



Research Update

► Summaries of current beef cattle research

Seven different genes may be related to feed efficiency

Numerous studies have shown that feed cost accounts for the greatest single cost in most beef production systems. Therefore, identification of genes that control feed efficiency could be an important breakthrough in reducing cost of production.

In this collaborative study, University of Alberta, Lacombe Research Centre and Lethbridge Research Centre scientists used the university's beef cattle population to conduct a genome scan to map chromosomal regions that may be related to net feed efficiency. Net feed efficiency was determined by measuring residual feed intake (RFI; actual feed intake minus expected feed intake) of individual animals.

The mapping analysis detected seven statistically significant chromosomal regions for net feed efficiency. The authors concluded that the chromosomal regions identified in this study provide a valuable reference for further fine mapping and identification of candidate genes for net feed efficiency.

[Nkrumah et al. 2005. *J. Anim. Sci.* 88 (Suppl. 1): Abstract M31]

Calf growth traits not antagonistic with calving traits

University of Manitoba and Agriculture Canada scientists used 6,442 calving records from three Angus herds for years 1984 through 2001 to determine, using two different analyses, genetic parameters for growth and calving traits in Canadian Angus cattle. Calf growth traits were birth weight (BW), weaning weight (WW) and yearling weight (YW). Calving traits were first calving date (CD1), calving date (CD) and calving interval (CI).

Averages of the two analyses for direct heritability estimates of BW, WW and YW were high (0.48, 0.70 and 0.65, respectively). The corresponding maternal heritability estimates were low to moderate (0.14, 0.22 and 0.09, respectively).

Estimates of direct heritabilities for CD1, CD and CI were low to moderate (0.18, 0.25 and 0.10, respectively). Direct growth traits tended to be strongly genetically correlated with one another (0.31 to 0.89), as were maternal growth traits (0.20 to 0.98).

Direct genetic correlations of growth traits with calving traits were generally negative (favorable). The same was true with maternal genetic correlations of growth traits with calving traits. These results indicate that selection for growth traits would not be antagonistic to calving traits and vice versa.

The authors also conducted an analysis of genetic trends for growth traits. This analysis revealed that BW, WW and YW in Canadian Angus cattle are increasing at rates of 0.37 pounds (lb.), 4.01 lb. and 9.69 lb. per year, respectively, indicating that strong selection pressure was placed on growth traits during the study period (1984 to 2001), further showing that these traits are highly heritable, as noted above.

The authors concluded that the genetic parameter estimates in this study indicate the potential merit for developing breeding strategies that permit genetic improvement of both growth and dams' calving efficiency in Canadian Angus cattle.

[Rasali et al. 2005. *Can. J. Anim. Sci.* 85 (3): 309]

Cow nutrient restriction affects fetus muscle profile

University of Wyoming scientists conducted a study to evaluate the effect of nutrient restriction on muscle development in bovine fetuses. Twenty Angus × Gelbvieh-cross cows carrying female fetuses were allotted to one of two dietary treatments from Day 39 to Day 125 of gestation:

- 1) Control — fed to gain weight (average: +4.25% of body weight); or
- 2) Nutrient-restricted (NR) — fed to lose weight (average: -6.9% of body weight).

On Day 125, half of the control and NR cows were harvested, and the remaining NR cows were fed to achieve body weight similar to the remaining control cows when harvested on Day 250 of gestation. Upon harvest at days 125 and 250, the loin muscle at the 12th rib of fetuses was removed and examined for number of myofibers (microscopic muscle fibers).

At Day 125, nutrient restriction significantly reduced the average number of myofibers in muscle bundles of fetal loin muscle (10.2 vs. 12.2 for NR and control, respectively). At Day 250, the number of myofibers in NR fetuses was still

significantly reduced compared to control fetuses.

These results showed that the reduction in muscle fibers due to nutrient restriction in early gestation could not be recovered during late stages of gestation. The authors concluded that the reduced number of myofibers in fetal muscle due to nutrient restriction during early gestation is expected to affect the physiological function of muscle and affect meat quality of progeny.

[Du et al. 2005. *J. Anim. Sci.* (Suppl. 1): Abstract 684]

Editor's Note: This research would support the case for early weaning to prevent cows from being in a negative energy balance and safeguard the muscle profile of the unborn calf.

hCG administration did not improve AI pregnancy rates

The objective of this collaborative study between Colorado State University and Intervet Inc. was to determine whether administration of human chorionic gonadotropin (hCG) five days after artificial insemination (AI) would improve fertility in heifers by increasing blood serum progesterone concentrations.

A total of 96 crossbred heifers were allotted to one of two treatments:

- 1) control — no hCG; or
- 2) hCG — 3,300 international units (IU) injected intramuscularly (IM) five days post-AI.

Serum progesterone concentrations were similar on days 4, 5 and 6 post-AI for controls and hCG heifers, but were greater for hCG heifers on days 7 and 8. Nevertheless, AI pregnancy rates did not improve for hCG heifers vs. controls. This led the authors to conclude that elevating serum progesterone concentrations does not improve fertility in beef heifers.

[Walker et al. 2005. *Prof. Anim. Sci.* 21:361]

Serum leptin strongly correlated with body composition

Leptin is a hormone that is synthesized and secreted predominantly by fat cells. Among other functions, it plays a role in regulating feed intake, body weight and energy expenditure. University of Alberta

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and University of Missouri researchers conducted a study to determine the relationship of serum leptin concentration with feedlot performance, ultrasound and carcass traits of crossbred steers.

Serum leptin concentration was positively correlated with dry-matter intake (DMI), final body weight, ultrasound marbling score and ultrasound backfat thickness. It was also positively correlated with carcass marbling score. Serum leptin was negatively correlated with lean meat yield and carcass ribeye area.

The authors concluded that serum leptin concentration is related to body weight, feed

intake and body composition of cattle. They noted, however, that the relationships with body composition were stronger than those with feed intake or body weight.

[Nkrumah et al. 2005. J. Anim. Sci. 88 (Suppl. 1): Abstract T144]

Effects of phase-feeding of crude protein on feedlot performance

Decreasing dietary crude protein (CP), especially during the latter part of the finishing period, could significantly decrease feed costs and reduce nitrogen (N) losses to the environment.

In a collaborative study, New Mexico State University, Texas Tech University and

University of Arizona researchers used 360 crossbred steers weighing 695 lb. to evaluate the effects of phase-feeding CP on performance of feedlot cattle fed a 90%-concentrate diet. Cattle were on feed for an average of 182 days. There were six treatment groups:

- 1) fed 11.5% CP throughout;
- 2) fed 13% CP throughout;
- 3) switched from 11.5% to 10.0% CP 56 days prior to harvest;
- 4) switched from 13% to 11.5% CP 56 days prior to harvest;
- 5) switched from 13% to 10% CP 56 days prior to harvest; and

6) switched from 13% to 11.5% CP 28 days prior to harvest.

Cattle were harvested when 60% of the cattle within a block were estimated to grade USDA Choice.

Steers switched from 13% to 10% CP had significantly lower average daily gain (ADG) (2.51 lb. vs. 3.35 lb.) and feed efficiency than steers fed 13% CP throughout.

Steers on phase-feeding programs had numerically lower ADG and DMI during the last 41 days on feed than those fed 11.5% or 13% CP throughout.

Performance of steers fed constant 11.5% CP was similar to steers fed constant 13% CP, although steers fed the lower CP diet had numerically lower ADG (3.26 lb. vs. 3.35 lb., respectively) and DMI (16.84 lb. vs. 17.55 lb., respectively).

These results indicate that a modest decrease in dietary CP (for example, 13% to 11.5%) has only modest effects on performance, but decreasing CP to 10% would negatively affect the performance of finishing cattle.

[Gleghorn et al. 2005. *J. Anim. Sci.* (Suppl. 1): Abstract 611]

Feedlot cattle getting fatter in wrong places

Cattle-Fax analysts recently reported that the percent of Yield Grade (YG) 4 cattle has been increasing at a rate of about one percentage point per year since 2001. In 2005, YG 4s averaged about 7%, compared to only 2% in 2001. If this rate continues, the percent of YG 4 cattle could reach 12% by 2010.

Equally alarming is the fact that the percent of Choice grade cattle has remained relatively flat during the same time period. In other words, carcasses are getting fatter on the outside, but marbling is not keeping pace with external fat. Heavier carcass weights are also contributing to the increase in YG 4s.

Accounting for variation in feedlot profitability

Using closeouts on 1,836 pens of cattle from producers in the Iowa Feedlot Monitoring program, Iowa State University scientists analyzed factors affecting performance and profitability.

As initial body weight increased, DMI and ADG increased, but feed efficiency declined. Cattle started on feed in the winter had significantly improved feed efficiency compared to those started in the summer or fall.

Cattle fed lower levels of concentrate (less than 75%) were the most profitable; those

fed intermediate levels (75%-85%) were least profitable; and those fed higher levels (greater than 85%) were intermediate in profitability.

Fewer cattle per pen (less than 100 vs. greater than 100 head) led to greater profit per head. Steers gained faster and more efficiently than heifers, but there was no difference in profitability.

The percentage of profit variability attributable to various factors broke down as follows: fed price, 26%; feeder price, 25%; feed efficiency, 13%; corn price, 2%; and ADG, 1%.

The authors concluded that because more than 50% of the variation in profit is due to fed and feeder-cattle prices, these results show the importance of marketing on profitability.

[Koknaruglu et al. 2005. *Prof. Anim. Sci.* 21:286]

Pasture-finished beef contains higher concentrations of beneficial fatty acids

The fatty acids linolenic acid (an omega-3 fatty acid) and conjugated linoleic acid (CLA) are known to be beneficial to human health. Virginia Tech researchers conducted a 140-day trial to evaluate the effect of two different diets on the concentration of these fatty acids in the adipose tissue of finishing steers.

Twelve steers were finished on a high-concentrate, corn-based diet, and 12 were finished on pasture. Subcutaneous adipose tissue biopsy samples were taken initially and at days 28, 84 and 140.

The CLA and linolenic acid contents of adipose tissue increased significantly in pasture-finished steers and decreased significantly in steers fed high-concentrate. By Day 140, the concentrations of adipose CLA were 10.1 milligrams (mg) per gram (g) vs. 2.12 mg per g tissue, respectively, for the two diets. The concentrations of adipose linolenic acid were 5.81 mg per g vs. 2.57 mg per g tissue, respectively.

These results indicate that pasture finishing increased CLA and omega-3 fatty acids in beef products, which may prove to be beneficial to consumer health.

[Guay et al. *J. Anim. Sci.* (Suppl. 1): Abstract 620]

Vaccination effective in reducing *E. coli* O157:H7 colonization

University of Nebraska researchers conducted a trial to evaluate the effects of vaccination on the probability of feedlot steers to shed *E. coli* O157:H7 in the feces

and for the organism to colonize in the terminal rectum.

A total of 288 steers were allotted to one of two treatments — vaccination or no vaccination. Fecal samples were collected from the rectum of each steer on days 1, 14, 28 and 56. At harvest (Day 57), mucosal samples were collected from each steer by scraping the mucosal lining of the rectum.

The probability to shed *E. coli* O157:H7 in the feces did not differ significantly between vaccinated and nonvaccinated steers. However, the probability of colonization by *E. coli* O157:H7 in the terminal rectum was dramatically reduced by vaccination (0.7% vs. 27.0% for vaccinated and nonvaccinated, respectively).

These results suggest that vaccination may be a promising preharvest intervention for the control of *E. coli* O157:H7 in feedlot cattle.

[Peterson et al. *J. Anim. Sci.* (Suppl. 1): Abstract 379]

A 50%- to 75%-concentrate diet appears optimum for newly received cattle

Because the receiving period is critical to the ultimate profitability of feedlot cattle, the opposing strategies of starting cattle on higher-roughage vs. lower-roughage diets continue to be debated in the feeding sector.

In this Texas Tech University study, data from the Clayton, N.M., Livestock Research Center were analyzed to determine relationships between dietary roughage concentration and receiving period morbidity, DMI and ADG. Table 1 compares the results of feeding a 40%-roughage vs. a 100%-roughage receiving diet for four weeks.

Morbidity and mortality decreased slightly as dietary roughage increased. As expected, ADG and DMI declined with increasing dietary roughage. An economic analysis revealed that the decreased morbidity associated with a 100%-roughage

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Table 1: Performance and health of steers fed a 40% vs. a 100%-roughage receiving diet for four weeks

Item	Dietary roughage, % of DM	
	40%	100%
ADG, lb.	1.30	0.13
DMI, lb. per day	10.6	8.8
Morbidity, %	40.0	36.0
Mortality, %	1.0	0.75
Feed cost of gain, \$ per cwt.	60.97	253.20
Profit, \$ per head	-5.11	-29.44

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vs. a 40%-roughage diet would not affect the loss in profit resulting from reduced performance when the 100%-roughage diet was fed.

The authors concluded that the optimum dietary strategy for starting lightweight (350-550 lb.), highly stressed, newly received cattle on feed would likely be to feed a 50%-to 75%-concentrate diet, which seems to allow cattle to perform well without economically important negative effects on receiving period health.

(Rivera et al. 2005. *Prof. Anim. Sci.* 21:345)

Retail consumers prefer larger ribeye steaks

The National Beef Quality Audit (NBQA) revealed that there is an extreme range among U.S. beef carcasses in size of the loin muscle. Ribeye area ranged from 7.75 square inches (sq. in.) to 23.2 sq. in. Previous research has shown that optimum ribeye size for the foodservice sector is 12-15 sq. in. Optimum size for the retail/consumer sector has not been determined and was the objective of this two-phase South Dakota State University study.

In Phase I, 50 USDA Choice ribeye rolls were assigned to five different size categories based on ribeye area:

- 1) 9.5-10.5 sq. in.;
- 2) 10.8-12.1 sq. in.;
- 3) 12.4-14.0 sq. in.;
- 4) 14.3-16.0 sq. in.; or
- 5) 16.3-18.4 sq. in.

Fourteen 1-in.-thick steaks were cut from each ribeye roll, transported to a retail grocery store and marked for sale at \$8.99 per lb. in the meatcase. Steaks were tallied every four hours to determine the amount

of time that each steak remained in the case. Steaks that did not sell within an allotted time were removed from the case and termed "pulled."

Results showed that time in case and percentage of steaks pulled from the case did not differ among the five size categories. However, large steaks (14.7-17.5 sq. in.) sold significantly faster than average-sized and small ribeye steaks.

In Phase II, a willingness-to-pay study was designed to determine whether consumers would discount large steaks (16.3-18.4 sq. in.) compared with average-size steaks (12.4-14.0 sq. in.) and to determine whether cutting steaks in half was a viable marketing option for the large ribeye steaks. A total of 75 consumers were recruited to participate in this phase.

Results showed that participants were willing to pay a premium of \$0.68 per lb. for large steaks vs. average steaks. Participants discounted the large steaks that were cut in half by \$0.46 per lb. from the average steaks.

The authors concluded that no optimum loin muscle existed for beef retail consumers; however, a trend existed toward greater demand for larger loin muscle sizes vs. smaller ones. They added that this study suggests the beef industry should not limit loin muscle size because of the consumer preference for larger sizes. In addition, the authors concluded that cutting large ribeye steaks in half to achieve smaller portions is not a viable marketing option.

(Sweeter et al. 2005. *J. Anim. Sci.* 83: 2598)



Editor's Note: Summaries of current industry research provided by Michigan State University beef cattle specialists Harlan Ritchie, Steven Rust and Daniel Buskirk.

Top 10 packers

According to Steve Kay of *Cattle Buyers Weekly*, the top 10 beef packers, by capacity, for 2005 were:

Company	Capacity (head/day)
1. Tyson Foods, Springdale, Ark.	36,000
2. Cargill Meat Solutions, Wichita, Kan.	28,300
3. Swift & Co., Greeley, Colo.	16,759
4. National Beef Packing Co., Kansas City, Mo.	13,000
5. Smithfield Beef Group, Green Bay, Wis.	8,000
6. American Foods Group, Alexandria, Minn.	6,500
7. Greater Omaha Packing Co., Omaha, Neb.	2,650
8. Nebraska Beef Ltd., Omaha, Neb.	2,600
9/10. Beef Packers, Fresno, Calif.	1,800
9/10. Brawley Beef, Brawley, Calif.	1,800

The top three packers account for about 76% of total commercial cattle harvest, and the top five account for approximately 93% of total harvest.

