The relationship of average backfat thickness of feedlot steers to performance

Roundup 2004
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Introduction

The length of time to keep cattle on feed that maximizes profits is determined by the point when incremental costs equal incremental increases in animal value. The primary cost in a cattle feeding enterprise is ration expense, so in order to effectively project optimal marketing time it is necessary to be able to determine future feed conversion. It is widely considered that feed conversion is related to composition of gain. That is because fat tissue contains only about 10% water compared to 73% water in muscle and the caloric value of a gram of fat is 69% more than that of a gram of protein. Consequently, it has been assumed that the energetic cost of fat accretion is much more than protein.

Ultrasound technology accurately estimates backfat thickness in the live animal and also accurately projects future fat thickness, which is highly correlated with composition of gain. Consequently, it should be possible to build a model using ultrasound backfat thickness to project future feed efficiency and determine the time when feed conversion declines to the point that cattle should be harvested. The objective of this project was to obtain the parameter values for such a model.

Materials and Methods

The experiment consisted of two replications of 5 pens each and an average of 27 head per pen. Before the experiment began, backfat thickness was measured with ultrasound and cattle were stratified into groups according to that measure. The experiment was initiated 43 and 50 days before harvest (replications 1 and 2, respectively). Initial weights were after an overnight shrink and final weights were calculated by dividing carcass weight by 0.64. Average initial and final weights were 1224 and 1464, respectively. Cattle used in this study were all black hided but some may have included some genetics from Continental breeds. An effort was made to allot cattle so that average initial weight was the same among groups.

Average backfat thickness for each group was the average of the initial ultrasound estimate and final carcass measure. The procedure effectively created groups that averaged 6.3 to 14.4 mm backfat (0.25 to 0.57, in). The primary interest in this study was measuring feed intake and animal gain to compute feed efficiency. However, a technique was devised to partition gain between fat and fat-free matter and compute the relative efficiency of fat and protein accretion.

Results

Gains were exceptionally high in this experiment. That probably was caused by the overnight shrink reducing fill and providing an initial weight that may have been unrealistically low. Also, these cattle had excellent performance potential. The protocol effectively created groups where composition of gain ranged from 45% to 58% fat. The correlation between the initial ultrasound backfat estimate and carcass backfat at harvest was 0.77.

There was no correlation between average backfat thickness among the groups and feed intake, average daily gain or feed efficiency. This was surprising because it contradicted conventional wisdom that cattle producing fat rather than muscle should be less efficient. An intensive analysis of the data provided explanations for the lack of response. This analysis showed that the energetic efficiency of producing a calorie of fat was 3.98 times greater than producing a calorie of protein. That value coincides with estimates by other scientists using different techniques. This inefficiency of protein accretion probably is associated with the fact that protein is dynamic tissue that is constantly catabolized and regenerated while fat tends to be static after it is deposited. Also, it may require more energy to synthesize protein molecules by linking amino acids together than to build fats from acetate. Both lower marbling scores and larger rib eye areas indicated that groups with less backfat probably included cattle that were part Continental breeds (Limousin, Simmental, Gelbvieh, etc). Maintenance energy requirements are higher among those breeds which would cause them to have poorer feed efficiency. Proportionally increasing maintenance requirements up to 9% for the groups with lowest average backfat balanced energy partitioning among the groups.

The correlation between backfat thickness and marbling score was 0.28. Although this value is statistically significant, it is not high enough to have much predictive value. It also challenges contentions that percent body fat can be used to predict when cattle will grade USDA Choice.

It is likely that a decline in feed efficiency associated with fatness would occur among groups of cattle with more than the fattest group in this study (0.57 inch average backfat). But in modern cattle feeding it does not seem practical to exceed that amount of fat thickness. Also, it is not known if these results would apply to types of cattle that have different growth and development characteristics than the animals used in this study.

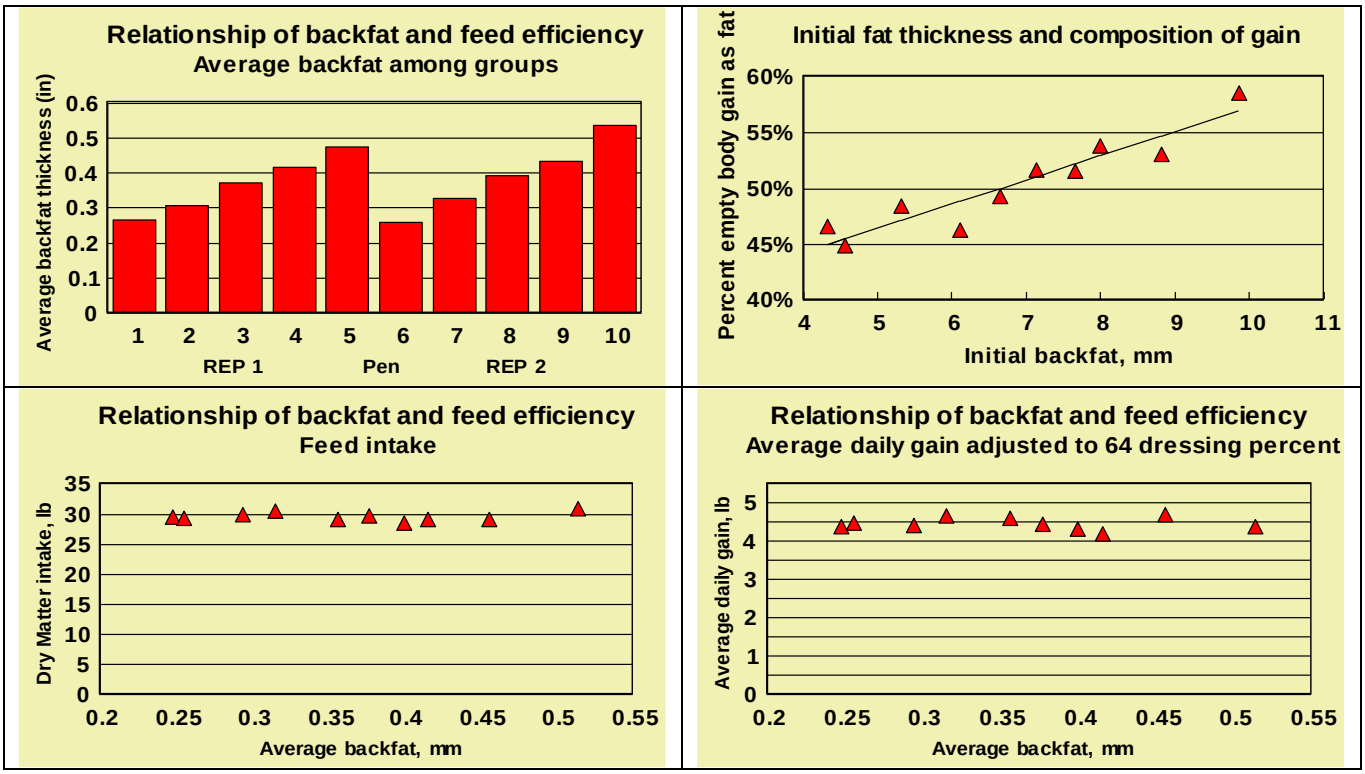
Conclusions

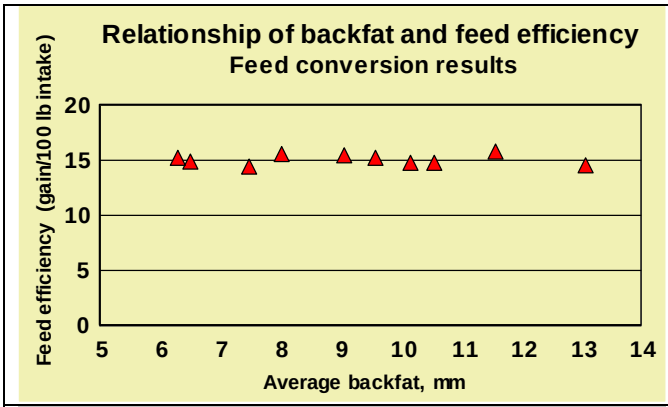
- **Ultrasound estimates of initial backfat effectively created groups with different composition of gain.**
- **There was no difference in feed intake, gain, nor feed efficiency among pens of cattle sorted into groups with different levels of backfat.**
- **The relative energetic efficiency of accreting a calorie of fat was 3.98 times that of accreting a calorie of protein.**

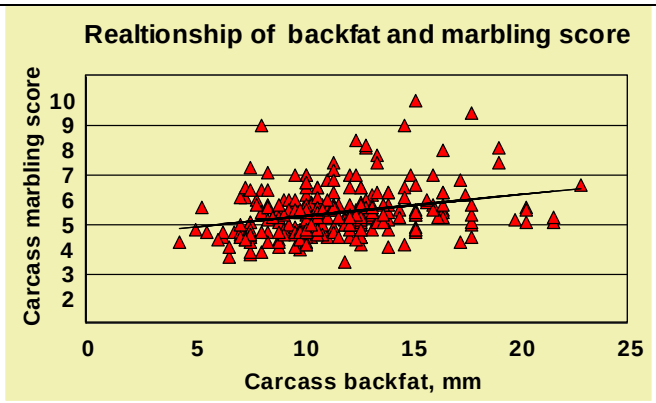
1. Tissues such as muscle that are primarily protein are dynamic and constantly break down and are replaced. Fat is static and once deposited it remains in place.

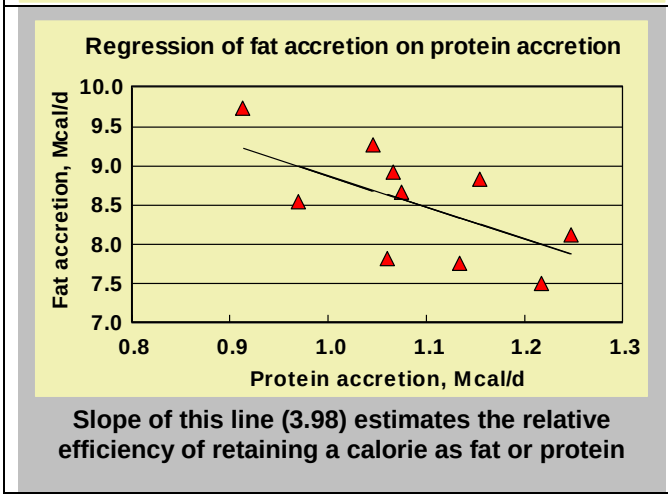
2. Maintenance requirements may be higher among late maturing breeds of cattle with more muscle and less fat.

3. The metabolic costs of synthesizing a molecule of protein are greater than synthesizing fat.




Relationship of backfat and feed efficiency
Feed conversion results
Feed efficiency (gain/100 lb intake)
20
15
10
5
0
5 6 7 8 9 10 11 12 13 14
Average backfat, mm


Realtionship of backfat and marbling score
Carcass marbling score
10 9 8 7 6 5 4 3 2
0 5 10 15 20 25
Carcass backfat, mm


Regression of fat accretion on protein accretion
Fat accretion, Mcal/d
10.0
9.5
9.0
8.5
8.0
7.5
7.0
0.8 0.9 1.0 1.1 1.2 1.3
Protein accretion, Mcal/d
Slope of this line (3.98) estimates the relative efficiency of retaining a calorie as fat or protein