BEEF CATTLE RESEARCH UPDATE

Britt Hicks, Ph.D.
Area Extension Livestock Specialist
Oklahoma Panhandle Research & Extension Center

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Phase Feeding Protein to Calf-Fed Holstein Steers

Recent California research used 180 Holstein steer calves (251 lb initial weight) to evaluate the effects of phase feeding metabolizable amino acids (MAA) on growth performance and carcass characteristics.[1] Three phase feeding strategies were evaluated:

1) Control, single-phase feeding – steers were fed a single urea based growing finishing diet to meet the average MAA requirements over the entire feeding period (11.5% crude protein ration with 1% urea as the sole source of supplemental protein)
2) 2-phase feeding – steers were fed a diet formulated to meet the average MAA requirements for the first 112 days on feed (14% crude protein ration with 0.4% urea, 7% canola meal, and 3.5% fish meal) and then finished on the control, urea-based diet
3) 3-phase feeding – 2 diets were formulated to meet average MAA requires during the first and second 56-day feedlot periods, respectively, and then finished on the control, urea-based diet. The diet fed the first 56 days contained 15% crude protein ration with no urea, 10% canola meal, and 5% fish meal and the diet fed during the second 56 day period contained 13% crude protein ration with 0.4% urea, 5% canola meal, and 2.5% fish meal.

All diets were 88% concentrate steam flaked corn based and formulated to provide approximately 0.70 Mcal/lb of NEm.

These researchers reported that multiple-phase feeding strategies when compared with the controls increased average daily gain by 18% and dry matter intake by 4% and improved gain efficiency by 12.5% during the first 112 days on feed. Over the entire 351-day feeding period, multiple-phase feeding strategies increased daily gains, dry mater intake and gain efficiency by 6.3%, 3.7% and 2.8%, respectively. Multiple phase feeding also increased hot carcass weight (5.2%), dressing percent (1%), fat thickness (25%) and rib-eye area (8.8%) compared with the single-phase control treatment. No differences in growth performance or carcass characteristics were observed when comparing 2-phase and 3-phased feeding strategies.

Based on models published in the 2000 Beef NRC,[2] the single phase feeding program was deficient in metabolizable methionine, lysine, and histidine, during the initial 112 days of the feeding period, providing 77.1, 78.9, and 72.9% of the respective requirements. During the final 239 days on feed, the supply of all MAA exceeded dietary requirements. In summary, these researchers concluded that multiple phased feeding protein strategies may enhance growth performance and carcass characteristics of Holsteins steer calves.

Feeding Behavior vs Efficiency

University of Missouri research recently studied (two trials) feeding behavior in feedlot cattle with differing feed efficiencies.[3] Feed efficiency was measured as residual feed intake (RFI). RFI is defined as the difference between an animal's actual feed intake and its expected intake based on body weight and growth rate. Positive RFI animals eat more than expected in relation to their weight and gain, so they are less efficient. A negative RFI value

is better and indicates a more efficient animal. In experiment 1, 80 crossbred Angus steers (714 lb initial weight) were fed a whole shelled corn based diet containing 28% roughage for 123 days. In experiment 2, 40 crossbred Angus steers (717 lb initial weight) were fed a whole shelled corn based diet containing no roughage for 123 days. In both experiments, the steers were fed once daily at approximately 8 a.m. in amounts such that the animals had access to feed at all times.

In both experiments, individual feed intakes and feeding behaviors were collected using the GrowSafe individual animal feed intake system (GrowSafe Systems LTD., Airdrie, Alberta, Canada). Individual feed intakes, initial and final body weights, and average daily gain were used to calculate RFI for each steer. In experiment 1, RFI values were calculated for three consecutive months and the six most efficient steers (low RFI) and six least efficient steers (high RFI) were identified. In experiment 2, RFI values were calculated for four consecutive months and the nine most efficient steers and eight least efficient steers were identified. After the selection of efficient and inefficient animals, the feeding behavior data was analyzed.

In both studies, no differences in initial or final body weights or average daily gains between efficient and inefficient groups were noted (Table 1). However, gain efficiency (gain/feed) was greater for efficient steers and daily feed intake was greater for inefficient steers in both experiments. The average daily eating rate (lb/min) did not differ between efficient and inefficient groups in either experiment. However, more efficient animals ate fewer times per day than inefficient steers in both experiments (11.0 vs 18.2 and 14.5 vs 17.6 times/day in experiments 1 and 2, respectively).

Table 1. Growth characteristics of efficient and inefficient steers by experiment.

	Experiment 1		Experiment 2	
Item	Efficient	Inefficient	Efficient	Inefficient
# Steers	6	6	9	8
Initial Wt, lb	717	728	734	728
Final Wt, lb	1096	1138	1250	1241
ADG, lb	3.09	3.33	3.3	3.29
DMI, lb	15.41[a]	22.71[b]	14.35[a]	17.35[b]
G:F	0.200[a]	0.146[b]	0.231[a]	0.189[b]
RFI, lb/day	-3.46[a]	3.64[b]	-1.81[a]	1.70[b]
Eating Bouts Daily	11.0[a]	18.2[b]	14.5[a]	17.6[b]
Daily Eating Rate, lb/min	0.216	0.209	0.351	0.286

[a,b]Within a experiment, means within a row lacking a common superscript differ ($P < 0.05$).
Adapted from Golden et al., 2008

These researchers reported that in both studies significant variation existed in animal daily feed intake. No animals within the efficient or inefficient groups were diagnosed or treated for acidosis or any other metabolic disorder. No differences in day to day intake patterns were noted between efficiency groups. The average number of days comprising a feeding pattern in both experiments for both efficiency groups was 2 to 3 days in multiples of 2 to 3 days.

The average feed consumption across periods of the day for efficient and inefficient animals in both experiments is plotted in Figure 1. In experiment 1, most of the feed consumption

occurred in periods 4, 5, and 6 (9 a.m. to 6 p.m.). During these periods, approximately 67.7 and 70.7% of the total feed consumption was consumed for efficient and inefficient animals, respectively. In experiment 2, most of the feed consumption occurred in periods 3, 4, 5 and 6 (6 a.m. to 6 p.m.) with efficient and inefficient animals consuming, respectively 78.5 and 82.7% of their feed in these periods. Period intakes appeared to be more variable for inefficient than efficient steers in both studies. In both experiments, inefficient steers appeared to eat more feed from 3 p.m. to 6 p.m. than in any other timer period.

In summary, no differences in growth rate and limited differences in day to day feeding behavior were observed between efficient and inefficient animals. However, inefficient steers consume more feed with more daily eating bouts than efficient steers. These results also suggest that there is increased variability of feed intake throughout the day for inefficient animals.

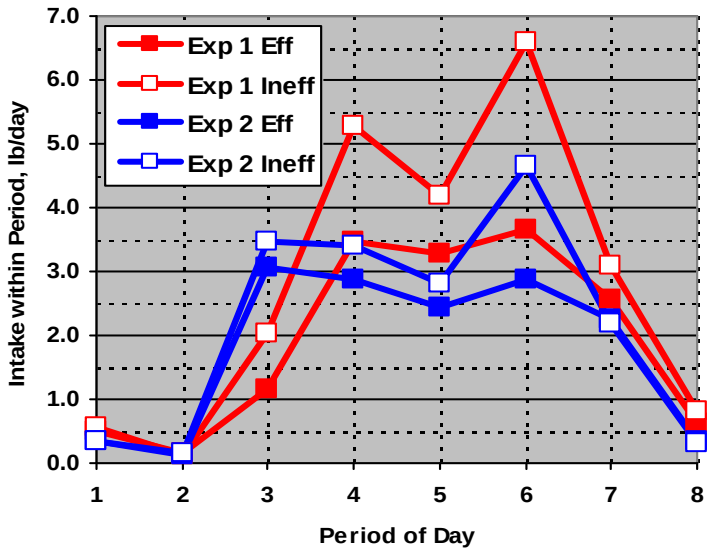

Figure 1. Average daily feed intake across periods of the day (divided into 8 three-hour periods beginning with 12 midnight) for efficient and inefficient steers.
Adapted from Golden et al., 2008

[1] Zinn, R. A., J. F. Calderón, L. Corona, A. Plascencia, M. F. Montaño, and N. Torrentera. 2007. Phase feeding strategies to meet metabolizable amino acid requirements of calf-fed Holstein steers. Prof. Anim. Sci. 23:333-339.

[2] NRC. 2000. Nutrient Requirements of Beef Cattle 7th rev. ed. Natl. Acad. Press, Washington, DC.

[3] Golden, J. W., M. S. Kerley, and W. H. Kolath. 2008. The relationship of feeding behavior to residual feed intake in crossbred angus steers fed traditional and no-roughage diets. J. Anim. Sci. 86:180-186.