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Gosey, James, "2006 Beef Report Summaries" (2006). *Historical Materials from University of Nebraska-Lincoln Extension*. 56.

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2006 Beef Report Summaries

Jim Gosey, Extension Beef Specialist

Reports on recent beef research are briefly summarized. The full reports are available in the 2006 Nebraska Beef Report, available from University of Nebraska–Lincoln Extension at <http://www.ianrpubs.unl.edu/sendIt/mp88.pdf>

Cow-Calf

Effects of supplementing beef cows with lipid from whole corn germ — A two-year study was conducted with crossbred beef cows to determine whether supplementation with fat from whole corn germ either pre- or postpartum (\pm 45 days) influenced ovarian activity before the breeding season, pregnancy rates, calving interval, calf performance, or serum leptin concentration. Cows supplemented prepartum with fat from whole corn germ had shorter calving intervals. Ovarian activity before the breeding season, pregnancy rate, calf growth, and serum leptin were not different between groups.

Effects of supplementing lactating, June-calving cows on second-calf pregnancy rates — A two-year experiment evaluated the influence of supplementation pre-breeding on second-calf pregnancy rates in June-calving heifers. For 60 days before start of the breeding season, heifers were assigned to one of two treatments: supplementation of dried distillers grains (1.5 lb/day) to meet energy and metabolizable protein requirements or unsupplemented control. Supplementation improved body condition score during the supplementation period and resulted in increased body condition score at weaning. Pregnancy rates were 90% and not changed by supplementation.

Effects of pre- and postpartum nutrition on reproduction in spring calving cows and calf feedlot performance — Crossbred, spring calving cows were used to evaluate the influence of supplemental protein prepartum and grazing sub-irrigated meadow postpartum on pregnancy rates and calf feedlot performance. Feeding supplement prepartum improved body condition score pre-calving and pre-breeding and increased the percentage of live calves at weaning but did not affect pregnancy rate or steer calf feedlot performance. Grazing sub-irrigated meadow did not change pregnancy rates or feedlot performance.

Effects of dam nutrition on growth and reproductive performance of heifer calves — A three-year experiment evaluated the effects of maternal nutrition on growth and reproductive performance of heifer calves. Supplementing cows with protein during late gestation resulted in heifers that were heavier at weaning and breeding, had higher pregnancy rates, and calved earlier. Allowing cows to graze meadows after calving improved calf weaning weight but not heifer reproductive performance. Heifers from cows that were fed hay after calving had reduced DMI and improved residual feed intake if their dams were supplemented with protein during gestation,

but ADG and G:F were not affected by dam supplementation or spring feeding strategies.

A system for wintering beef heifers using dried distillers grains — A two-year experiment compared two systems for wintering pregnant heifers. The standard system served as the control (CON) and the treatment system (TRT) included a dried distillers grains based supplement. Heifers in the TRT system were heavier and had greater body condition score at end of supplementation. Calving difficulty, percentage of live calves weaned and subsequent pregnancy rate were similar between systems. Calves born to heifers in the TRT system were heavier at birth and weaning. The TRT system cost \$8.16/heifer less than the CON system.

Feeding melengestrol acetate to bulls prior to and at puberty alters body weight and hormone concentration — Melengestrol acetate (MGA), which is commonly used in the beef industry to manipulate ovarian activity of females, was fed to bulls at two times during development, prepubertal (5.5 to 7.5 months) and peri-pubertal (6.5 to 9.5 months), to determine effects on testes size, scrotal circumference, body weight, and/or hormone production. Feeding bulls MGA during the prepubertal and peri-pubertal time can alter body weight and testosterone production.

Bull exposure, when combined with a 7-day MGA synchronization, does not enhance conception rates in cows — The purpose of the current experiments was to determine if cows exposed to sterile bulls (epididymectomized) in combination with a 7-day MGA treatment would have an advantage in conception rates to cows not exposed to bulls. Bull exposure increased percentage of cows cycling prior to synchronization and reduced the time from calving to initiation of cycling. Overall there was not an increase in conception rates to timed AI or in total pregnancy rates in bull-exposed MGA treated cows when compared to cows not exposed to bulls.

Vascular endothelial growth factor mRNA isoforms 120 and 164 are differentially regulated prior to ovulation — Vascular Endothelial Growth Factor (VEGF) is produced by cells surrounding the egg in the follicle prior to ovulation. If VEGF is inhibited, ovulation does not occur. The VEGF gene can be spliced to produce different protein isoforms which have specific functions. Our objective was to determine if VEGF 120 and 164 mRNA isoforms are differentially regulated in the preovulatory follicle. VEGF isoforms were differentially regulated during both CL regression and after a simulated LH surge. Differences observed in VEGF isoform regulation may allow for manipulation of ovulation in the beef cow.

Growing

Digestibility of undegradable intake protein of feedstuffs — Digestibility of undegradable intake protein of sub-irrigated meadows, upland native range, smooth bromegrass, and other feedstuffs was measured using the mobile nylon bag technique.

Compared to the constant 80% digestibility of UIP used by the 1996 Beef NRC, grazed and harvested forages tend to have much lower UIP digestibility values while the supplemental protein sources evaluated tend to have higher UIP digestibility values.

Effect of fat and undegradable intake protein in dried distillers grains on performance of cattle grazing smooth bromegrass pastures — Growing heifers grazing smooth bromegrass pastures were supplemented daily with dry distillers grains, corn bran + corn oil, or corn bran + corn gluten meal to determine the relative contributions of fat and undegradable intake protein in dried distillers grains to animal performance. ADG was improved by 0.14 lb for every 0.10% BW increase in dried distillers grains supplementation. Cattle supplemented with corn bran + corn gluten meal gained 38% as much as cattle supplemented with dry distillers grains while cattle supplemented with corn bran + corn oil showed no improvement. Neither fat nor undegradable intake protein account for all the observed improvement in ADG from supplementing dry distillers grains.

Effects of supplementing dried distillers grains to steers grazing summer Sandhill range — Yearling steers continuously grazed summer native Sandhill range, with supplementation of varying levels of dried distillers grains with solubles (DDGS): 0.26, 0.51, 0.77, and 1.03% BW. Forage intakes were predicted using an equation based on TDN. Forage intakes decreased and average daily gain increased as level of DDGS increased. No significant differences were found in feedlot performance or carcass data. Economical analyses suggest supplementing DDGS is profitable. Increased gain from supplementing yearling steers DDGS while grazing summer range did not affect feedlot performance and can be economical.

Influence of dried distillers grains supplementation frequency on forage digestibility and growth performance — Two experiments evaluated the influence of dried distillers grains supplementation frequency on forage digestibility and growth of yearling steers. In Experiment 1, treatments were dried distillers grains fed at 16.7% of the diet either daily, every other day or every third day. Diet DM, OM and NDF digestibility decreased as dried distillers grains supplementation occurred less frequently. In Experiment 2, 48 crossbred steers were used to compare corn/soybean meal with dried distillers grains as winter supplements. Steers performed similarly when supplements were fed 6 days/week but performance was decreased when dried distillers grains was fed 3 days/week. Better animal performance may result from more frequent supplementation of dried distillers grains.

Dried distillers grains supplementation of calves grazing corn residue — Dried distillers grains (DDGS) were fed to weanling steer calves grazing nonirrigated corn residue to determine daily gain response and residue intake response to increasing levels of DDGS (from 1.5 to 6.5 lb/day in 1 lb increments). The DDGS was fed individually using Calan electronic gates. Daily gain increased from 0.9 (1.5 lb DDGS) to 1.8 (6.5 lb DDGS) lb/day. Forage intake decreased from 11.3 (1.5 lb DDGS) to 8.3 (6.5 lb DDGS) lb/day. Results provide information for selecting a DDGS supplementation level to achieve a target gain.

Effect of corn hybrid and processing method on site and extent of nutrient digestibility using the mobile bag technique — The influence of corn hybrid and processing method on site and extent of DM, starch, and protein digestibility was determined using the mobile bag technique. Samples consisted of three hybrids with known digestibility and feeding value processed as either dry rolled corn (DRC) or high moisture corn (HMC). Ruminant and total tract nutrient digestibilities were greater for HMC compared to DRC. Undegradable intake protein (UIP) digestibility was greater for HMC compared to DRC (77.8 and

73.7%, respectively). However, UIP was lower for HMC than DRC. Differences among processing methods and hybrids exist for site and extent of nutrient digestibility.

Finishing

Influence of corn hybrid and processing method on digestibility and ruminal fermentation — Three hybrids with different kernel traits and feeding value were selected to determine effects of corn hybrid and processing method (high moisture corn (HMC), or dry rolled corn (DRC)) on nutrient digestibility and ruminal fermentation. DMI, intake rate, and total time spent eating were greater for HMC than DRC. Changes in ruminal pH and pH variance were also greater for HMC compared to DRC. Total-tract nutrient digestibility was influenced by processing method and hybrid. Nutrient digestibilities were greater for HMC compared to DRC. Selection of hybrids with softer kernel traits and use of HMC will result in greater digestibility and favorable ruminal fermentation end products such as propionate.

Influence of corn hybrid on kernel traits — Sixty commercially available corn hybrids were used to identify kernel traits that may be used as an indicator of feeding value to cattle. Based on the dry matter disappearance in the rumen, a harder kernel will be more efficiently digested. An approximately 10% change in dry matter disappearance is shown between the most and least digestible hybrid. Physical kernel traits can be helpful in determining corn hybrids used for feeding cattle.

Influence of corn hybrid, kernel traits, and dry rolling or steam flaking on digestibility — Seventy-two commercially available corn hybrids were used to quantify kernel characteristics associated with improved feeding value to cattle. Hybrids were tested for kernel size, hardness, *in situ* digestibility, and starch use. For dry rolled corn, a 27% difference in dry matter disappearance was found across hybrids. For flaking, a 6% to 29% improvement over dry rolled corn was observed. An 8% to 36% advantage for steam flaking in starch digestibility was also found. The results of this trial suggest there can be an interaction between hybrid value and whether fed as dry rolled or steam-flaked corn.

Effect of corn processing in finishing diets containing wet distillers grains on feedlot performance and carcass characteristics of finishing steers — An experiment evaluated the effects of six corn processing methods in feedlot diets containing 30% (DM basis) wet distillers grains plus solubles (WDGS). Treatments consisted of whole corn, dry rolled corn, a dry rolled/high moisture corn mix, high moisture corn, steam flaked corn, and fine ground corn. The ADG was highest for steers receiving dry rolled corn, high moisture corn, or a 50:50 blend of dry rolled and high moisture corn. Feed conversion was best for steers receiving high moisture corn. Results indicate that there is a performance advantage obtained by processing corn as either dry rolled or high moisture when included with WDGS in finishing diets.

Effect of dietary inclusion of wet distillers grains on feedlot performance of finishing cattle and energy value relative to corn — An experiment evaluated the effects of six dietary inclusions of wet distillers grain plus solubles (WDGS) on feedlot performance and carcass characteristics of yearling steers, and also evaluated the energy value of WDGS relative to corn. Final BW, DMI, and ADG increased quadratically, while feed:gain decreased quadratically as WDGS inclusion increased from 0 to 50% of DM. Energy value of WDGS relative to corn was above 100% for all inclusion levels and decreased (178 to 121%) as dietary WDGS inclusion increased, (10 to 50% of DM). Results indicate that WDGS can be used effectively in finishing diets, with optimum performance being observed at 30 to 40% dietary inclusion.

Economic optimum use of wet distillers grains in feedlots

— An economic analysis was conducted utilizing feedlot performance, current feed ingredient prices, trucking, and cost of feeding inputs to determine economics of feeding wet distillers grains plus solubles (WDGS) at five dietary inclusions. Cattle returns are greatest when incorporated WDGS is fed at 30 to 40% of DM at feedlots located between 0 and 60 miles from the plant. As distance of the feedlot increases from 60 to 100 miles from the plant, optimum inclusion is between 20 and 30% of dietary DM. Results indicate more than just the cost of the product influence the economics of feeding WDGS.

Evaluation of a low protein distillers by-product for finishing cattle — An experiment was conducted to evaluate the effect of level of a low protein distillers by-product, Dakota Bran Cake (DBRAN) on feedlot performance and carcass characteristics of yearling steers. Diets contained 0, 15, 30, 45% DBRAN, or 30% dried distillers grains plus solubles (DDGS), replacing corn (DM basis). Final BW, ADG, and F:G improved as level of DBRAN in the diet increased. The DBRAN had feeding performance similar to DDGS at the same inclusion level. Feeding DBRAN, up to 45% of the diet, improved performance compared to feeding high moisture/dry rolled corn, suggesting DBRAN has 100 – 108% of the energy value of corn.

Effect of MIN-AD ruminal buffer and roughage level on ruminal metabolism and extent of digestion in steers — Six ruminally and duodenally cannulated steers were used in a metabolism experiment to determine effects of adding a ruminal buffer to diets containing increasing levels of roughage. Steers were fed high-concentrate diets containing 4.5, 9.0, or 13.5% alfalfa hay with or without 1.0% MIN-AD ruminal buffer. There were no differences observed in feed intake, ruminal metabolism, or total tract digestibility due to MIN-AD inclusion in the diet. Addition of MIN-AD to high-concentrate diets did not produce a response similar to increasing the roughage level in the diet.

Sodium chloride and soybeans in feedlot diets — Two trials were conducted to evaluate feeding sodium chloride salt (NaCl) and soybeans to feedlot cattle in summer and winter seasons. The treatments were 1) control; 2) 1% added salt; 3) 5% added whole soybeans; and 4) the combination of 1% added salt and 5% added whole soybeans. Added salt had a tendency to decrease dry matter intake and increase water intake. Additional salt and soybeans elevated tympanic temperatures. Treatment did not have an effect on performance, carcass quality grade, or dressing percentage.

Effects of field pea level and processing in finishing diets — Cattle were fed coarse rolled or whole field peas in a finishing diet to determine impact on finishing performance. The peas were included in the diet DM at 0%, 15%, and 30%. There were no significant differences in ADG, F:G, or carcass characteristics among processing methods or field pea level. The DMI increased as the field peas inclusion increased to 30% the diet DM. Field peas can be fed whole and replace corn in the diet up to 30%.

Vaccination for *Escherichia coli* O157:H7 in market ready feedlot cattle — A clinical trial was conducted during the summer of 2004 to evaluate the effects of vaccinating cattle against *Escherichia coli* on the probability of detecting *E. coli* O157:H7 in feces and colonization at the terminal rectum. The probability for vaccinated or nonvaccinated cattle to shed *E. coli* O157:H7 in feces was not significantly different. However, the probability for steers to be colonized by *E. coli* O157:H7 in the terminal rectum was greatly reduced for vaccinated (0.3%) compared with nonvaccinated (20.0%) steers. The vaccine was effective at reducing colonization of *E. coli* O157:H7 at the terminal rectum of cattle.

Large-scale clinical trial to evaluate an experimental *Escherichia coli* vaccine — A clinical trial was conducted

within 19 Nebraska feedlots to evaluate effects of an *Escherichia coli* vaccine on the probability to detect *Escherichia coli* O157:H7 on ROPES or for cattle to be colonized by *Escherichia coli* O157:H7 at the terminal rectum. Vaccinated pens of cattle were less likely to test ROPES-positive and had a lower probability for *E. coli* O157:H7 colonization. The vaccine was effective at reducing *E. coli* O157:H7 in the feedlot pen environment and colonization at the terminal rectum of cattle.

Livestock risk protection insurance vs. futures hedging: basis risk implications — This study analyzes the benefit of Livestock Risk Protection (LRP) insurance to cattle producers in reducing basis risk. Nebraska producers insuring fed cattle with LRP realize a basis risk reduction of one-third to one-half compared to futures or options hedging. Nebraska feeder cattle producers using LRP experience only a slight reduction in basis risk. With more accurate basis forecasts, producers can better estimate net hedged selling prices and, consequently, future cash flows.

Inhibition of methanogenesis in rumen fluid cultures — We identified 32 compounds that inhibit 13 to 100% of the methane produced by in vitro cultures of rumen fluid and have the potential to inhibit enteric methanogenesis in ruminant animals. The compounds are analogous to a substrate in the methane biosynthesis pathway and may inhibit methane production, yet not affect other organisms in the rumen.

Growth promoting agents and season effects on blood metabolite and body temperature measures — To assess growth promoting agents efficacy among seasons, triiodothyronine, thyroxine, blood metabolites, and tympanic temperature were measured in summer and winter studies. Within each season, pens of heifers were assigned to one of six growth promotant treatments. Season by growth promotant interactions ($P < 0.05$) indicated that the combination of estrogen and trenbolone acetate increased triiodothyronine in the winter, whereas trenbolone acetate alone decreased both triiodothyronine and thyroxine in the winter. Changes in blood metabolite levels resulting from the use of growth promotants do not appear to substantially influence seasonal changes in body temperature.

Effects of Optaflexx fed in combination with MGA on feedlot heifer performance — A commercial feedlot experiment was conducted using 1,807 heifers to evaluate the effects of Optaflexx fed in combination with MGA on finishing heifer performance. In heifers receiving MGA throughout the entire 126-143 day feeding period, feeding Optaflexx for the last 31-38 days increased ADG and hot carcass weight compared to heifers fed MGA but not Optaflexx. Heifers fed MGA and Optaflexx had increased DMI, improved feed efficiency and increased final live weight. Carcass quality measurements were not influenced by treatment.

Effect of Optaflexx dosage and duration of feeding prior to slaughter on feed conversion and carcass characteristics — Finishing steer calves were fed 0, 100, or 200 mg/head/day of Optaflexx for the final 28, 35, or 42 days of the finishing period. Feeding Optaflexx to feedlot steers increased ADG, improved F:G, and increased carcass weight. Feeding 200 mg/head/day of Optaflexx improved feed conversion by 8.1% without impacting carcass characteristics. Feeding Optaflexx at 200 mg/head/day for 28 to 42 days appears beneficial when compared with feeding diets without Optaflexx.

Summary of manure amounts, characteristics, and nitrogen mass balance for open feedlot pens in summer compared to winter — Data from 18 experiments (244 pen means) over a 10-year period were summarized in order to make a long-term comparison between seasons dealing with nutrient mass balance studies and characteristics and amount of manure from open feedlot pens. The amount of manure DM increased from 10.6 lb to 20.0 lb/head finished/day from

summer (May to September) to winter (November to May). Quantities of OM, ash, and N (lb/head finished/day) increased from 2.5 lb OM, 8.1 lb ash, and 0.13 lb N to 4.8 lb OM, 15.2 lb ash, and 0.22 lb N/head finished/day from summer to winter, respectively. Summer pens averaged 2.7% of N excretion in pen runoff N, and 6.2% of OM excretion in pen runoff, while winter pens averaged 1.8% of N excretion in pen runoff N, and 1.9% of OM excretion in pen runoff. Average N volatilization was higher for summer feeding pens (69%) compared to winter (47%). More total manure and manure N must be handled, but less volatilization of N and less N runoff occur in the winter compared to the summer feeding period.

Nitrogen mass balance and cattle performance of steers fed clinoptilolite zeolite clay — Winter and a summer nitrogen mass balance experiments were conducted to analyze effects of feeding clinoptilolite zeolite clay to steers. No differences were found in steer ADG, F/G or carcass characteristics. Nitrogen mass balance and volatilization were not affected by a 1.2% addition of clinoptilolite zeolite clay in feedlot diets. These experiments indicate clinoptilolite zeolite clay does not have a large enough cation exchange potential to be effective in reducing N volatilization in open feedlot pens.

Factors affecting N losses as measured using forced-air wind tunnels and N mass balance — Two experiments using wind tunnels were conducted in conjunction with an N mass balance to evaluate the effect of clinoptilolite zeolite clay on ammonia (NH₃) losses. Ammonia losses were measured during the last six weeks of each feeding period and compared to losses calculated using an N mass balance. Nitrogen loss, pH, surface DM and N contents, and soil and surface temperatures were assessed. There were no differences in NH₃ volatilization due to dietary treatments. As measured by the wind tunnels, 26.4 to 29.2% of the total N loss (by mass balance) was lost as volatilized NH₃. The wind tunnel is a useful tool for measuring gaseous emissions.

Managing phosphorus in beef feedlot operations — A commercial feedlot study determined manure nutrient flow in six feedlots using a corn and by-product based diet with an average P content of 0.39% (DM basis), and a range of 0.34 to 0.48%. Mass balances for N and P were conducted on each pen. The average feed nutrient intake was 0.52 lb N/head/day (64.0 ± 7.6 lb/animal fed) and 0.09 lb P/head/day (10.9 ± 2.2 lb/animal fed). Based upon averages from the 6,366 head of cattle, 11.5% of the feed nitrogen and 16.9% of the feed phosphorus were retained by the animal with the remaining nutrients excreted. Based upon these data, 31% of the excreted nitrogen or (17.2 lb/animal fed) and 90% of the excreted phosphorus (or 8.1 lb/animal fed) were removed in manure at cleaning.

Economics of manure phosphorus distribution from beef feeding operations — An economic model was developed to evaluate cost and value of manure distribution. A 2,500 head feedlot was used to calculate excretion amounts from cattle fed diets with a range of phosphorus. Diet P and subsequent costs of distributing that manure were used to analyze the corresponding costs of manure P distribution, in addition to determining the required acres needed to be in compliance with a nutrient management plan (NMP). When animals are fed diets of increasing P concentration, total distribution cost increased, ranging from \$2.80-\$5.10/head finished/year, but the agronomic and market value of manure produced increased faster.

Valuing feedyard management education, experience and expertise — A mail survey was used to determine the value Nebraska feedyard operators place on education, experience, and area of expertise in new assistant manager hires. Using conjoint analysis, calculations are made that estimate the marginal value of moving from one level of these attributes to another. Results show that operators preferred higher levels of education and experience. However, relevant experience was preferred over formal education. As an area of expertise, animal health was valued highest by operators of feedyards in all size categories for new assistant managers.

Beef Products

Alternative enhancement strategies for beef muscles — USDA select grade semitendinosus (eye of round) muscles from 12 cattle were used for controls (nonenhanced); salt and phosphate enhanced; water enhanced, or enhanced by addition of 10% of a solution containing 1, 3, or 5% sodium citrate to evaluate the effect of citrate on meat tenderness. Shear force and trained taste panel ratings were not different, ($P > 0.05$) between controls and citrate-treated muscles. Perhaps the high connective tissue content of the semitendinosus or poor retention of the enhancement solution contributed to these results, which are in conflict with our previous research using other muscles.

Flavor relationships among muscles of the beef chuck and round — Flavor relationships among muscles and causes of liver-like off-flavor of six muscles from each of 30 beef carcasses were evaluated by a trained sensory panel. The infraspinatus (flat iron) was lowest in sour, metallic, and oxidized flavors and highest in fatty flavor. The vastus lateralis (knuckle side) had the most intense off-flavor and was among the highest for sour and oxidized. Heme iron concentration and pH were lowly related to off-flavor. Of 18 muscles from three carcasses, 16 were high in liver-like off-flavor. These data suggest liver-like off-flavor is related to something that impacts muscles of the entire animal.

The influence of cooking rate and holding time on beef flavor — Seven muscles from 10 beef carcasses were cooked quickly or slowly and held 0 or 1 hour to explore the influence of cooking rate and holding time on beef flavor. Off-flavor intensity was lowest when beef was cooked slowly (on a 300°F grill instead of a 480°F grill) and when it was held for one hour prior to sensory evaluation. The infraspinatus (flat iron) had the least intense off-flavor and the vastus intermedius (knuckle bottom) had the most intense off-flavor. Slow cooking or holding for one hour prior to consumption reduced the intensity of off-flavor in value cuts.

Wet distillers grains plus solubles do not increase liver-like off-flavors in cooked beef — Crossbred steers were fed with varying levels of wet distillers grains to test the incidence of liver-like off-flavors. USDA Choice steaks, when compared to USDA Select, had significantly higher sensory muscle fiber tenderness scores, less detectable connective tissue, higher juiciness scores, and more intense off-flavor ratings. Wet distillers grains did not significantly influence off-flavor indicating these by-products can be used to finish cattle without causing detrimental effects on the sensory profile.

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Revised October 2005, 3,000

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