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Evaluation and Observation of Testing Feed Efficiency in Angus Seedstock Heifers

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Summary

A total of 38 Angus heifers in four contemporary groups over two years were evaluated for pelleted feed intakes, feed conversions and residual feed intake (RFI) using a PinPointer feeding system at Wardens Farms, Council Bluffs, Iowa. Daily pellet intakes (.47 mcal/lb of NEg) averaged 18.6 lbs during the first week and peaked at week nine with 26 lbs. Individual heifer variation on a percent of body weight basis was from 2.1% to 3.3%, but during week 2 the range was 1.7%. Adjusted feed conversions calculated using BIF guidelines averaged 8.11 and 13.24 for 2005 and 2006, respectively. RFIs by methodology averaged zero, but had a standard deviation of 1.24 and 1.18 for both years, respectively, which is similar to evaluations looking at bulls for efficiency. RFIs calculated at 56 days on test were compared to end of test RFIs and were found to be significantly ($P<.0001$) correlated at .85. RFI was found to be significantly ($P<.0001$) correlated to average daily feed intake at .61, but not correlated to any other measures of performance including ultrasound traits.

Introduction

Improvement in feed efficiency in cattle has become even more important with increased demand and price for energy feed stocks. Feed cost represent 60 percent of the total cost in finishing cattle and it has been shown with economic analysis that 5 percent improvement in feed efficiency has an economic impact four times greater than a 5 percent improvement in daily gain. Most efforts toward improvement of feed efficiency have come from measurement and selection with the male population with little effort at evaluating young female breeding stock. Certainly with today's technology of embryo transfer it is possible to increase the impact that outstanding females can have on genetic change.

Materials and Methods

This project was done in conjunction with Wardens Angus Farm, Council Bluffs, Iowa utilizing replacement Angus heifers from the 2005 and 2006 calf crops. Each year 19 heifers were selected for a total of 38 head and evaluated for feed intake using two PinPointer 4000 systems. This is a self-feeding type system that relies on using a complete pelleted ration. A concern when doing this test was to develop a lower energy pellet that would not over condition the heifers, yet work reasonably well in the self feeding system. The pellet used had estimated values by the manufacturer for net energy for maintenance and gain of .74 and .46 mcal per pound of dry matter, respectively, with a protein content of 14 percent. Long stem predominantly brome grass hay was offered at 3-4 pounds daily. This was not accounted for in the feed efficiency calculations.

In year one heifers were tested for 70 days starting January 30, 2006 and year two heifers were tested for 84 days starting December 19, 2006. The average performance levels of the heifers tested is outlined in table 1. When compared to Angus breed averages the heifers have genetic evaluations for birth weight less than breed average and growth characteristics just above breed average.

Feed conversions and adjusted feed conversions were calculated according to standards set out in the Guidelines from the Beef Improvement Federation. In other words all feed conversions were adjusted to average metabolic weight for the contemporary group in which they were tested. Recently the beef industry has shifted its attention to computing residual feed intake (RFI or net feed intake) for animals by using methods outlined by R. Koch, University of Nebraska, back in the 1960s. RFIs were calculated within contemporary group by fitting expectation regressions for daily feed intake using average metabolic weight while on test and average daily gain during the test. Pearson correlations using SAS 9.1 were calculated.

Table 1. Phenotypic and genetic evaluation characteristics of Angus heifers tested.

Item	Average	Standard Deviation
Birth weight	75.2	7.4
Adjusted 205 weight	604.1	56.6
Adjusted 365 weight	928.3	61.1
EPDs		
Birth weight	.85	1.34
Weaning weight 40.0		6.0
Yearling weight 75.6		6.5
Maternal milk	22.9	3.0

Table 2. Summary of heifer weights and daily feed intake by week.

Week on test	Average Heifer Weight by Week	Average Daily Feed Intake	Std Dev Daily Feed Intake	Minimum Individual Daily Feed Intake	Maximum Individual Daily Feed Intake
Week 1	769.1	18.6	2.45	12.3	24.0
Week 2	785.6	20.2	2.67	13.9	25.7
Week 3	802.0	21.0	2.46	17.1	26.0
Week 4	818.5	22.2	2.55	15.4	26.7
Week 5	835.0	22.7	2.34	17.9	26.9
Week 6	851.5	23.1	2.30	18.1	29.1
Week 7	867.9	25.1	2.38	21.4	29.7
Week 8	884.4	25.4	2.29	20.3	30.9
Week 9	900.9	26.1	2.54	19.3	30.4
Week 10	917.4	24.8	2.29	19.7	28.6

Results and Discussion

Pelleted daily feed intake is summarized by week in table 2. Intake increased from 18.6 lbs to over 26 lbs daily after 9 weeks on test and then declined. There was great variation in daily feed intakes with a range of 8.3 lbs in week 7 to 11.8 lbs in week 2. Of course body weight can cause this, but when expressed on a percent of total body weight it was found that the range was 2.1 to 3.3 percent. During the second week on test there was 1.7 percent range, which of course could have been due to either a malfunction in measuring feed intake or a health problem in one heifer, although that was not noted.

Feed conversions varied in these heifers varied just like seen in previous bull testing programs, although they averaged lower because the ADGs were lower due to energy level fed. Raw and adjusted feed conversions averaged 8.1 and 13.2 lbs of feed per pound of gain for 2005 and 2006, respectively. Year 2006 in particular saw a greater range in feed conversion due to lower gains and it is expected that the large decrease in gains in 2006 heifers was due to the severity of weather while on test. RFI calculations, however, did a nice job of taking care of the increased feed conversion variability in the 2006 heifers. When one observes the ranges in RFIs for both years and compares the standard deviations the data looks very similar. In 2005 there was a 4.46 range in RFIs while in 2006 it was 4.10.

Table 3. Summary of gains, feed conversions, residual feed intakes at 56 days and end of test, and ending ultrasound trait averages.

	Average	Std Dev	Minimum	Maximum
		Year = 2005		
ADG, 70 d.	2.92	.36	2.20	3.47
Raw FC, 56 d.	7.76	1.14	5.99	10.67
Adj. FC, 56 d.	7.76	1.06	5.92	10.39
RFI, 56 d.	0.00	1.34	-3.18	1.88
Raw FC, 70 d.	8.11	1.03	6.54	10.68
Adj.. FC, 70 d	8.11	.98	6.62	10.45
RFI, 70 d.	0.00	1.24	-2.68	1.78
Ribeye area, sq.in.	10.67	.88	9.1	12.8
Fat cover, in.	.38	.07	.26	.47
% IMF	4.55	1.13	3.76	8.59
		Year = 2006		
ADG, 84 d.	1.79	.42	1.02	2.67
Raw. FC, 56 d	10.18	1.80	7.20	13.41
Adj. FC, 56 d.	10.19	1.80	7.11	13.88
RFI 56 d.	0.00	1.28	-2.90	2.63
Raw FC, 84 d.	13.26	3.08	9.26	21.92
Adj. FC, 84 d.	13.24	2.91	9.03	20.90
RFI, 84 d.	0.00	1.18	-2.39	1.71
Ribeye area, sq.in.	11.24	1.17	9.2	13.6
Fat cover, in.	.52	.15	.21	.76
% IMF	5.46	.88	3.81	7.35

FC=feed conversion, RFI=residual feed intake, %IMF=intramuscular fat

On a national and international basis there has been discussion on how long feed efficiency tests should be run. Because weight data was collected at 28 day intervals, it was possible to calculate feed conversions and RFIs at 56 days and compare them to the final efficiency calculations. Naturally the longer on test and the heavier the heifers become the less efficient they become. Based on this simple analysis it appears there is less variation in feed conversions and RFIs the longer on test. This could be due to a number factors, but certainly shrink and fill at the beginning and ending of a test come in as a major factor with fewer days on test. The Pearson correlation between RFI at 56 days and the end of test RFI was .92 and highly significant (P<.0001). Heifers were ranked from top to bottom (1 to 10) within each contemporary group for both RFIs at 56 days and the end of the test. The correlation between those two ranks was highly significant (P<.0001) at 0.85.

Many producers ask about whether RFI is correlated to other performance traits. Pearson correlations done actual and adjusted performance measures and EPDs available on these heifers showed no significant correlations to any of the following traits: birth weight, adjusted weaning and yearling weight, ultrasound ribeye, fat cover, % intramuscular fat, and EPDs for birth, weaning, yearling and maternal milk. Of course, based on RFI methodology it is not correlated to either heifer body weight or gain on test. It was, however, significantly correlated (P<.0001) to average daily feed intake at 0.61. This means that the more feed consumed on a daily basis the higher the RFI, which means poorer feed efficiency.

Table 4. Phenotypic correlations between RFI and several performance traits.

	Correlation with RFI	Significance
Birth weight	.14	NS
Adj. 205 weight	-.12	NS
Adj. 365 weight	.00	NS
EPDs		
Birth weight	.04	NS
Weaning weight	-.09	NS
Yearling weight	.06	NS
Maternal milk	.11	NS
Ultrasound traits		
Ribeye area	-.04	NS
Fat cover	.12	NS
%IMF*	.18	NS
Average daily feed intake	.61	P<.0001

*% intramuscular fat

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Photo Highlights from Wardens Farms Feed Efficiency Evaluation, 2005

Picture 1.

Picture 2.