36, 43, 50, 57, and 64 for both feeders. The t-test for equality of precision indicates that differences were occurring only for test lengths of less than 50 and 57 days for feeder 1 and 2, respectively.

When the ranking's on NFE of the top 4 bulls in feeder 1 were compared at each feeding time period, from 36 days through to 71 days, those 4 bulls were always ranked in the top four and the top two bulls were always ranked in the top two, although not always in the same order. With feeder 2 at each time period, the same bull was always ranked at number 1, and the bull that was ranked at number 2 on day 71 was also ranked at number 2 for days 43, 50, 57, and 64.

DISCUSSION

Testing for net feed conversion efficiency allows for comparison of individual animals within a test group, with the main objective being to estimate breeding values of potential sires, and to be able to compare sires from different locations. A test protocol (Exton 1998) has been formulated to allow testing under uniform conditions, with the present recommended industry standard of a feeding period of 70 days. Although Archer *et al* (1997) suggest that 70 days would be optimal for measuring feed conversion and residual feed intake, their comparisons were made using test lengths with weekly liveweight measurements.

The results of this study indicate that through the continuous collection of animal liveweights on a fully automated weighing/feeding system, it should be possible to be able to shorten the feeding period currently required for the measurement of net feed conversion efficiency by at least 14 days.

It may be possible through using automated weighing to shorten the test period even further (because of the high correlations achieved between 71 down to 36 days). If a producer just wanted to select the top performing 2 bulls in terms of NFE from a group of say 12, it may be possible to do so after a period of 36 days, as the 2 superior sires from one group in this study ranked the highest by that stage, with the top 2 bulls in the other group maintaining their ranking after day 43. However if the requirement was to rank the whole 12 in order to get a measure of the estimated breeding value for that trait, a longer feeding period would be necessary.

CONCLUSION

The results indicate that the test to measure residual feed intake and thus net feed efficiency through using a fully automated liveweight weighing/feeding system could be shortened from the 70-day standard to at least 57 days without loss of precision. Results from one feeder indicate that 50 days may be adequate, with an even shorter period being a possibility. However, the limited number of animals used in this study does not allow a recommendation shorter than that stated. Further work with more animals certainly seems warranted.

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