

## 2015 Beef Report Summaries

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Brief synopses of recent UNL beef research.

### Introduction

Each year the UNL Department of Animal Science reports its current beef cattle research. More detailed reports are available in the 2013 Nebraska Beef Report, available in print from University of Nebraska–Lincoln Extension or on the Web at <http://www.ianrpubs.unl.edu/sendIt/mp101.pdf> or <http://beef.unl.edu>.

### Cow/Calf

**Impact of Heifer Development System on Subsequent Gain and Reproduction.** Replacement heifers from 2 calving herds were fed ad libitum hay and 4 lb of supplement/day, or grazed meadow and received 1 lb of supplement/day from mid-January to mid-April prior to both breeding seasons. Heifers fed hay had a greater daily gain during the treatment period compared with meadow grazing heifers. However, grazing heifers compensated during their respective breeding season, resulting in similar body weights at pregnancy diagnosis for March-calving heifers. The proportion of heifers attaining puberty before breeding and conceiving was similar between the treatment groups in both herds.

**Genetic Parameter Estimates for Calving Difficulty and Birth Weight in a Multibreed Population.** Eighteen breeds were utilized to estimate genetic parameters for birth weight and calving difficulty on first-parity females. Birth weight and calving difficulty were moderately heritable allowing for genetic selection to decrease calving difficulty. Genetic correlation estimates were positive between direct effects for birth weight and calving difficulty. This work will serve as the foundation for estimating across-breed EPD for calving difficulty in the U.S.

**Estimation of British- and Continental-Specific Heterosis Effects for Birth, Weaning, and Yearling Weight in Cattle.** Heterosis was calculated for 6,834 individuals with birth, weaning, and yearling weight records. Heterosis was further estimated by proportions of British x British (BxB), British x Continental (BxC), and Continental x Continental (CxC) crosses. Estimates of BxB, BxC, and CxC heterosis were significant for weaning and yearling weight. This illustrated differences among biological types exist and provide an opportunity to utilize specific breeds and exploit heterosis in a crossbreeding system to achieve production goals.

**Using Sugar Beet Pulp to Replace Wheat Straw when Limit Feeding Late Gestation Beef Cows.** Sugar beet pulp was evaluated as a partial replacement for wheat straw in a limit fed ration for gestating beef cows. Body weight and body condition were similar between cows fed a diet of wet distillers grains:beet pulp:wheat straw in either a 20:20:60 or a 20:45:35 ratio (DM

basis). Cows on both diets gained 0.5 of a condition score over an average of 76 days. Sugar beet pulp can effectively reduce wheat straw to 35% diet DM in a byproduct/crop residue diet limit fed to gestating beef cows.

**Supplementing Cow-Calf Pairs Grazing Smooth Bromegrass.** Supplementing a 30:70 modified distillers grains plus solubles:cornstalks mixture reduced estimated grazed forage intake by approximately 40% by cow-calf pairs grazing smooth bromegrass. Doubling the stocking rate and supplementing did not impact cow or calf performance. A summer supplementation program designed to reduce grazed forage intake is a viable strategy for increasing stocking rate if forage is limited.

**Effects of Calf Age at Weaning on Cow and Calf Performance and Feed Utilization in an Intensive Production System.** The effects of calf weaning age on cow and calf performance, reproduction, and feed utilization were investigated. Early weaning increased cow BW. Pregnancy rates were not impacted by calf age at weaning. Dry matter intake (DMI) was similar between normal-weaned cow-calf pairs and early-weaned cows and calves. Feed requirements and utilization were comparable between treatments when fed high energy diets, implying weaning decisions should be made on the basis of management rather than feed efficiency.

**An Economic Analysis of Conventional and Alternative Cow-Calf Production Systems.** Profitability through weaning was predicted for cow-calf production systems using various input price scenarios. At base input prices, conventional systems were more economical than alternative systems. As pasture price increased, alternative systems became cost effective. Feeding cows year-round in a confinement setting appeared the least economical; however, an alternative system combining summer drylot feeding with cornstalk grazing is projected to be economically competitive given an abundance of corn residue.

**Effect of Post-Weaning Management and Age at Weaning on Calf Growing and Finishing Performance.** The impact of post-weaning management system and calf age at weaning on growing and finishing performance was evaluated. During the growing phase, cattle in the fast-track system had improved intake, gain, and feed conversion. Although initial finishing weight was similar between systems, slow-track cattle had greater intake, gain, final body weight, and carcass weight. The improvement in finishing performance for slow-track cattle demonstrates the value of different management systems.

### Growing

**Dried Distillers Grains Supplementation of Calves Grazing Irrigated Corn Residue.** Calves grazing irrigated corn residue were supplemented dried distillers grains plus solubles (DGS) at 0.3, 0.5, 0.7, 0.9, or 1.1% of body weight. Daily gain improved

linearly (0.77 lb/head/day to 2.21 lb/head/day) with increasing supplementation (1.5 lb/day to 7 lb/day). Supplementing DGS to calves grazing corn residue increased gain during the winter period.

**Comparison of Commercial Lick Tubs to Distillers Grains Supplementation for Calves Grazing Corn Residue.** Calves grazing irrigated corn residue were supplemented dried distillers grains plus solubles (DGS) or allowed continuous access to a commercial lick tub. Dried DGS was fed at 2.94 lb/steer/day and the lick tubs were consumed at 2.04 lb/steer/day (DM basis). Gain was greater for cattle supplemented with dried DGS (1.36 lb/day) compared to those with access to lick tubs (0.83 lb/day). Economic analysis shows that as the price of DGS increases, the difference in profit between supplementation strategies is reduced.

**Efficacy of Bovatec 2.2 Mineral Blocks for Cattle Grazing Crested Wheatgrass Pastures.** A grazing study evaluated providing Bovatec® in a trace mineralized salt block. Daily block intake was 1.40 and 1.25 oz/day for the Bovatec and control (no ionophore) cattle, respectively. Although cattle consuming the Bovatec block gained 5% more than the control cattle, this was not significant (1.75 vs 1.67 lb/day, respectively). Supplying an ionophore through a self-feeding block may not improve gain compared to supplying mineral alone in a self-feeding block.

**Effect of Distillers Grains Plus Solubles and Monensin Supplementation on Grazing Steers.** Steers rotationally grazing smooth bromegrass were supplemented monensin at 0 or 200 mg with modified distillers grains plus solubles (MDGS) Monensin did not affect ADG of steers supplemented MDGS  $\geq$  0.4% BW. Steers supplemented with monensin had a decrease in estimated forage intake from 16.16 lb to 14.75 lb/OM daily.

**Comparison of Wet or Dry Distillers Grains Plus Solubles to Corn as an Energy Source in Forage-Based Diets.** Wet or dry distillers grains plus solubles were compared to each other or to corn as an energy source in forage-based diets. The energy value of distillers grains plus solubles fed at 15% of diet DM was 137% and fed at 30% of the diet DM was 136% relative to dry-rolled corn. Wet and dry distillers grains plus solubles had equal energy values.

**Effects of Processing Treated Corn Stover and Distillers Grains on Performance of Growing Cattle.** A complete pelleted feed containing calcium oxide (CaO) treated corn stover and distillers grains was evaluated. Feeding the pellet *ad libitum* resulted in greater DMI and ADG; however, the cattle had greater F:G. The pellet has 98% the feeding value of the control treatment.

**Digestibility of Calcium Oxide Treated Corn Residue with De-Oiled Distillers Grains.** A digestion study was conducted to evaluate diets containing calcium oxide treated corn residue. Chemical treatment did not affect digestibility. The use of chemically treated residue in combination with distillers grains in growing diets may not impact diet digestibility.

**Digestibility of De-Oiled Modified Distillers Grains Plus Solubles in Forage-Based Diets.** Removing oil from distillers grains by centrifugation does not impact intake or total tract digestibility in beef cattle growing diets. However, increasing the concentration of de-oiled distillers grains in the diet significantly improved intake and digestibility. Thus, concentration of distillers grain in the diet has a greater impact on total tract digestibility than the fat content in forage-based diets.

**Evaluation of the Impact of an Alternative Corn Residue Harvest Method on Performance and Methane Emissions from Growing Cattle.** A growing study was conducted to evaluate the impact of alternative corn residue harvesting methods and inclusion of Rumensin® on performance and methane to carbon dioxide ratio (CH<sub>4</sub>:CO<sub>2</sub>) of steers. Use of the alternative harvesting method resulted in greater ADG and improved F:G ratio than traditionally harvested cornstalks. Rumensin increased ADG and improved DMI; however, it did not have an impact on F:G ratio.

Altering the composition of baled corn residue did affect CH<sub>4</sub>:CO<sub>2</sub>, while inclusion of Rumensin had no impact.

**Effect of Diet on the Rumen Microbial Community Composition of Growing Cattle and the Role It Plays in Methane Emissions.** To understand the relationship between microbial community and methane, the microbial community of the rumen was examined. This study demonstrates that diet influences the microbial community within the rumen, and the potential to develop dietary intervention strategies for methane mitigation and animal performance.

## Forage Management and Crop Residue Utilization

**Stocking Rate Effects on Forage Nutrient Composition in Early Summer Pastures.** In Nebraska Sandhills early summer upland range, stocked pastures had lower CP, *in vitro* organic matter digestibility, forage availability, and higher NDF compared with ungrazed pastures. Clipped samples of current year growth had greater CP and *in vitro* organic matter digestibility than diet samples. Early season grazing decreases diet nutrient content and forage availability compared with ungrazed pastures, suggesting that cattle consumed current and previous year growth.

**Effects of Grazing on Nebraska Sandhills Meadow Forage Nutrient Content.** In Sandhills meadows used for summer grazing, non-grazed pastures had greater CP than grazed pastures early in the grazing season. By late July treatments did not differ in CP content. Non-grazed pastures had greater *in vitro* organic matter disappearance compared with grazed pastures from late July through September. The greatest differences in nutrient content between grazed and non-grazed meadow pastures occur early and late in the grazing season.

**Effect of Corn Residue Removal on Subsequent Crop Yields.** In a 16 year study, cattle grazing corn residue in the spring or the fall slightly improved subsequent soybean yields and had no effect on corn yields in an irrigated field maintained in an annual corn-soybean rotation at Mead, Neb. In a five-year study, fall grazing or baling of corn residue had no effect on subsequent corn grain yields in a field maintained in continuous corn production at Brule, Neb. Grazing of corn residue in the fall or spring at or below UNL recommended stocking rates will have slightly positive or no impacts on subsequent soybean or corn yields.

**Effect of Corn Plant Maturity on Yield and Nutrient Quality of Corn Plants.** Two corn plots (short and normal season) were serially harvested to evaluate nutrient, digestibility, and yield change over the duration from half-milk line through black layer. Digestibility of the corn plant decreased as corn plant maturity and NDF content increased. The lower leaf in the normal season plot decreased in digestibility, but did not change in the short season plot. The NDF content of the upper plant increased in both plots. These results suggest there is a delicate balance between plant maturity, nutrient content, and yield.

**Evaluation of Changes in Nutritional Quality of Corn Residue Over Time.** Irrigated corn residue was sampled across time to determine changes in quality and proportion of corn residue as the plant dried and was exposed to weathering. Corn plants from two hybrids were planted on two planting dates and harvested at periodic intervals from August 2012 to December 2012. Proportions of stem, blade/sheath, husk/shank, and cob made up smaller components of total plant DM as it matured, with the largest relative reduction occurring in the blade/sheath or stem. Hybrid impacted TDN primarily because the 119 day hybrid was less mature at the early sampling dates.

**Effect of Harvest Method on *In Vitro* Digestibility of Corn Residues.** New corn residue harvesting methods were evaluated to determine the impacts of altering the proportions of plant part in a round bale. As husk comprised a greater proportion of the

bale, digestibility appeared to increase when compared with a conventional bale of cornstalks.

**Effects of Ingestion and Collection Bag Type on Nutrient Composition of Forage Samples from Esophageally Fistulated Cattle.** Ingestion and mastication of forage samples adds ash. Generally, levels of CP were lower and NDF and IVOMD were similar for post-ingested versus pre-ingested forage. Bag type (screen vs. solid) generally did not affect ash, NDF, or IVOMD. Bag did not affect CP of alfalfa, but CP of grass samples from screen bags was lower than solid bags. More fresh than dry forage was recovered through the esophageal opening.

## Finishing

**Feeding Elevated Levels of Corn Silage and MDGS in Finishing Diets.** A finishing experiment evaluated substituting corn silage and modified distillers grains with solubles (MDGS) for corn. There were no interactions between corn silage and MDGS inclusion for carcass adjusted performance. As corn silage inclusion increased in the diet, there was a modest reduction in ADG and an increase in F:G. When MDGS inclusion was increased, ADG and F:G were improved.

**The Effects of Corn Price, Shrink, and Harvest Moisture on Corn Silage Economics.** Economic assumptions were applied to corn production to set corn silage prices for breakeven corn production, whether harvested for corn grain or corn silage. Price levels were used for the calculation of returns per finished steer as corn silage inclusion increased in finishing diets. As corn price increased, the economics of feeding elevated concentrations of corn silage became more favorable. The economic importance of shrink and harvest moisture content were assessed. As corn price increases and the inclusion of corn silage increases, corn silage management decisions have greater economic importance.

**Evaluation of Rumen Metabolism and Digestibility of Corn Silage and MDGS Finishing Diets.** Rumen pH, digestibility, and *in situ* nutrient disappearance in steers fed a diet containing 95% corn silage or diets containing 15 or 45% corn silage and 20 or 40% modified distillers grain with solubles (MDGS) were evaluated. Steers fed 45% corn silage had increased ruminal pH, DMI, NDF intake, and NDF digestibility. Decreased DM and OM digestibility were observed in diets containing 40% MDGS. Disappearance of corn bran NDF was increased in diets containing 45% corn silage. These results imply enhanced fiber digestibility as diets increased in corn silage.

**Response to Increasing Concentrations of De-oiled Modified Distillers Grains Plus Solubles in Beef Feedlot Diets.** The response to feeding increasing concentrations of de-oiled modified distillers grains plus solubles (MDGS) on cattle performance and carcass characteristics was evaluated. Increasing concentration of de-oiled MDGS in the diet resulted in a linear improvement in F:G. There was a tendency for 3.4% improvement in F:G for cattle fed normal MDGS diets over those fed de-oiled MDGS.

**Feeding Value of De-oiled Wet Distillers Grains Plus Solubles Relative to Normal When Fed with Either Dry-Rolled Corn or Steam-Flaked Corn in Beef Finishing Diets.** The effects of feeding de-oiled wet distillers grains plus solubles (WDGS) in dry rolled corn (DRC) or steam-flaked corn (SFC) diets relative to normal fat WDGS were determined. No significant interactions were observed, but cattle fed DRC had greater DMI and were less efficient than those fed SFC. ADG and F:G improved as concentration of de-oiled WDGS increased. Numerically cattle fed normal WDGS were more efficient than cattle fed de-oiled WDGS.

**Nutrient Digestibility and Ruminal pH of Finishing Diets Containing Dry Milling Byproducts With and Without Oil Extraction.** The effects of corn oil removal in condensed distill-

ers solubles (CDS) and modified distillers grains plus solubles (MDGS) was determined on nutrient digestibility and ruminal pH. Oil removal did not impact digestibility in steers fed CDS or MDGS. Steers fed de-oiled CDS had a lower fat digestibility than steers fed normal CDS. Ruminal pH was lower for steers fed de-oiled MDGS than for steers fed normal MDGS, however no difference within CDS was observed.

**Effects of Replacing Corn with a Pelleted Treated Corn Stover and Distillers Grains on Intake and Total Tract Digestibility of Finishing Diets.** Replacing DRC with a pelleted feed containing treated corn stover, solubles, and distillers grains (DDG) had no effect on intake. Total tract digestibilities were not affected by dietary treatment. Proportions of acetate, propionate, and butyrate were not impacted. DRC can be replaced with a pelleted stover and distillers in the finishing diet without altering total tract digestion.

**Effects of Replacing Corn with a Pelleted Treated Corn Stover and Distillers Grains on Performance of Finishing Cattle.** Steers consuming a pelleted treated corn stover feed with 40% modified distillers grains with solubles (MDGS) had equal or similar performance to the control diet with 40% MDGS. Cattle consuming 10% pelleted feed with 20% MDGS had similar efficiencies as the control diet; however, feeding the pellet at 20 or 30% of the diet DM with 20% MDGS decreased feed efficiency.

**Using Enspira to Improve Fiber Digestion.** A fibrolytic enzyme (Enspira™) was evaluated for effects on total tract digestion of a finishing diet. *In situ* NDF digestibility was not different between the treatments. Rate of digestion of the corn residue and corn silage was lower for the enzyme treatment compared to the control. Ruminal pH was not significantly different between the two treatments. There was no difference in VFA profile, DM, OM, NDF, ADF, or hemicellulose digestibilities between the control and enzyme treatment.

**Effect of 300 or 400 mg Daily of Ractopamine Hydrochloride on Growth Performance and Carcass Characteristics of Finishing Steers.** Feeding 300 mg of ractopamine hydrochloride (Optaflexx®) for 28 or 42 days increased live final BW by 13 and 29 lb, while feeding Optaflexx at 400 mg resulted in 27 or 24 lb increases relative to 0 mg steers, respectively. Feeding 300 mg of Optaflexx for 28 or 42 days improved HCW 11.1 or 16.6 lb. Feeding 400 mg of Optaflexx improved HCW 19.7 or 20.7 lb compared to steers fed no Optaflexx, respectively.

**Effects of Three Aggressive Implant Protocols on Feedlot Performance and Carcass Traits of Calf-Fed Steers.** Three initial implant strategies [Revalor® 200 (Rev200), Revalor® IS (RevIS), or Revalor® XS (RevXS)] followed by a Revalor 200 terminal implant were evaluated. No differences in final BW, DMI, ADG, or F:G were observed. The RevXS treatment resulted in larger LM area, lower calculated yield grades, less back fat, and more yield grade 1 carcasses. The Rev200 and the RevXS treatments had a higher percentage of carcasses that graded select compared to RevIS suggesting initial implant has little impact on feedlot performance but small effects on quality and fatness at equal days on feed.

**A Comparison of Two Implant Protocols: Synovex-Choice/Synovex-Plus vs. Synovex-S/Revalor-S on Steer Feedlot Performance and Carcass Characteristics.** Implant strategies were compared utilizing Synovex® Choice followed by Synovex Plus® or Synovex® S followed by Revalor® S. There was no difference in ADG or HCW between treatment groups. There were no differences in yield grade, marbling score, or proportion of steers grading USDA Choice.

**Effect of Zinc and Copper Source on Finishing Steer Feedlot Performance and Incidence of Footrot.** The combination of inorganic and organic copper and zinc trace minerals were compared to basic copper chloride and zinc hydroxychloride

trace minerals on performance and carcass characteristics and the incidence of footrot in feedlot cattle. There were no differences in DMI, ADG, F:G, hot carcass weight, carcass traits, or treatment for footrot.

**Effects of Next Enhance® Concentrations in Finishing Diets on Performance and Carcass Characteristics of Yearling Feedlot Cattle.** A feedlot study evaluated the effects of NEXT ENHANCE® 300 (NEXT) essential oil concentration in finishing diets containing Rumensin® and Tylan® on yearling steer performance and carcass characteristics. Increasing NEXT concentration in the diet had no effect on DMI, ADG, or F:G. These data suggest that feeding increasing concentrations of NEXT had little impact on feedlot performance of large yearling steers.

**Evaluating Two Rates of Monensin During the Grain Adaptation Period on Cattle Performance and Carcass Characteristics.** Monensin was supplemented at 360 or 480 mg/head/day during the adaptation period. During the adaptation period, interim body weight was greater and dry matter intake was less for steers fed 360 mg/head/day monensin. Average daily gain and feed efficiency were improved with the 360 mg/head/day treatment. There were no differences in final performance and carcass characteristics. This suggests it is not beneficial to feed the 480 mg/head/day rate of monensin in the adaptation period.

**Effects of Dietary Fat Source and Monensin on Methane Emissions, VFA Profile, and Performance of Finishing Steers.** The effects of dietary fat source and monensin on performance, methane (CH<sub>4</sub>) emissions, and ruminal VFA profile were evaluated. No effects on performance or VFA profile were observed. Modified distillers grain plus solubles (MDGS) in the diet tended to increase measures of CH<sub>4</sub> production when compared to corn oil or tallow. Inclusion of monensin in the finishing diet was not significant for CH<sub>4</sub> production.

**Mineral Composition of Beef Cattle Carcasses.** Mineral retention was measured in cattle grown at different rates of gain and finished on a common diet. Calcium and P retention were not affected by treatment and were similar between the growing and finishing periods averaging 4.2 g P and 10.8 g Ca /100 g protein gain. As ADG during the growing period was decreased, K, Mg, and S mineral retention during the finishing period were increased. Expressing mineral retention as g/100 g protein gain reduced variation due to animal size and ADG and suggests current NRC predictions are accurate.

**Mineral Composition of Serial Slaughter Holstein Carcasses.** Steer carcasses were evaluated for P, Ca, K, Mg, and S retention. Every 28 days, five steers either fed Zilmax for 20 days prior to harvest or not fed Zilmax, were harvested. There were no differences in treatment or days on feed when mineral retention was expressed as g/100 g of protein gain. Expressing mineral retention relative to protein gain reduced variation due to rate of gain and animal size.

**Anaerobic Digestion of Feedlot Manure.** Cattle diet can impact manure quality and quantity but has minimal impacts on methane production from anaerobic digestion of manure. Quality of manure does affect methane production and is impacted by the environment cattle are housed in and methods used to collect manure. As the amount of ash contamination of manure was increased OM degradation and methane production decreased. With adequate daily cleanout of ash from digesters, open-lot beef cattle manure can be used for anaerobic digestion.

## Beef Products

**A Basic Mechanism of Beef Tenderization: Feeding Wet Distillers Grains Plus Solubles Contributes to Sarcoplasmic Reticulum Membrane Instability.** Steaks from steers fed wet distillers grains (WDGS) were tenderer and had greater free calcium concentrations. Feeding WDGS also increased proportions of polyunsaturated fatty acid concentration in sarcoplasmic reticulum (SR) membrane and altered SR lipid and phospholipid profiles. This suggests that feeding increased concentrations of WDGS in the finishing diet can increase meat tenderness.

**The Effects of Source and Amount of Nitrite on Quality Characteristics of All-Beef Frankfurters.** Frankfurters cured with alternative sources of nitrite had a slightly darker, less red exterior and slightly more yellow interior than those containing sodium nitrite. No differences were observed for pH or water activity. Both curing methods can be used to manufacture all-beef frankfurters with similar characteristics when using equivalent amounts of nitrite.

**Effect of Feeding Distillers Grains in Different Phases of Production on the Fatty Acid Profile and Oxidation of Frozen, Cooked Beef Links.** Lipid oxidation of cooked ground beef links made from cattle fed different diets and with different concentrations of added natural antioxidants was compared to evaluate product shelf life. Samples without antioxidants were the most oxidized, with no differences between other antioxidant concentrations throughout frozen storage. An increase in polyunsaturated fatty acids was found in beef when finished on modified distillers grains but did not result in increased oxidation. The addition of natural antioxidants effectively reduced oxidative rancidity regardless of animal diet.

**Effect of Feeding Distillers Grains and Supplementing with Dietary Antioxidants on Ground Beef Color During Retail Display.** Ground beef patties from cattle fed corn-based diets with or without wet distillers grains and supplemented with two levels of vitamin E, or Ethoxyquin during the finishing phase were compared to analyze color stability during retail display. As display time increased, patties from all dietary treatments had greater discoloration and became darker, less red, and more yellow. Beef patties discolored during retail display, but the rate and degree of discoloration were unaffected by diet or antioxidant supplementation.

**This publication has been peer reviewed.**

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1975-2013, Revised December 2014

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