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G05-425 2005 Beef Report Summaries

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2005 Beef Report Summaries

Reports on recent beef research are briefly summarized. The full reports are available in the 2005 Nebraska Beef Report, available from Cooperative Extension or online at <http://pubs.unl.edu/pubs/beef/beefrpt.htm>.

Jim Gosey, Extension Beef Specialist

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Cow-Calf

Comparison of two development systems for March-born replacement beef heifers. A three-year study (2001-2003) was conducted to determine the effect of development system on reproductive performance of first-calf heifers. March-born heifers (n=261) were developed to reach either 55% of mature body weight (MBW) before a 45-day breeding season or 50% of MBW before a 60-day breeding season. Extending the breeding season 15 days for heifers developed to 50% of MBW prior to the first breeding season resulted in equal pregnancy, calving and weaning rates to heifers developed to 55% of MBW. Furthermore, the reduction in development costs in the 50% of MBW system more than offset the reduced income from lower weaning weights caused by later calving dates, resulting in decreased cost to produce one pregnant yearling heifer or 2-year old cow.

Effects of supplemental protein during gestation and grazing sub-irrigated meadow during the postpartum interval on pregnancy rates of spring calving cows and calf growth. A two-year experiment evaluated the influence of supplemental protein during the last trimester of gestation and grazing sub-irrigated meadow during the postpartum interval on pregnancy rates and calf growth in a March calving production system. Supplemental protein during the last trimester did not improve subsequent pregnancy rate but resulted in a tendency for increased carcass weight. Allowing cows to graze sub-irrigated meadow during the postpartum interval improved pregnancy rates but did not change steer performance in the feedlot. Feeding supplemental protein during the last trimester of gestation and allowing cows to graze sub-irrigated meadow were both economical methods of improving production.

The effects of temperature and temperature-humidity index on pregnancy rate in beef cows. Ten years of records from a 150-head beef cow herd were used to determine the relationship of temperature

and temperature-humidity index (THI) on pregnancy rate in beef cows. Pregnancy rate of the herd for the duration of the experiment averaged 92%. There was a linear relationship between average 30-day temperature and pregnancy rate during the first 30 days of the breeding season. Average THI greater than 65 for the first 30 days of the breeding season tended to decrease pregnancy rate in the first 30 days, but there was no effect on the 60-day pregnancy rate. If the 60-day average THI was greater than 70, pregnancy rate for 60 days tended to decrease. High temperatures and high temperature-humidity index decrease the pregnancy rate during the first 30 days of the breeding season. Cows acclimate to environmental conditions and if the length of the breeding season is 60 days or more, pregnancy rate is not reduced.

Effects of dried distillers grains supplementation frequency on heifer growth. Dried distillers grains were fed to growing heifers as an energy source and supplement to grass hay. Heifers were fed the equivalent of 3 lbs/hd daily of the same supplement, either three or six times per week. Heifers fed dried distillers grains six times per week gained more weight than heifers fed three times per week but those fed three times per week had greater allantoin to creatinine ratios which indicates more microbial crude protein was produced. Better animal performance may result from more frequent supplementation of dried distillers grains.

Reproductive response in heifers fed soybeans during post weaning development. Three experiments were conducted to determine effects of soybeans on reproduction in heifers. In Experiment 1, heifers received whole soybeans or control diet with wet corn gluten feed for 110 days. Heifers receiving soybeans had decreased synchronization rate and delayed estrous response. Diet did not affect AI conception, AI pregnancy, or final pregnancy rates. In Experiments 2 and 3, heifer diets were supplemented with ground soybeans or dried distillers grains. Heifers in Experiment 2 were predominantly prepubertal and supplemented 161 days. Heifers fed dry distillers grain gained faster and were heavier than those fed soybeans. Heifers in Experiment 3 were postpubertal and supplemented 30 days. Heifers fed soybeans had larger dominant follicles than those fed distillers grains.

Grazing

The effects of dried distillers grains on heifers consuming low or high-quality forage. Two forage sources, high and low quality, were used to evaluate effects of five levels of dried distillers grains on forage intake. Ninety heifer calves were fed high or low quality forage, supplemented with 0, 1.5, 3, 4.5, or 6 lb DM dried distillers grains. Forage intakes linearly decreased as dried distillers grains increased. Average daily gain increased linearly with increased dried distillers grains indicating that dried distillers grains can be a protein and energy supplement source and a substitute for forage. Dried distillers grains are an economical supplement to cattle on either high or low quality forage diets.

Tree growth and cattle weight gain in a ponderosa pine system. Integrated timber and livestock systems (Silvopastoral) are common in several regions of the United States. Grazing of three timber stands in eastern Nebraska showed no signs of tree damage due to rubbing or soil compaction. Steer gains were lower under the silvopastoral system compared to a typical pasture system (1.05 lb/day versus 1.70 lb/day). Growth of timber in silvopastoral stands was reduced from 37.8 cubic feet per year to 35.0 cubic feet per year; however, total productivity of the silvopastoral system (timber plus livestock) was greater (\$20.98/acre) than traditional timber systems.

Determination of undegradable intake protein digestibility in forages. Digestibility of undegradable intake protein of smooth brome grass, birdsfoot trefoil, and heat-treated alfalfa was determined using the mobile nylon bag technique. Undegradable intake protein (UIP) was determined using neutral detergent insoluble protein at 75% of the total mean retention time; 1.82 and 1.71 in June and July for brome and

1.30 and 1.94 in June and July for birdsfoot trefoil. Digestibility (%) of the UIP in brome was 38.6 and 27.1 in June and July and in birdsfoot trefoil 21.1 and 25.1. The UIP (% DM) of alfalfa dried to simulate dehydrated, sun-cured, and fresh alfalfa, was 3.13, 2.10, and 1.84. Digestibility (%) of UIP was highest for dehydrated (46.4) followed by sun-cured (25.6) and fresh alfalfa (14.7). The undegradable intake protein content and digestibility of the UIP of forages is low. Constant digestibility values used in current protein evaluation systems appear to be too high for forages.

Finishing

Effects of corn moisture and degradable intake protein concentration on finishing cattle performance. A finishing trial was conducted to determine the effects of corn moisture and degradable intake protein level on cattle performance. Diets consisted of 65% processed corn, either dry-rolled, high-moisture at 24% or 30% moisture, or reconstituted dry corn at 28% or 35% moisture. Degradable intake protein levels were evaluated by adding 0%, 0.45% or 0.90% urea (DM basis). Supplementing 0.45% urea increased performance and sufficiently met degradable intake protein requirements. Diets containing high-moisture and reconstituted corn improved feed conversion compared to diets containing dry-rolled corn. Increasing the moisture of ensiled corn further enhanced the feeding value of corn by improving feed conversion.

Effects of corn moisture and length of ensiling on dry matter digestibility and rumen degradable protein. An in situ trial was conducted to evaluate effects of corn moisture and length of ensiling on dry matter digestibility (ISDMD) and degradable intake protein (DIP). Corn treatments consisted of dry-rolled, high-moisture, and reconstituted dry corn. Corn samples were incubated in situ for 22 hours and ISDMD (%) and DIP (% of CP) values were calculated. Both high-moisture and reconstituted corn had higher ISDMD and DIP values than dry-rolled corn. Dry matter digestibility and degradable intake protein increased for high-moisture and reconstituted corn when either moisture or length of ensiling was increased.

Influence of corn kernel traits on digestibility and ruminal fermentation. A metabolism trial was conducted to determine the influence of corn kernel traits on digestibility. The seven hybrids used in this study were the same as those fed in a feedlot performance trial where kernel traits were correlated to feed conversion. These hybrids were selected to represent a range within and among kernel traits. There were no differences in total tract digestibility for hybrids that have softer endosperm. Ruminal pH parameters and intake behavior were not found to be different for animals in the metabolism trial; however, differences did exist among hybrids for volatile fatty acid production. VFA production over time was similar for all.

Effect of different corn processing methods and roughage levels in feedlot diets containing wet corn gluten feed. Sixty steers were individually fed for a 101-day period to evaluate two corn-processing methods, either dry rolled (DRC) or 29% moisture reconstituted corn (HMC), in combination with two levels of alfalfa hay (0% and 7% DM) in finishing diets containing 25% wet corn gluten feed (WCGF). Final body weight was greater for the steers fed DRC compared to steers fed HMC diets. Steers receiving DRC treatments had a 16% higher DMI than HMC treatments. DMI was greater in the DRC 7% alfalfa treatment than the DRC 0% alfalfa treatment, while there was no difference between the HMC treatments. There was a trend for a better feed conversion for DRC 0% alfalfa hay compared to HMC 0% alfalfa hay. The results indicate that the 25% WCGF inclusion level was insufficient to overcome the subacute acidosis associated with diets based on high moisture corn in this study. The value of forage in feedlot diets may depend on the corn processing method when diets contain WCGF.

Effect of corn bran and corn steep inclusion in finishing diets on diet digestibility and fiber

disappearance. Eight ruminally cannulated heifers were used in a replicated 4 x 4 Latin square to determine effects of replacing dry rolled corn with corn bran or a combination of corn bran and corn steep, on diet digestibility and rumen environment. Heifers received diets including 0% bran, 30% bran, 30% bran/15% steep and 45% bran/15% steep. By-product diets were effective in reducing acidosis, and had lower dry matter and organic matter digestibilities than the control diet, regardless of steep inclusion. Fiber digestion and microbial efficiency may have been promoted with the inclusion of corn bran and steep in the diet. Feeding a diet containing corn bran and steep may be valuable for improving nutrient utilization in the rumen.

Degradable intake protein in finishing diets containing dried distillers grains. An experiment evaluated the effects of finishing diets containing dried distillers grains supplemented with degradable intake protein on performance and carcass characteristics of yearling heifers. Diets contained 10% or 20% dried distillers grains (DDG) with or without 0.80% or 0.63% urea. Degradable intake protein balances were -192 (10% DDG no urea), 58 (10% DDG + urea), -111 (20% DDG), and 81 (20% DDG + urea) grams/day. No response in performance or carcass characteristics were observed among treatments. The results indicate sufficient amounts of urea were recycled to the rumen to meet the degradable intake protein requirement. Therefore, supplemental degradable intake protein is not necessary in finishing diets containing dried distillers grains at 10% or 20% of diet DM.

Effect of feeding a by-product combination consisting of wet distillers grains and wet corn gluten feed to feedlot cattle. Two-hundred-and-eighty yearling steers were used to evaluate effects of increasing levels of a corn milling by-products combination (Blend) (50% wet corn gluten feed, 50% wet distillers grains; DM basis) and different alfalfa hay levels on feedlot performance and carcass characteristics. Levels of Blend were 0%, 25%, 50% or 75% diet DM. Alfalfa level was either kept constant at 7.5% of DM or the forage level decreased, i.e., 7.5%, 5.0%, 2.5%, and 0% alfalfa for the 0%, 25%, 50%, and 75% Blend, respectively. (Steer DMI, ADG, and F:G responded quadratically ($P < 0.05$), with the greatest ADG and improved F:G at 25% and 50% blend.) These results suggest that feeding a 50:50 combination of wet corn gluten feed and wet distillers grains up to 50% of diets will enhance cattle performance.

Ethanol distiller by-product phosphorus concentration as influenced by corn hybrid. Analysis of commercial corn hybrids indicated grain phosphorus concentrations ranging from 0.19% to 0.39%. This range provides an opportunity to reduce phosphorus in the distiller's by-products. Based on 90% starch conversion efficiency, the estimated phosphorus concentrations of ethanol by-product were 0.52% and 1.04% when using grain with phosphorus concentrations of 0.19% and 0.39%, respectively. This is a reduction of 50% when using low phosphorus instead of high phosphorus corn hybrids.

Effects of field peas in beef finishing diets. Feeding field peas was compared to feeding corn in beef finishing diets. Field peas are higher in protein (20-28% CP) than corn, but contain one-third less starch. Diets containing field peas at 0%, 20%, 40%, and 59% replacement of corn in ration DM were fed to 129 steers. Dry matter intake increased from 0% to 40% of diets, but decreased when 59% peas replaced corn compared to 40%. No significant differences in ADG and G:F were observed. Field peas can replace 59% of the corn DM in beef finishing diet with no significant differences in animal gain or feed efficiency.

Effects of dietary phosphorus level in beef finishing diets on phosphorus excretion characteristics. Five ruminally fistulated steers were fed five finishing diets containing varying levels and sources of phosphorus (P). Diets consisted of three brewer's grits-based diets consisting of no supplemental P (0.12%) and two diets supplemented with mineral P (0.27%, and 0.42% P), one corn-based diet (0.30% P), and one diet containing dry distillers grains (0.36% P). As P intake increased, P excretion increased and was positively correlated ($r = 0.67$; $P < 0.01$) to P intake. Most of the P excretion was fecal P

averaging 88.7% of total excretion. With the exception of steers fed the 0.12% P diet with very little (0.50 g/day) urinary P, steers fed the other treatment diets excreted an average 2.1 g/day via the urine. These data suggest that P intake is positively correlated to P excretion and diet P concentration may impact route of excretion. Eliminating supplemental P from corn or corn/by-product diets will reduce the amount of P excreted while maintaining cattle performance.

Effects of corn bran and corn steep inclusion in finishing diets on cattle performance and nitrogen mass balance. Two experiments were conducted to evaluate the effects of decreasing digestibility of a finishing diet by replacing dry rolled corn (DRC) with corn bran, or a combination of corn bran and steep, on cattle performance and nitrogen mass balance in open feedlots. Replacement of DRC with bran had no impact on performance when steep was included in the finishing diets at 15% DM. Feeding bran and steep, in combination, was an effective means of reducing nitrogen losses in winter, as well as maintaining cattle performance throughout the year.

Composting of feedlot manure: compost characteristics, crop yields and application rates. Crop yields were measured on treated areas and no-compost check strips in large-scale production fields to determine the impact of a one-time compost application. Adding compost to irrigated corn, irrigated soybeans and dryland corn acres significantly increased yields. In a separate study, compost was added at 0, 20, or 40 t/ac. Little difference was observed in yields in this particular field. In all of these studies, nitrogen management was not modified based on compost addition, suggesting that yield improvements are presumably related to other nutrients.

Vaccination for *Escherichia coli* O157:H7 in market ready feedlot cattle. A clinical trial was conducted in summer 2003 to evaluate effects of vaccinating feedlot cattle against Type III secretory proteins of enterohemorrhagic *Escherichia coli* on prevalence of *E. coli* O157:H7 in feces. Treatments included: 1) no vaccination; 2) vaccinated once at re-implant (day 42); 3) vaccinated upon arrival (day 0) and again at re-implant (day 42); and 4) vaccinated on arrival (day 0), at day 21, and again at re-implant (day 42). Vaccination effectively reduced the proportion of feedlot cattle shedding O157 in the feces, the effect was dose-responsive, and vaccination within a pen conferred protection to unvaccinated pen-mates (herd-immunity). Vaccination had no adverse effect on finishing performance and appears to be a promising pre-harvest intervention strategy for control of *E. coli* O157:H7.

Direct-fed microbial products for *Escherichia coli* O157:h7 in market ready feedlot cattle. A clinical trial was conducted in summer 2002 and 2003 to evaluate the effect of a direct-fed microbial product (DFM) on the prevalence of *E. coli* O157:H7 in feces of feedlot steers. The DFM consisted of *Lactobacillus acidophilus* (NPC 747) fed at the rate of 1×10^9 colony forming units (CFU's) per head per day. Treatments included supplemental DFM or no supplemental DFM. Feedlot steers supplemented with DFM were 35% less likely to shed *E. coli* O157:H7 in the feces compared with steers that were not supplemented with DFM. Finishing performance was not affected by adding DFM into the ration.

Performance and economics of sorting yearling steers by feedlot initial body weight. Four groups of long yearling steers were used to evaluate the effect of sorting by feedlot initial body weight on performance and feedlot economic variables during the feeding period. Steers were sorted into the lightest 25%, middle 50%, and heaviest 25%, along with a non-sorted control. Steers were marketed by sort treatment; heavy -- two weeks prior; middle -- one week after; and light -- three weeks after the unsorted control steers. Sorting by initial feedlot weight did not affect dry matter intake, average daily gain, marbling, 12th rib fat thickness, USDA yield and quality grades, or economic analysis. However, sorting by initial feedlot weight increased days on feed, feedlot final BW, and hot carcass weight.

Performance and economics of yearlings developed with intensive winter management, and

partial season grazing. Two experiments were conducted over two years to evaluate the effects of two developmental systems on performance and economics of long yearling steer production. Steers were wintered in a conventional system with corn residue grazing and dry lot hay feeding, with 5 lb per day wet corn gluten feed as a supplement. Intensively managed steers were given 6 lb per day wet corn gluten feed and implanted with Ralgro at the beginning of the wintering period and Synovex-S at the beginning of the dry lot phase. In addition, intensively managed steers were removed from summer pasture early. Intensive system steers were marketed in October and conventional system steers were marketed in November, following a finishing period. Economic analysis indicated a performance and economic advantage to the intensive system when steers were marketed after the wintering period or after the summer grazing period; however, if steers were marketed after feedlot finishing, profitability estimates between the two development systems did not differ.

Effect of high roughage and high energy diets on body temperature. Four heifers were used in two trials comparing the effect of high energy and high roughage diets on three body temperature measurements. Body temperatures were measured in the vagina, in the ear canal near the tympanic membrane, and in the rumen. The high roughage diet lowered all three measures of body temperature as compared with the high energy diet. Vaginal, tympanic, and ruminal temperature all appeared to effectively measure body temperature as they followed the same diurnal cycle; however, ruminal temperatures were, on average, 0.5-1.4°F higher than other body temperatures.

Effect of clinoptilolite zeolite clay on cattle performance and nitrogen volatilization loss. A winter feeding experiment evaluated the effects of adding zeolite clay at 1.2% of the diet on steer performance and nitrogen (N) volatilization loss. No differences were found in steer performance, removed manure composition, or N balance; however, small numeric improvements were observed in ADG and F:G for steers fed zeolite. Adding zeolite clay to feedlot diets at the rate of 1.2% of the diet did not reduce N loss in open feedlots.

Evaluation of initial implants for finishing steers. A commercial feedlot experiment utilizing 12 pens and 1038 steers evaluated initial implant strategies for feedlot steers. Steers were administered either Revalor-IS[®] or Synovex-S[®] at initial processing. Both treatment groups received Revalor-S as a terminal implant. Revalor-IS as an initial implant increased hot carcass weight and carcass adjusted final weight; however, there was no effect on any other measure of performance or carcass characteristics. Selling steers on a carcass merit basis resulted in a similar return per head for both implant strategies. Reduced-dose combination implants may increase hot carcass weight and carcass adjusted final weight with no detrimental impact on carcass merit.

Beef Products

Effect of injecting modified connective tissue solutions on quality of beef roasts. Soluble collagen from enzymatically treated beef tendons was used to inject USDA Select grade semitendinosus (ST) beef muscles. Similar samples injected only with water, salt and phosphates and non-injected ST roasts were used as controls. No treatment differences were found for package purge loss and shear force. Color of collagen injected samples was either similar to non-injected or salt/phosphate injected pieces. Sensory evaluation by taste panelists indicated that samples injected with enzyme treated collagen were tenderer, juicier, and more flavorful. Collagen from enzyme modified beef tendons can be successfully used for injection of whole muscle products resulting in increased value of the raw material and finished product.

Packaging effects on shelf-life and sensory traits of enhanced beef. An experiment was conducted to determine the effects of commercial case-ready packaging systems on sensory, shelf-life, color and color

stability of enhanced beef. The beef in this experiment was enhanced by injection of a water, salt and phosphate solution to improve texture, flavor and consistency. Beef strip loins and top sirloins were enhanced and steaks were stored in one of three packaging systems: high-oxygen barrier trays, low-oxygen peelable trays, or vacuum packages. After dark storage for 8 or 15 days, simulating distribution time, steaks were displayed up to 3 days in a retail case. Steak discoloration and sensory traits were rated. Extended dark storage and retail display were detrimental to flavor and color. The best packaging systems were those that minimized opportunities for oxidation. In this study, that included vacuum packaging and, as long as dark storage was limited to eight days, high oxygen packaging.

Benchmarking the differences between cow and beef muscles. Nine muscles from cow and A-maturity beef carcasses were evaluated for physical and chemical characteristics. Fifteen carcasses were selected from five populations (fed beef cows, non-fed beef cows, fed dairy cows, non-fed dairy cows, and Select-grade beef). Some muscles from four populations of cow carcasses evaluated have similar chemical and physical properties to muscles from A-maturity, USDA Select carcasses. Perhaps those muscles from cow carcasses could be utilized in a manner that would increase their value. Most muscles from cow carcasses were darker in color, had higher pH values, and had greater heme iron content than muscles from younger cattle, which may be undesirable to consumers. Supplemental technology may be needed to upgrade muscles from cow carcasses.

Pre-rigor water injection and post-rigor sodium citrate treatment on beef tenderness. Three muscles from the beef chuck of 20 beef steers were used as post-rigor controls, pre-rigor controls (removed pre-rigor), or treated with combinations of sodium citrate and/or water to evaluate the effect of citrate on meat tenderness. Shear force values on steaks from the infraspinatus, supraspinatus and triceps brachii muscles revealed citrate-treated muscles were tenderer than water and post-rigor control treatments. It appears sodium citrate can tenderize meat independent of water injection.

Evaluation and composition of beef *Semitendinosus* utilizing a novel cooking system. The effects of cooking dwell time on chemical and physical properties of cooked meat and cook-out purge were examined. Cooked meat yields were not affected among cooking dwell times for samples with 12% added enhancement solution. Increasing cooking dwell time resulted in increased cooked meat tenderness. No differences were demonstrated among cook-out purge samples for moisture, ash, fat, and total collagen values regardless of cooking dwell time, pump level, and endpoint temperature of the sample. Cook-out purge refers to the water and water-soluble proteins left in a cook-in bag after the beef product is removed. This research will be beneficial to meat processors in creating a Ready-To-Eat (RTE) product that utilizes cook-out purge.

The effects of phosphate type and potassium lactate level on quality characteristics of enhanced beef steaks. Beef semitendinosus steaks were used to evaluate the effects of sodium phosphate and potassium lactate on quality characteristics of enhanced beef steaks. Sodium phosphate decreased the amount of package purge and cook loss, and gave the beef product a darker, redder appearance. Potassium lactate gave the product a darker, redder appearance, while increasing levels of lactate decreased total psychrotrophic (bacterial) plate counts as well as package purge and cook loss. Sodium phosphate and potassium lactate helped extend shelf-life and improved quality attributes of enhanced beef steaks.

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