**NCCC308: Nutrition and Management of Feedlot Cattle to Optimize Performance, Carcass Value, and Environmental Compatibility**

**Hosted by University of Nebraska-Lincoln**

UNL Animal Science Complex 3940 Fair St, Lincoln, NE 68583

May 21-23, 2024

**Guests:**

NCCC-308 members

UNL ruminant nutrition graduate students and faculty/extension educators

**Contact Info:**

Jessica Sperber: 806-476-9466 [jsperber2@unl.edu](mailto:jsperber2@unl.edu)

**Air Travel Accommodations:**

Lincoln Airport – Lincoln, NE

Eppley Airfield – Omaha, NE

*Omaha airport will have more flight times available/better pricing, but will require transit (uber/rental car) from Omaha to Hyatt Place Lincoln (60 min commute)*

**Hotel Accommodations:**

Hyatt Place Lincoln/Downtown-Haymarket

600 Q St, Lincoln, NE 68508

Arrival: Tuesday, May 21st

Checkout: Thursday, May 23rd - *Checkout time is 12pm*

**Amenities**: ComplimentaryBreakfast, Internet & Self-Parking ($12 Value/Night)

To park, all guests park in the RED 1 Garage, located on Q Street, right next to the hotel. Upon check-in, you are able to pull into our loading zone upfront in order to check-in, receive their guestroom keys and parking garage key before heading to the garage, as they'll need the Hyatt access card to wave in front of our payment machine in the garage entrance to allow them into and out of the garage complimentary.

**Agenda** - *All times in CT*

**Tuesday May 21st**

Meeting location: University of Nebraska-Lincoln Animal Science Complex Room A222

*Van transportation available at hotel for 1:30pm transfer to the UNL Animal Science Complex*

2:00 pm Welcome to Nebraska – *Dr. Deb VanOverbeke, Animal Science Dept. Head*

2:15 pm Discussion of 2025 location, secretary assignment, ListServe management

3:00 pm Experiment station reports

5:00 pm Vans depart Animal Science Complex to Hyatt Place

5:45 pm Dinner in Downtown Haymarket – Sponsored by *Sweetbran*

7:05 pm Lincoln Saltdogs vs. Fargo-Moorhead Baseball – Sponsored by *Sulutions*

**Wednesday May 22nd**

7:00 am Breakfast at hotel - *Provided with hotel stay*

8:00 am Depart for Eastern Nebraska Research, Extension and Education Center

*Vans will pick guests up outside of main lobby*

9:00 am Station reports

12:00 pm Working lunch provided at ENREEC – Parker’s Smokehouse

*Discussion on elimination of values for whole shelled corn from 2016 NASEM*

1:00 pm Tour ENREEC and Klosterman Feedlot Innovation Center

3:00 pm Depart for tour at Craig Cattle Co.

7:30 pm Dinner in Downtown Haymarket –Sponsored by *Merck Animal Health*

**Thursday May 23rd**

7:00 am Breakfast at hotel - *Provided with hotel stay*

7:30 am Travel to UNL Animal Science complex

8:00 am Administrative update – Steve Loerch

9:00 am Experiment station reports

12:00 pm Meeting adjournment

**Attendance Confirmed**

Tara Felix, Penn State University

Steve Loerch, Administrator

Zachary Smith, South Dakota State University

Jessica Sperber, University of Nebraska-Lincoln

Galen Erickson, University of Nebraska-Lincoln

Pablo Loza, University of Nebraska-Lincoln

Jerad Jaborek, Michigan State University

Dale Blasi, Kansas State University

Alfredo DiCostanzo, University of Nebraska-Lincoln

Stephanie Hansen, Iowa State University

Nico DiLorenzo, University of Florida

Pedro Carvalho, Colorado State University

Warren Rusche, South Dakota State University

Kendall Samuelson, West Texas A&M University

Kendall Swanson, North Dakota State University

**NC Project Station Report – Ale Relling, OSU**

**1. Impact Nugget:**

Using a multi-fungi feed additive we observed an increase in high-fiber diet digestibility and dry matter intake, which leads to an increased growth in feedlot cattle.

**2. New Facilities and Equipment**.

None

**3**. **Unique Project Related Findings.  List anything noteworthy and unique learned this year.**

We have discovered that the supplementation with a multi-fungi feed additive changes rumen digestibility but does not affect rumen microbiome composition.

4. **Accomplishment Summaries.  Draft one to three short paragraphs (2 to 5 sentences each) that summarize research or outreach accomplishments that relate to the project objectives.  Please use language that the general public can readily comprehend.**

Cattle have the gut physiology adapted to obtain energy from high-forage diets; however, there are some forages with a high content of lignin, which makes the fiber hard to digest. I have tested the use of a multi-fungi feed additive that improves fiber digestibility and with that increases feedlot cattle growth.

**5. Impact Statements.  Please draft 2 or 3 impact statement summaries related to the project objectives.  Statements should be quantitative when possible and be oriented towards the general public.  This is perhaps the most difficult yet most important part of the report**.

**Situation:** Feeding cost represents the greatest direct cost in the feedlot industry

**Response:** Weevaluate the effect of a multi-specie fungi additive to improve fiber digestibility

**Impact:** Themulti-specie fungi additive enhance fiber digestibility, increased feed intake and feedlot cattle growth..

**6. Published Written Works.  Include scientific publications, trade magazine articles, books, posters, websites developed, and any other relevant printed works produced.  Please use the formatting in the examples below.**

Peer review papers

Perez Segura LF, Ramirez RF, Relling AE, Roque-Jimenez JA, Zhang N, Vargas-Bello-Pérez E, Lee-Rangel HA. 2023. Effects of maternal calcium propionate supplementation on offspring productivity and meat metabolomic profile in sheep. PLoS One. 18:e0294627. doi: 10.1371/journal.pone.0294627

Rivera-Bautista C, Grajales-Lagunes A, Relling A, Chay-Canul A, Vazquez-Valladolid A, Vargas-Bello-Pérez E, Lee-Rangel HA. 2023. Effect of age and diet on carcass and meat quality in ewes. Heliyon. 9:e22350. doi: 10.1016/j.heliyon.2023.e22350.

Carranza Martin, A. C., A. Garcia Guerra, and A. E. Relling. 2023. Effects of polyunsaturated fatty acid supplementation on plasma and follicular fluid resolvin D1 concentration and mRNA abundance in granulosa cells in ewes. J. Anim. Sciences. doi: [10.1093/jas/skad310](https://doi.org/10.1093/jas/skad310)

De Carlis, M. S. P, J. S. Biava, T. U. Sturion A. S. A. Lais, N. R. Eckermann, P. D. Montanher, P. C. Gonzales Dias Junior, A. C. Silva Vicente, J. H. Comelli, R S. Goulart, A. E. Relling, A. V. Pires, and E. M. Ferreira, 2023. Effect of different levels of physically effective neutral detergent fibre from forage in whole corn grain-based diets for feedlot lambs. Animal Production Science. doi: 10.1071/AN22394**.**

Pittaluga, A. M., J. Kieffer, and A. E. Relling 2023. Effect of grain inclusion rates in diets provided to early-weaned calves and steroidal implants utilization on growth performance and carcass characteristics of beef steers, Translational Animal Science, 7, txad068, <https://doi.org/10.1093/tas/txad068>

Roque-Jiménez J. A.,  M. F. Oviedo-Ojeda, M. Whalin, H. A. Lee-Rangel, and A. E. Relling. 2023. Ewe early gestation supplementation with eicosapentaenoic and docosahexaenoic acids affects the liver, muscle, and adipose tissue fatty acid profile and liver mRNA expression in the offspring, Journal of Animal Science, 101: skad144, <https://doi.org/10.1093/jas/skad144>

Pellegrino, F., Y. Corrada, S. J. Picco, A. E. Relling, and A. Risso. 2023. Association between dietary polyunsaturated fatty acids and their concentration in blood plasma, red blood cell, and semen of dogs. Open Veterinary Journal. doi:10.5455/OVJ.2023.v13.i3.11

Mattioli, G. A., D. E. Rosa, E. Turic, A. E. Relling, L. E. Fazzio. 2023. Effect of Parenteral Supplementation with Liposoluble Vitamins and Trace Minerals on Growth, Stress, Antioxidant Status and Immunity Biomarkers in Feedlot Cattle. Asian Journal of Research in Animal and Veterinary Sciences, 11(2), 19-28.

Pittaluga, A. M., J, Kieffer, and A. E. Relling. 2023. Effect of weaning strategy and backgrounding management on growth performance, carcass characteristics, and mRNA expression in the longissimus muscle of beef steers, *Journal of Animal Science*, Volume 101, doi:10.1093/jas/skad074

Swanson, K. C., A. E. Relling, and A. DiCostanzo. 2023. NCCC308: Nutrition and Management of Feedlot Cattle to Optimize Performance, Carcass Value, and Environmental Compatibility – Feature Collection - Nutrition and Management of Finishing Cattle. J. Anim Sci.101: skad003, <https://doi.org/10.1093/jas/skad003>

Tajonar, K., M. Gonzalez-Ronquillo, A. E. Relling, R. E. Nordquist, C. Nawroth, and E. Vargas-Bello-Pérez Einar. 2023. Toward assessing the role of dietary fatty acids in lamb's neurological and cognitive development. Frontiers in Veterinary Science. 10. doi: 10.3389/fvets.2023.1081141

Jaborek, J. R., F. L. Fluharty, K. Lee, H. N. Zerby, and A. E. Relling. 2023. Lipid metabolism mRNA expression and cellularity of intramuscular adipocytes within the Longissimus muscle of Angus- and Wagyu-sired cattle fed for a similar days on feed or body weight endpoint. J. Anim. Sci.. doi: [10.1093/jas/skac371](https://doi.org/10.1093/jas/skac371)

Jaborek, J. R., F. L. Fluharty, H. N. Zerby, and A. E. Relling. 2023. [Growth performance, carcass characteristics, and fatty acid composition of Angus-and Wagyu-sired finishing cattle fed for a similar days on feed or body weight endpoint](https://academic.oup.com/jas/article-abstract/doi/10.1093/jas/skac343/6965104). J. Anim Sci. doi:[10.1093/jas/skac343](https://doi.org/10.1093/jas/skac343)

[Pittaluga](javascript:;), A. M., [F. Yang](javascript:;), [J. R. Gaffney](javascript:;), [M. Embree](javascript:;), and [A. E. Relling](javascript:;). 2023. Effect of supplementation with ruminal probiotics on growth performance, carcass characteristics, plasma metabolites, methane emissions, and the associated rumen microbiome changes in beef cattle. J. Anim Sci. doi:[10.1093/jas/skac308](https://doi.org/10.1093/jas/skac308)

[Waldon](javascript:;), N., [K. R. Nickles](javascript:;), [A. J. Parker](javascript:;), [K. Swanson](javascript:;), and [A. E. Relling](javascript:;). 2023. A review of the effect of nutrient and energy restriction during late gestation on beef cattle offspring growth and development. J. Anim Sci. doi:[10.1093/jas/skac319](https://doi.org/10.1093/jas/skac319)

Nickles, K. R., A. E. Relling, A. Garcia-Guerra, F. L. Fluharty, and A. J. Parker. 2023. [Environmental stress during the last trimester of gestation in pregnant cows and its effect on offspring growth performance and response to glucose and adrenocorticotropic hormone](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=o1ND_b4AAAAJ&sortby=pubdate&citation_for_view=o1ND_b4AAAAJ:W5xh706n7nkC). J. Anim Sci. doi: [10.1093/jas/skac332](https://doi.org/10.1093/jas/skac332)

**7. Scientific and Outreach Oral Presentations.  Include workshops, colloquia, conferences, symposia, and industry meetings in which you presented and/or organized.  See below for formatting.**

|  |
| --- |
| Pittaluga, A. M. and A. E. Relling. [Effect of Multispecies Fungal Culture Extract Supplementation on the Growth Performance and Carcass Characteristics of Feedlot Cattle](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=o1ND_b4AAAAJ&sortby=pubdate&citation_for_view=o1ND_b4AAAAJ:epqYDVWIO7EC). ASAS 2023 annual meeting  Pittaluga, A. M., J. Kieffer, and A. E. Relling. [Effect of Weaning Strategy and Backgrounding Length on Growth Performance, Carcass Characteristics, and mRNA Expression in the Longissimus Muscle of Beef Steers](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=o1ND_b4AAAAJ&sortby=pubdate&citation_for_view=o1ND_b4AAAAJ:EkHepimYqZsC). ASAS Midwest section 2023 annual meeting.  Carranza-Martin, A. C., A. G. Guerra, C. Furnus, and A. E. Relling. [Effects of Polyunsaturated Fatty Acids Supplementation in Resolvin D1 Concentration in Plasma and Follicular Fluid in Ewes](https://scholar.google.com/citations?view_op=view_citation&hl=en&user=o1ND_b4AAAAJ&sortby=pubdate&citation_for_view=o1ND_b4AAAAJ:zLWjf1WUPmwC). ASAS Midwest section 2023 annual meeting.  Relling A.E. and D. Colombatto. Intersection between perfect nutrition and practical application in beef cattle nutrition. 2023 International Symposium for the Nutrition of Herbivores, Brazil. |

**8. Fund leveraging, specifically, collaborative grants between stations and members.**

Enger, B.D.  Co-PI- A. E. Relling. Mintrex’s impact on mammary gland integrity under a challenge environment. Novus International. $213,460

Relling, A. E. Influence of including varying doses of a multispecies fungal culture extract in a forage-based diet on the growth performance and apparent total tract digestibility in beef steers. Biopremix $43,228

Bohrer, B., CoPI: B. Campbell and A. E. Relling. Effect of sex (ram or wether) on live performance, carcass characteristics, meat quality, and volatile compounds affecting sensory characteristics of heavy weight finishing lambs. Ohio Woold and Sheep program, $6,745.4

Relling A.E. An innovative method to retain methane energy to improve cattle growth. CFAES Internal seeds grant. $74,963

**9. Other relevant accomplishments and activities.**

N/A

**Iowa State University Station Report – S. Hansen**

1. Impact Nugget:  A concise statement of advancements, accomplishments and impacts.  (Limit to 1-2 sentences)

Iowa State University feedlot research advanced our understanding of the implications of excessive liver Cu concentrations in dairy beef steers on disease, as high Cu cattle were not different in vaccine response but had worse outcomes after disease challenge. Additional work in receiving cattle supports the value of added zinc in diets prior to transit events, and a separate study found hi shear dry extruded corn to be equal or superior to steam flaked corn in feed efficiency response.

2. New Facilities and Equipment. Include production areas, sensors, instruments, and control systems purchased/installed.

Nothing to add.

3. Unique Project Related Findings.  List anything noteworthy and unique learned this year.

Feeding dry extruded corn resulted in total tract starch digestibility similar to that of steam flaked corn fed cattle, and resulted in improved feed efficiency (receiving trial).

Dairy beef calves are struggling with high liver Cu and it is making them more susceptible to disease, increased calf grower and dairy education is needed around this area. Also, they have very overzealous immune systems and struggle with lung health.

4. Accomplishment Summaries.  Draft one to three short paragraphs (2 to 5 sentences each) that summarize research or outreach accomplishments that relate to the project objectives.  Please use language that the general public can readily comprehend.

**Objective 1.** Enhance the utilization of C from energy feeds to compete in an energy economy and improve national food security.

A novel corn processing method was explored, in which corn is dry extruded, resulting in a product that is similar to steam flaked corn in its gelatinization. Total tract starch digestibility was similar to steam flaked corn and greater than dry rolled corn, in this receiving trial, and cattle feed efficiency was better in extruded corn diets than rolled corn diets, with steam flaked being intermediate. With the potential to process corn and capture value beyond dry rolling alone, this could be a great opportunity for midwestern producers to explore.

**Objective 2.** To enhance the environmental sustainability of the feedlot industry through conservation and nutrient management.

In a finishing study examining Experior (B3 agonist), we found cattle with lesser liver Cu (moderate status) had the best response to Experior across all measures: hot carcass weight, blood glucose, blood insulin, feed efficiency. This may suggest trace minerals influence the response of cattle to this beta agonist which is approved to decrease ammonia outputs from cattle, by increasing hot carcass weight. More work is needed in this area to better understand this phenomenon.

**Objective 3.** To enhance the production efficiency and quality of feedlot cattle through management strategies and technologies.

Consistent with our prior work, feeding 100 ppm of Zn (in this trial as ZnSO4) to steers for 6 weeks prior to a trucking event, improved DMI in the preconditioning period and in the early weeks after the trucking event.

5. Impact

Work conducted at Iowa State University over the past year continues to provide the beef industry with an improved understanding of the trace mineral requirements of feedlot cattle in order to optimize performance, particularly as affected by growth promoting technologies, stress, and disease challenge. Further, work exploring novel corn processing methods is in early stages but looks promising for improved nutrient extraction from corn and thus improved feed efficiency in feedlot cattle.

6. Published Written Works.  Include scientific publications, trade magazine articles, books, posters, websites developed, and any other relevant printed works produced.  Please use the formatting in the examples below.

Peer reviewed manuscripts

Lundy-Woolfolk, E., O. Genther-Schroeder, M. Branine, and S. Hansen. 2023. Effects

of supplemental zinc on growth, carcass characteristics and liver abscess formation in

steers with experimentally induced ruminal acidosis challenge. Trans. Anim. Sci.

7:txad072.

Rients, E., R. Wyatt, E. Deters, O. Genther-Schroeder, and S. Hansen. 2023. Zinc

supplementation and ractopamine hydrochloride impact gene expression of zinc

transporters in finishing beef steers. Front. Anim. Sci. Vol 4.

<https://doi.org/10.3389/fanim.2023.1191230>

Schulte, M. D. & Hochmuth, K. G. & Steadham, E. M. & Prusa, K. J. & Lonergan, S.

M. & Hansen, S. L. and Huff-Lonergan, E. J. 2023 Carcass Characteristics and Quality

Attributes of Beef from Cattle Supplemented Zinc and Ractopamine Hydrochloride. Meat

and Muscle Biology7(1): 14457, 1-14. doi: https://doi.org/10.22175/mmb.14457.

Koulicoff L.A., T. Heilman, L. Vitanza, A. Welter, H. Jeneske, T. G. O'Quinn, S. Hansen, E. Huff-Lonergan, M. D. Schulte, and M.D. Chao. 2023. Matrix metalloproteinase-9 may contribute to collagen structure modification during postmortem aging of beef. Meat

Abstracts

Smerchek, D.T., Rients, E. L., McLaughlin, A. M., Thornton, K. J., and Hansen, S. L. 2023. Interactions between steroidal implants and zinc supplementation in feedlot steers.

Plains Nutrition Council. Texas.

Smerchek, D.T., Rients, E. L., McLaughlin, A. M., Thornton, K. J., and Hansen, S. L.

2023. Interactions between steroidal implants and zinc supplementation in feedlot steers.

Midwest ASAS. Wisconsin.

Baumhover, A. M., Smerchek, D. T., Rients, E. L., McLaughlin, A. M., Thornton, K. J.,

and Hansen, S. L. 2023. Effect of steroidal implants and zinc supplementation on

circulating metabolites and insulin sensitivity in feedlot steers. Midwest Undergraduate

Competition.

Rients, E., C Franco, F. Diaz, J. McGill, and S. L. Hansen. 2023. Zinc supplementation

and implant abscess effects on growth performance and immune system of growing beef

steers.

Franco, CE, EA Reints, FE Diaz, SL Hansen, JL McGill. 2022. The Effects of Dietary

Zinc Supplement on Bovine Immune Cells and Intracellular Zinc Concentration.

American Association of Immunologists Annual Meeting 2022. Portland, OR.

FE Diaz, CE Franco, EA Rients, SL Hansen, JL McGill. 2022. Dietary Zinc

supplementation impact on relative frequency and innate function of peripheral bovine

immune cells. American Association of Immunologists Annual Meeting 2022. Portland,

OR.

Franco, CE, F Diaz, E Rients, DT Smerchek, SL Hansen, JL McGill. Dietary zinc and

BRD effects on intracellular zinc concentration and transporter expressions in bovine

immune cells. Conference of Research Workers in Animal Diseases 2023. Chicago, IL

Rients, E, Franco, CE, SL Hansen, JL McGill. Weather impacts cattle behavior during

disease challenge. Conference of Research Workers in Animal Diseases 2023. Chicago, IL

McLaughlin, A. M., S. L. Hansen. 2023. Effect of NexPro on immune response and

performance of finishing steers. Plains Nutrition Council. Texas.

McLaughlin, A. M., S. L. Hansen. 2023. Effect of NexPro on immune response and

performance of finishing steers. Midwest ASAS. Wisconsin.

7. Scientific and Outreach Oral Presentations.  Include workshops, colloquia, conferences, symposia, and industry meetings in which you presented and/or organized.  See below for formatting.

Hansen, S. L. 2023. Trace mineral needs of modern beef and dairy cattle. Pacific NW

Nutrition Conference. Boise.

Hansen, S. L. and J. A. Henderson. 2023. The role of sulfur affecting selenium and

copper nutrition in cow calf. Florida Ruminant Nutrition Symposium. Gainsville.

Hansen, S. L. 2023. Can we manage transit stress with nutrition? ISU Meat Science

Seminar.

Hansen, S. L. and B. M. Ortner. 2023. Nutritional strategies ot overcome transit stress.

Tri-State Dairy Nutrition Conference. Indiana.

Hansen, S. L. 2023. Strategies to improve resiliency and recovery from transit stress.

Canadian Animal Nutrition Conference. Montreal.

Hansen, S. L. 2023. Trace mineral requirements for beef cattle. Jefo Nutrition. Montreal.

Hansen, S. L. 2023. Pathways to Peak Performance: Mineral requirements for Beef

Cattle. Montana Nutrition Conference. Bozeman.

8. Fund leveraging, specifically, collaborative grants between stations and members.

None to report this year

9. Other relevant accomplishments and activities.

**NCCC308 Report – South Dakota State University**

**Smith & Rusche**

**Period the Report Covers:** May 2023 to May 2024

**Project Director and Contributor(s)  
PD:** Zachary Smith, PhD, South Dakota State University, Brookings,

**Contributor (s):** Warren Rusche, PhD, South Dakota State University, Brookings and Ana Clara Baiao Menezes, PhD, South Dakota State University, Brookings

**Impact Nugget:**

South Dakota State University has conducted research related to the nutrition and management of confinement fed beef cattle (receiving, backgrounding, and finishing cattle) in the Northern Plains (NP).

**New Facilities and Equipment:**

The Ruminant Nutrition Center (RNC) in Brookings and the Southeast Research Farm (SERF) near Beresford have been run a full capacity the past year. At the RNC pen days were 16,470 pen days of 19,032 possible pen days (86.5% of annual capacity). At the SERF pen days were 7,752 pen days of 8,724 possible pen days (88.9% of annual capacity). This has resulted in the need to quickly attend to facility repairs in a timely manner. The SDSU Dairy Training and Research Facility was shut down and there are plans to modify the existing infrastructure to support beef cattle research which in turn should increase the beef teams research productivity to support the training of an additional 3 students each year.

**Unique Project Related Findings:**

***Soy co-product research***

Changes to the fuel landscape in the United States have resulted in changes in long-held supplemental protein price relationships. We are witnessing the beginning of a new era with the adoption of oilseeds as a source of renewable diesel fuel and as a form of sustainable aviation fuel. If increased demand for renewable fuels from oilseeds results in similar expansion that we saw in the beginning of the ethanol era, it is entirely possible that oilseed meal becomes less expensive simply because of greater supply. Because of this, South Dakota State Researchers have secured funding from state Soy Checkoff entities (SD and MN) and Private Industry to conduct a series of experiments looking at the use of soy co-products as a complete or partial replacement of corn-milling co-products.

***Comparing corn bran plus condensed distillers solubles or wet corn gluten feed to soybean meal: Effects on feedlot growth performance and carcass trait responses of beef steers (Exp. 1)***

This work has been published previously. In this experiment we used British x Continental steers (n = 240; initial BW = 884 ± 95.2 lbs) that were assigned to the following dietary treatments in a randomized complete block design (RCBD): 1) a finishing diet with soybean meal that contained no corn co-product (SBM) 2) a finishing diet that contained corn fiber and syrup in replacement of corn and soybean meal (CBCDS) 3) a finishing diet that contained WCGF in replacement of corn and soybean meal (WCGF). Growth performance and carcass trait data are located in Tables 6 and 7. There were no differences (*P* ≥ 0.28) between treatments for final body weight (BW), average daily gain, dry matter intake, feed conversion efficiency, observed dietary NE for maintenance (NEm) and NE for gain (NEg), or observed-to-expected NEm and NEg. No differences (*P* ≥ 0.16) were noted between treatments for hot carcass weight, ribeye area, RF, marbling score, kidney-pelvic-heart fat, estimated empty body fat (EBF), BW at 28% EBF (AFBW), and distribution of USDA Quality and Yield grades.

**Negligible difference between modified distillers grains plus solubles and soybean protein sources on growth performance and carcass traits in yearling finishing steers (Exp. 2)**

In this experiment, predominately Angus steers [initial shrunk body weight (BW) = 959 ± 52.1 lbs] were used in a 118-d trial using three treatments: modified distillers grains (MDGS) fed at 15% diet DM (MDGS) replaced by either soybean meal and corn (9 and 6% of DM, respectively; SBM), or soybean meal and soyhull pellets (9 and 6% of DM, respectively; SBM-SBH). Steers (n = 240) were individually weighed and allotted to one of 24 pens (n = 10 steers per pen; 8 pens per treatment) at the Southeast Research Farm located near Beresford, SD. Dietary concentrations of crude protein and neutral detergent fiber based on tabular values and weekly batching records were 12.3 and 17.6%, 12.8 and 14.5%, and 12.8 and 17.8% for MDGS, SBM, and SBM-SBH, respectively. No differences amongst treatments (P ≥ 0.11) were found for carcass-adjusted final BW, dry matter intake (DMI), average daily gain (ADG), or feed efficiency. Dietary treatment had no effect (P ≥ 0.11) on HCW, dressing percentage, ribeye area, rib fat, marbling score, USDA yield Grade, estimated EBF, or final BW adjusted to 28% EBF. Distribution of USDA quality and yield grades were unaffected by treatment (P ≥ 0.39). Dietary treatment did not affect liver abscess incidence and severity (P = 0.11). Net energy values calculated from animal performance agreed closely with tabular estimates with observed-to-expected ratios for net energy equaling one. In this experiment, feeding supplemental protein sources with enhanced diet conditioning attributes and greater concentrations of ruminal undegradable protein provided no advantage to cattle performance.

**Partial or Total Replacement of Dried Distillers Grains with Soybean Meal improved Feedlot Growth Performance but Increased Liver Abscess Severity (Exp. 3)**

In this experiment, Continental × British steers (initial shrunk body weight [BW] = 842 ± 81.6 lbs) were used in a 139-d trial. Treatments included: DDGS fed at 20% DM (13.4% CP; DDGS), SBM replacing 50% of DDGS (14.4% CP; SBM50), and SBM replacing 100% of DDGS (15.4% CP; SBM100). Steers (n = 189) were weighed and allotted to 1 of 24 pens (n = 8 steers per pen; 8 pens per treatment) at the Ruminant Nutrition Center near Brookings, SD. Inclusion level was evaluated for linear and quadratic components by the method of orthogonal polynomials. Final BW was calculated by dividing hot carcass weight (HCW) by 0.625. No differences were noted (P ≥ 0.18) for final BW, average daily gain, dry matter intake, or feed efficiency. Dietary treatment tended to affect feed efficiency (quadratic; P = 0.10) and SBM increased the apparent efficiency of energy capture. Treatment had no effect (P ≥ 0.22) on HCW, rib fat, marbling score, USDA yield grade, or final body weight adjusted to 28% empty body fat. Complete replacement of DDGS with SBM increased rib eye area by 1% (linear; P = 0.02), but decreased dressing percentage (linear, P = 0.03). Distribution of USDA quality or yield grades were unaffected by treatment (P ≥ 0.36). Net energy values calculated from animal performance for DDGS agreed closely with tabular estimates. In this experiment, replacement of DDGS with SBM increased the observed-to-expected ratio of dietary NE, increased muscularity and tended to decrease DP with no other observed effects on growth performance or carcass traits.

**Extruded and expelled soybean meal increases daily gain and carcass weight when fed as a partial replacement for dried distillers grains plus solubles in diets offered to finishing beef steers (Exp. 4)**

In this experiment, Charolais – Angus crossbred steers (n = 144; initial shrunk BW = 880 ± 59.5 lbs) were assigned to 1 of 18 pens (8 steers/pen). Pens were randomly assigned to one of three dietary treatments (6 pens/treatment): 100% DDGS included at 15% of diet on a DM basis (EE0), 70% DDGS and 30% extruded and expelled (EE) SBM included at 15% of diet on DM basis (EE30), and 40% DDGS and 60% EESBM included at 15% of diet on DM basis (EE60) in a randomized complete block design with pen as experimental unit. All growth performance results were determined on a carcass-adjusted (HCW/0.625) basis. Supplementation of EESBM increased (P ≤ 0.04) final BW and ADG by 1.6 and 3.8%, respectively. Additionally, dietary treatment tended to result in increased (P ≤ 0.07) DMI and improved feed conversion by 1.2 and 2.6%. Final BW, ADG and feed efficiency increased (linear; P ≤ 0.03) with increasing inclusion of EESBM in replacement of DDGS. DMI tended to increase quadratically (P = 0.10) with increasing EESBM inclusion. No differences (P ≥ 0.37) were observed in any other carcass-adjusted growth performance responses as well as apparent utilization of dietary net energy (P ≥ 0.15). The effect of EESBM inclusion linearly increased (P = 0.02) HCW with increasing EESBM inclusion. A tendency for a linear response (P = 0.09) was noted for EBF% in favor of EESBM inclusion. No other differences (P ≥ 0.12) were observed in carcass performance, distribution of yield and quality grades, and lung and liver health outcomes. In conclusion, feeding EESBM as a partial replacement of DDGS resulted in greater DMI, daily gain and carcass weight, without negatively influencing measures of carcass quality or cutability. The NE value of EESBM was estimated to be 8.5% greater than DDGS.

**Effects of substitution of DDGS with soybean meal in finishing diets: Dietary protein degradability and ruminal parameters (Exp. 5)**

In this experiment, digestive function was evaluated using, Red Angus steers (n = 4; BW = 792 ± 19.8 lbs) with ruminal, duodenal, and ileal cannulas, in a 4 × 4 Latin square. Diets consisted of dry-rolled corn (70%), hay (10%), liquid supplement (5%), and test ingredients (15%). Treatments were (DM basis): 1) 15.0% DDGS (CON); SBM in replacement of 50% of DDGS (SBM50); SBM in replacement of 75% of DDGS (SBM75), and SBM in replacement of 100% of DDGS (SBM100). Each period lasted 18-d, consisting of a 7-d diet adaptation followed by an 11-d collection period. The goals were to evaluate the effects of substitution of DDGS with soybean meal on energy metabolism, nutrient flow and digestibility of beef cattle fed finishing diets. Overall, our results showed that SBM75 resulted in greater concentrations of ammonia, acetate, propionate, butyrate, isobutyrate, and valerate compared to CON. These data suggest that 75% substitution of DDGS with SBM has the potential to optimize microbial fermentation. To complement these results, we are currently evaluating rumen protein degradation profiles and amino acid flow to small intestine. Further, via in situ techniques, we evaluated the rumen degradation profiles of dry matter, organic matter, and crude protein of each diet. There were no differences (P ≥ 0.47; Figure 1) on fractions a, b, and kd or RDP (55%) between treatments for DM, OM, and CP. According to our analysis, approximately 13-h of incubation is necessary to accurately estimate the RDP content of the diet. The NASEM (2016) adopts 35 and 75% of RDP for DDGS and SBM, respectively, based on fixed incubation time of 16h. In this study, the similar degradation profiles between diets suggest that RDP of complete diets differs from that of individually assayed ingredients. Moreover, this data suggests that soybean meal can be used in replacement to DDGS in feedlot finishing diets without compromising ruminal degradability of nutrients.

**Summary**

In experiments 2, 3, and 4, ADG increased by 5 to 66% and DMI was increased by 0.75 to 9.3% during the initial 21 to 35 period. These enhancements in body weight gain were maintained throughout the entirety of the feeding period. Future research might need to evaluate the influence of phase feeding diets with protein sources that provide a more ideal amino acid profile or provide ruminal degradable protein from plant sources. Alternatively, these results might be a function of the cattle fed. All steers used in the research were healthy, high-growth potential Northern Plains cattle. Results from this body of research indicate that feeding supplemental protein sources with enhanced diet conditioning attributes and greater concentrations of ruminal undegradable protein provided no advantage to cattle growth performance under small-pen research conditions. However, under conditions where CP level was greater or when diet conditioning attributes were similar amongst test diets, soy-based co-products were superior to corn-milling co-products.

**Impact Statements:**

The work presented here is of interest to South and North American cattle producers. The work presented here is crucial to continued progress towards sustainable and economical beef production.

**Published Written Works:**

1. B. B. Grimes Francis, F. L. Francis, E. R. Gubbels, T. C. Norman, T. M. Ribeiro, S. R. Hanson, C. R. Ross, D. M. Paulus Compart, W. C. Rusche, and Z. K. Smith. 2024. Applied Animal Science. Effects of supplementation with calcium magnesium carbonate, tylosin phosphate, or both on growth performance, carcass traits, liver outcomes, and rumination activity in yearling beef steers fed a finishing diet. AAS special issue
2. Norman, T.C.; DeHaan, E.R.; Francis, F.L.; Rusche, W.C.; Smith, Z.K. Effect of Lighter and Heavier Initial Weight on Growth Performance and Carcass Traits of Single-Source Beef Steers. Animals 2024, 14, 567. <https://doi.org/10.3390/ani14040567>.
3. Hanson, S.R.; DeHaan, E.R.; Francis, F.L.; Rusche, W.C.; Smith, Z.K. Evaluation of Precision Ingredient Inclusion on Production Efficiency Responses in Finishing Beef Cattle. Ruminants 2024, 4, 112-124. <https://doi.org/10.3390/ruminants4010007>.
4. Delver, J.J. and Smith, Z.K. Opportunities for Camelina Meal as a Livestock Feed Ingredient. Agriculture 2024, 14, 116. <https://doi.org/10.3390/agriculture14010116>
5. Thiago Lauro Maia Ribeiro, Forest L Francis, Erin R Gubbels, Jason E Griffin, Warren C Rusche, Zachary K Smith, Supplemental organic trace minerals and a yeast culture product in newly weaned steers: effects of use and delivery method on growth performance and hepatic trace mineral content, Translational Animal Science, Volume 7, Issue 1, 2023, txad119, <https://doi.org/10.1093/tas/txad119>
6. Smith, Z. K., E. Eckhardt, W. S. Kim, A. C. B. Menezes, W. C. Rusche, and J.K. Kim. Temperature Fluctuations Modulate Molecular Mechanisms in Skeletal Muscle and Influence Growth Potential in Beef Steers. 2023. J Anim Sci. 2023 Jan 3:101:skad343. doi: 10.1093/jas/skad343.
7. Smith, Z. K. Impact of Chromium Propionate Supplementation and Days of Adaptation on Energy Status in Newly Weaned Steer Calves. Open Journal of Animal Science. 2023. 13: 409-420.
8. Rusche, W. C. and Z. K. Smith. Evaluation of ruminal dry matter disappearance and pH of dry corn, high-moisture corn, and rye under in vitro conditions. 2024. Agriculture Science.
9. Nold, E.R.; Norman, T.C.; Rusche, W.C.; Nold, R.A.; Smith, Z.K. Evaluation of Growth Performance, Efficiency of Dietary Net Energy Utilization, and Carcass Trait Responses of Heavy Finishing Lambs Administered 12 mg of Zeranol Subcutaneously in the Ear 59 d before Harvest. *Ruminants* 2023, *3*, 240-245. <https://doi.org/10.3390/ruminants3030022>

**Scientific and Outreach Oral Presentations:**

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| --- |
| 1. DeBruin, B. M., C. E. Bakker, J. K. Grubbs, K. R. Underwood, W. C. Rusche, Z. K. Smith, and A. D. Blair. 2024. Influence of an oregano-based essential oil on growth performance and carcass traits of beef steers. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Macholan, N.L., G. Jardon, E. Colombo, Z, K. Smith, W. C. Rusche, and A. C. B. Menezes. 2024. Substitution of dried distillers grains with soybean meal on beef cattle diets: Effects on ruminal ammonia and volatile fatty acid concentrations. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Moening, K. M., G. Jardon, E. Colombo, Z. K. Smith, W, C. Rusche, and A. C. B. Menezes. 2024. Ruminal degradation profiles of dry matter, organic matter, and crude protein of finishing diets with different levels of inclusion of DDGS and soybean meal. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Schoelerman, Z., W. C. Rusche, Z. K. Smith, and F. L. Francis. 2024. Effects of orally administered *Megasphaera elsdenii* during finishing diet realimentation on feedlot steer fecal consistency, clinical depression, and rumination. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Ribeiro, T. L. M, B. Grimes Francis, Z. K. Smith, F. L. Francis, C. Ross, J. Heldt, W. C. Rusche, and E. H. Wall. 2024. Evaluation of a phytogenic blend on growth performance, health, carcass traits, and efficiency of dietary net energy utilization in finishing beef steers. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Leeson, R., E. R. DeHaan, J. Delver, F. L. Francis, B. Grimes Francis, T. Ribeiro, Z. K. Smith, and W. C. Rusche. Effects of phase feeding hybrid rye on feedlot performance in backgrounded beef steers. 2024. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Ross, C., E. R. DeHaan, F. L. Francis, B. Grimes Francis, T. Ribeiro, Z. K. Smith, and W. C. Rusche. 2024. Effects of partial or total replacement of dried distillers with soybean meal on growth performance, carcass characteristics, sera urea nitrogen, and net energy utilization in finishing beef steers. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Francis, B. Grimes, J. Delver, F. L. Francis, E. R. DeHaan, T. Ribeiro, C. Ross, W. C. Rusche, and Z, K. Smith. 2024. Effect of replacement of dried distillers grains plus solubles with increasing extruded and expelled soybean meal on feedlot performance and carcass characteristics in finishing steers. Midwest ASAS, Madison, WI. ACCEPTED. |
| 1. Delver, J., W. C. Rusche, and Z. K. Smith. 2024. Evaluation of a phytogenic feed additive with essential oils and plant extracts on growth performance in single sourced steer calves fed a forage-based diet during the initial 53 d receiving period. Midwest ASAS, Madison, WI. ACCEPTED. 2. Grimes Francis, B. B., J. P. Hutcheson, L. J. Walter, W. T. Nichols, G. I. Crawford, and Z. K. Smith. 2024. Effect of two different implant programs on growth performance and carcass characteristics in beef steers fed to three differing harvest endpoints. In: Proceedings of the 2024 Plains Nutrition Council Spring Conference. San Antonio, TX. p. 117. 3. Jardon G. H., Macholan N. L., Moening K. M., Colombo E. R., Smith Z. K., Rusche W. R., Menezes A. C. B. 2024. Effects of substitution of DDGS with soybean meal in finishing diets: Dietary protein degradability and ruminal parameters. In: Proceedings of the 2024 Plains Nutrition Council Spring Conference. San Antonio, TX. P. 124 |

**Fund Leveraging:**

Fund’s for conducting research at this station have come in the form of governmental (USDA-NIFA and Hatch), state/regional commodity groups, and private industry contract research grants. Obtaining funding has been challenging at times for many of the production-based applied feedlot management questions we have generated. Many research opportunities exist for “product” testing and these types of experiments have allowed us to keep the feedlots running and have allowed us opportunities to conduct experiments we deem necessary, but where limited funding is available.

**Other Relevant Accomplishments and Activities:**

N/A

**NCCC308 Station Report – University Of Missouri**

**D. Brake**

Impact Nugget:

*University of Missouri developed a feedlot short-course and published data evaluating the impact of corn processing energy retention in small versus large cattle.*

New Facilities and Equipment:

University of Missouri has upgraded the Growsafe technology for 20 feedlot pens, purchased a Waters UPLC and secured funding for a new nitrogen analyzer.

Unique Project Related Findings:

Providing amounts of metabolizable lysine and methionine beyond current estimates of metabolizable lysine and methionine requirements to yearling steers fed a corn-based finishing ration had little impacts on measures of performance and feeding behavior despite differences in implant status. Interestingly, however, feed efficiency and feeding rate were decreased when additional amounts of metabolizable lysine and methionine were provided to non-implanted steers but not in steers implanted with moderate or large amounts of anabolic implants.

Computer vision represents a near instantaneous tool to estimate maintenance energy costs of cattle through estimation of surface area. Measures of NEm derived from measures of surface area using computer vision seem to provide more accurate and precise estimates of fasting heat production measured through indirect calorimetry that do current model estimates.

Accomplishment Summaries:

University of Missouri quantified effects of source of metabolizable protein and implant status on yearling steer performance and feeding behavior. Increased supply of metabolizable protein through supplementation of rumen-protected AAs should theoretically provide an increased nutritional plane to utilize physiological changes in response to implant strategy, however, in this study there was a depression in performance (G:F) among non-implanted steers provided rumen-protected Lys and Met. Non-implanted steers fed a conventional diet had similar performance to implanted steers fed either diet. Similar to performance, measures of feeding rate we slower for steers with no implant and fed rumen-protected AA compared to other treatment combinations. Steers fed rumen-protected AA had an increased number of bunk visits per meal while feeding rate was decreased compared to steers fed a conventional diet.

Estimates of true maintenance energy expenditures are laborious to complete and typically require animals to be fasted for an extended period of time to measure fasting heat production or require the physical measurement of surface area from animals’ hides. With increased technological innovation, the measurement of animal surface area can be completed through computer vision and AI algorithms. University of Missouri is currently tracking a set of cattle from feedlot entry (550 lbs, SBW) to finish weight to validate computer derived surface area measurements as a near instantaneous measure of maintenance energy costs. Using indirect calorimetry after a 5 d fast together with shrunk body weight and computer surface area measurements, we are able to evaluate current equations and the validity of the computer measurements. We have observed that NASEM estimates of NEm are 20% greater than measures of fasting heat production and 33% greater than measures of computer derived surface area however there is a large degree of correlation between NASEM/FHP, NASEM/SA and FHP/SA. This change in true costs of maintenance may describe the increased performance of commercial feedlot cattle compared to NASEM.

Impact Statements:

Increased flows of metabolizable protein from rumen-protected sources decrease performance of non-implanted yearlings while there is no benefit towards increased metabolizable amino acids among implanted steers.

NASEM values for NEm overestimate the maintenance cost of feedlot steers (550-1360lbs).

Published Written Works:

Petzel, E. A., Acharya, S., Shiba, S., Bailey, E. A., and Brake, D. W. Performance and feeding behavior of finishing steers of different implant status and fed diets differing in amino acid level.

Bailey, E.A., M.J. Adams, K.R. Meng, J.M. Zeltwanger, D.W. Brake, and X. Du. 2024. Interaction of an herbicide containting aminopyralid and metsulfuron and nitrogen fertilizer in tall fescue pasture grazed by stocker cattle. Appl. Anim. Sci. 40:103-111. doi: 10.15232/aas.2023-02451. (20%). Contributed to interpretation of data and substantially revised the manuscript. Impact Factor = 1.5. Normalized Eigenfactor = 0.13901.

Petzel, E.A., S. Acharya, E.C. Titgemeyer, E.A. Bailey, and D.W. Brake. 2024. Effects of heating soybeans on postruminal amino acid bioavailability, performance, and ruminal fermentation in lactating cows. J. Anim. Sci. skae084. doi: 10.1093/jas/skae084. (70%). Contributed to the conception and design of the work; acquisition, analysis, and interpretation of data; and substantially revised the manuscript. Impact Factor = 3.3. Normalized Eigenfactor = 2.26624.

Nelson, K.A., L.N. Sandler, D. Dhakal, Z.L. Erwin, D.W. Brake, G. Singh, and G. Kaur. 2023. Radish management and grazing effects on weed control and corn response. Agron. J. 115:2339-2350. doi:10.1002/agj2.21431. (20%). Contributed to interpretation of data and substantially revised the manuscript. Impact Factor = 2.1. Normalized Eigenfactor = 1.44321.

Omotara, G., S.M.A. Tousi, J.E. Decker, D.W. Brake, and G.N. DeSouza. 2023. High-throughput and accurate 3D scanning of cattle using time-of-flight sensors and deep learning. bioRxiv. 2023.08.04.552010. doi: 10.1101/2023.08.04.552010. (20%). Contributed to interpretation of data and substantially revised the manuscript.

**Scientific and Outreach Oral Presentations:**

Meyer, A. M., Rathert-Williams, A. R., Wichman, L. G., Petzel, E. A., Brake, D. W., and Redifer, C. A. 2023. 71 Effects of Late Gestational Nutrient Restriction on calf pre-weaning growth, backgrounding and feedlot performance and carcass composition. J. Anim Sci. 101(Supplement\_2), pp.203-204.

Petzel, E. A., Acharya, S., Shiba, S., Bailey, E., and Brake, D. W. 2023. 166 Influence of source of metabolizable protein and implant status on feedlot performance and feeding behavior in yearling steers. J. Anim. Sci. 101(Supplement\_2) pp.211-212

Schnurbusch, T., Brake, D. W., Petzel, E. A., Callahan, Z. D., Poock, S. E., and Wiegand, B. R. 2023. 194 A systems approach to deriving carcass value from Holstein x Simangus cattle in an accelerated finishing model. J. Anim. Sci 101(Supplement\_2) pp.56-57

**NCCC308 Station Report – North Dakota State University**

**K. Swanson**

1. Impact Nugget:  A concise statement of advancements, accomplishments and impacts.  (Limit to 1-2 sentences)

2. New Facilities and Equipment. Include production areas, sensors, instruments, and control systems purchased/installed.

3. Unique Project Related Findings.  List anything noteworthy and unique learned this year.

North Dakota State University conducted a site of digestion experiment to evaluate the effects of replacing increasing amounts of corn distillers grains plus solubles (DDGS) with heat treated soybean meal as a supplement for steers fed a forage-based diet. Heat-treated soybean meal (TSBM) replaced dried distillers grains plus solubles (DDGS) in the diet at 0, 4, 8, and 12% of the diet dry matter. Diets were formulated to supply excess MP, whereas lysine was predicted to be sufficient only in the 12% treatment. Results suggest that organic matter, nitrogen, lysine, and essential amino acid flow to the small intestine was not influenced by increasing substitution of DDGS with TSBM. Additionally, OM digestibility was not influenced by treatment and increasing TSBM substitution of DDGS linearly increased intestinal digestibility of N, lysine, and essential amino acids, suggesting that substitution of DDGS with TSBM may increase absorption of lysine and essential amino acids in growing cattle.

North Dakota State University conducted an experiment examining the effect of vasoactive intestinal polypeptide (VIP), a gut hormone with anti-inflammatory and other functions, on serum lipopolysaccharide (LPS) and lipopolysaccharide binding protein (LBP) concentrations, and expression of gastrointestinal tight junction genes in lambs fed a high-grain diet. Lambs in the treatment group were injected intraperitoneally with VIP (1.3 nmol/kg BW in 0.9% NaCl), whereas lambs in the control group were injected with 0.9% NaCl every second day over 28 days. There were VIP treatment by day interactions for serum LPS and LBP as LPS and LBP increased from day 0 to day 28 in control lambs but not in lambs receiving LPS. Expression of tight junction genes in gastrointestinal tissues was not influenced by treatment. These results suggest that VIP may help to moderate the transfer of LPS to the systemic circulation and that this this may be because of factors other than changes in expression of tight junction genes. More research is needed to confirm these findings and to further examine the mechanisms by which VIP may reduce the negative effects on growth performance and health that can be observed when feeding grain-based diets to ruminants.

4. Accomplishment Summaries.  Draft one to three short paragraphs (2 to 5 sentences each) that summarize research or outreach accomplishments that relate to the project objectives.  Please use language that the general public can readily comprehend.

5. Impact Statements.  Please draft 2 or 3 impact statement summaries related to the project objectives.  Statements should be quantitative when possible and be oriented towards the general public.  This is perhaps the most difficult yet most important part of the report.

6. Published Written Works.  Include scientific publications, trade magazine articles, books, posters, websites developed, and any other relevant printed works produced.  Please use the formatting in the examples below.

Mia, G. K., E. Hawley, M. Yusuf, G. Dorsam, and K. C. Swanson. 2024. Influence of vasoactive intestinal polypeptide on growth performance, nutrient digestibility, nitrogen balance, and digestive enzyme activity in lambs. J. Anim. Sci. 102:skae112.

Magossi, G., K. Schmidt, T. Winders, Z. Carlson, D. B. Holman, S. Underdahl, K. Swanson, and S. Amat. 2024. A single intranasal dose of essential oil spray confers modulation of the nasopharyngeal microbiota and short-term inhibition of Mannheimia in feedlot cattle: a pilot study. Sci. Rep. 14:823.

Wanchuk, M. R., D. A. McGranahan, K. K. Sedivec, and K. C. Swanson. 2023. Prescribed fire increases forage mineral content in grazed rangeland. Agr. Ecos. Env. 368:109004.

Winders, T. M., S. Amat, and K. C. Swanson. 2024. Evaluation of the effects of hempseed cake on plasma metabolites and cytokines in response to an LPS challenge in finishing steers. Can. J. Anim. Sci. (accepted)

Pucetti, P. S. C. Valadares Filho, J. V. Roque, J. T. Silva, K. R. Oliveira, F. A. S. Silva, V. J. Cardoso, F. F. Silva, and K. C. Swanson. 2024. Predicting ruminal degradability and chemical composition of corn silage using near-infrared spectroscopy and multivariate regression. Plos One 19:e0296447.

Aryee, G., S. M. Luecke, C. R. Dahlen, K. C. Swanson, and S. Amat. 2023. Holistic view and novel perspective on ruminal and extra-gastrointestinal methanogens in cattle. Microorganisms. 11:2746.

Trotta, R. J., K. C. Swanson, J. L. Klotz, and D. L. Harmon. 2023. Postruminal casein infusion and exogenous glucagon-like peptide 2 administration differentially stimulate pancreatic α-amylase and small intestinal α-glucosidase activity in cattle. J. Nutr. 10:2854-2867.

Mia, M. G. K., T. M. Winders, E. M. Serum, S. Amat, B. W. Neville, C. R. Dahlen, D. J. Smith, and K. C. Swanson. 2023. The effects of feeding hempseed cake on pancreatic and jejunal digestive enzymatic activity in finishing heifers. Can. J. Anim. Sci. 103:416-419

Winders, T. M., D. B. Holman, K. N. Schmidt, S. M. Luecke, D. J. Smith, B. W. Neville, C. R. Dahlen, K. C. Swanson, and S. Amat. 2023. Feeding hempseed cake alters the bovine gut, respiratory and reproductive microbiota. Sci. Rep. 13:8121.

Smith, D. J., E. M. Serum, T. W. Winders, B. Neville, G. R. Herges, C. R. Dahlen, and K. C. Swanson. 2023. Excretion and residue depletion of cannabinoids in beef cattle fed hempseed cake for 111 days. Food Add. Contam. A. 40:552-565.

Toledo, D., K. C. Swanson, M. Meehan, C. R. Dahlen, R. Christensen, and D. Asplin. 2023. Forage quantity and quality of pastures dominated by Kentucky bluegrass do not meet the nutritional recommendations for beef cow-calf pairs in a drought and non-drought year. Grass Forage Sci. 78:268-274.

Swanson, K. C., A. E. Relling, A. DiCostanzo. 2023. NCCC308: Nutrition and management of feedlot cattle to optimize performance, carcass value and environmental impact. J. Anim. Sci. 101:skad003.

Waldon, N., K. Nickles, A. Parker, K. Swanson, and A. Relling. 2023. A review of the effect of nutrient and energy restriction during late gestation on beef cattle offspring growth and development. J. Anim. Sci. 101:skac319.

Winders, T. M., B. W. Neville, and K. C. Swanson. 2023. Effects of hempseed cake on ruminal fermentation parameters, nutrient digestibility, nutrient flow, and nitrogen balance in finishing steers. J. Anim. Sci. 101:skac291.

Acharya, S., E. A. Petzel, K. E. Hales, K. R. Underwood, K. C. Swanson, E. A. Bailey, K. M. Cammack, and D. W. Brake. 2023. Effects of long-term postgrastric infusion of casein or glutamic acid on small intestinal starch digestion and energy balance in cattle. J. Anim. Sci. 101:skac329.

Yusuf, M., K. C. Swanson, L. H. Hulsman Hanna, M. L. Bauer. 2023. Understanding the relationship between weather variables and dry matter intake in beef steers. J. Anim. Sci. 101:skac423.

8. Fund leveraging, specifically, collaborative grants between stations and members.

9. Other relevant accomplishments and activities.

**University of Georgia NCCC308 report**

**Todd Callaway**

1. **Impact Nugget**

We are in the concluding phases of a study attempting to create an “microbiome enhanced EPD” in Angus cattle, focused on feed efficiency and marbling. This has involved sampling from cattle in 14 states across the US in feedlots equipped with feed intake monitoring systems that were willing to share genotypic information as well as performance metrics that can be linked to the ruminal and fecal microbial composition.

2. **New Facilities and Equipment:**

A research feedlot has been established at UGA, that includes a C-lock feed and water intake monitoring system, along with a smart scale to monitor animal performance metrics and efficiency. The feedlot is also equipped with GreenFeed methane monitoring systems which allows us to link the ruminal fermentation and eructation with the animal growth metrics. A recently established capacity to sequence the bacterial, protozoal, and fungal populations of the rumen and feces, and correlate these populations with in vitro feedstuff degradation and specific activities of ammonia and methane production. Collectively, this provides the opportunity to link fully the microbial population and activities with animal performance.

Publications

*El-Jeni*, R., C. Villot, O. *Koyun*, A. *Osorio-Doblado*, J. J. *Baloyi*, J. M. Lourenco, M. Steele, and T. R. **Callaway**. 2024. “Probiotic” approaches to improving dairy production: reassessing “magic foo-foo dust”. J. Dairy Sci. 107:1832-1856. <https://doi.org/10.3168/jds.2023-23831>.

*Carmichael*, M. N., M. M. Dycus, J. M. Lourenco, C. B. Welch, D. B. Davis, T. R. Krause, M. J. Rothrock, F. L. Fluharty, T. D. Pringle, and T. R. **Callaway**. 2024. Ruminal Microbiome Differences in Angus Steers with Differing Feed Efficiencies During the Feedlot-Finishing Phase. Microorganisms 12: 536. <https://doi.org/10.3390/microorganisms12030536>

Perez, H. G., C. K. Stevenson, J. M. Lourenco, and T. R. **Callaway**. 2024. Understanding rumen microbiology: an overview. Encyclopedia (Journal). 4:148 157.  https://doi.org/10.3390/encyclopedia4010013

Corcionivoschi, N., I. Balta, D. McCleery, I. Bundurus, I. Pet, T. **Callaway**, I. Nichita, L. Stef, and S. Moraiu. 2024. Mechanisms of *Escherichia coli* attachment to meat. Foodborne Path. Dis. (Accepted 27 February)

Presentations

1. Can the ruminal microbiome ever answer all the questions that nutritionists have? Amer. Soc. Anim. Sci. Ann. Meeting. Albuquerque, NM. 18 July 2023.
2. Nutrition and Microbiology: Complementary goals and demands. 3rd International Livestock Science Conference, Ankara, Turkey. 13 November 2023.
3. Eubiotic approaches to improving livestock productivity and health. Vitasim Technical Group Meeting. Shanghai, China. 21 December 2023.
4. Ruminant diets: drivers of productivity, sustainability, and food safety. Praetoria (S. Africa) Food Safety Workshop. 30 January 2024.
5. Eubiotics/Direct Fed Microbials and dairy production: what they are and what they aren’t. Southwest Dairy Nutrition Conference. Chandler, AZ. 8 February 2024.
6. Nutrition, health, and sustainability of ruminant production. Tri-University Symposium (QAU, UCD, UGA) on Farm Animal Food Production and Quality. Qingdao Agricultural University, Qingdao, China. 19-20 March 2024.
7. Eubiotic approaches: Is there a silver bullet? Purina Nutrition Technical Meeting. Webinar. 17 May 2024.
8. Are probiotics just magic foo-foo dust? Balchem Animal Nutrition, Real Science Lecture Series Webinar. 4 June 2024.
9. Preharvest food safety interventions for ruminants. AMSA Reciprocal Meat Conference. Oklahoma City, OK. 17-18 June 2024.

**Fund Leveraging Grants Received**

GA Cattlemen’s Association, Georgia Commodity Commission for Beef, Several nutritional supplement corporations.

**NCCC 308 Station Report - Kendall L. Samuelson**

West Texas A&M University, Canyon, Texas, 79016

**Impact Nugget**

West Texas A&M University has developed understanding of available technologies, feed ingredients, and management practices used in the feedlot industry and evaluated impacts on finishing cattle performance, carcass outcomes, liver abscess prevalence, and rumen buffering. We have completed research investigating the contribution of diet and feed management practices on development of liver abscesses and these results have been accepted for publication in Applied Animal Science.

**New Facilities and Equipment**

We are in the process of developing design and construction plans for a new large animal education center, metabolism research building, and research feedlot. We are expected to begin construction on these facilities in Fall 2024.

**Project Related Findings**

The results of our research suggest that feeding a higher concentrate diet with less NDF increases liver abscess prevalence to a greater extent than inducing erratic intake patterns.

**Accomplishments**

*Inducing liver abscesses in finishing steers with high dietary starch and erratic feed management and their effects on growth performance, rumen buffering characteristics, and carcass outcomes*

We evaluated the simple and interactive effects of dietary starch concentration and feed management regimen on growth performance, rumen buffering characteristics, carcass outcomes, and liver abscess prevalence of finishing steers. On d 0, beef steers (n=720) were allocated to 48 soil-surfaced pens with 15 steers per pen (120 ft2 of pen space and 14 in of linear bunk space per steer). The experiment was a randomized complete block design consisting of 4 treatments in a 2 × 2 factorial treatment structure (12 pens/ interaction treatment; 24 pens/main effect). Treatments were finishing diets designed to supply typical concentrations of starch (49.1% total starch; CON) or an increased concentration of readily fermentable starch via use of low roughage and no grain-milling co-products (64.4% total starch; HOT) fed to cattle receiving 1 of 2 feed management regimens. Feed management regimens were consistent feed management (REG) or randomized variations (ERR) in feed quantity (85% followed by 115% of the previous 4-d average DMI once per week) and delivery time (delayed for 1, 2, 3, or 4 h twice per week). Three steers per pen received an indwelling rumen bolus to quantify ruminal pH and a 3-axis accelerometer ear-tag to quantify rumination during the first 150 d. Fecal score and fecal pH were determined on d 0, 56, 112, and before harvest. Decreasing the roughage concentration and excluding grain-milling co-products from the diet to provide high concentrations of readily fermentable starch caused reduced ruminal and fecal pH and increased liver abscesses, but occurred at the expense of live and carcass performance in feedlot steers. In contrast, erratic feed management induced DMI variation, but did not influence growth performance, carcass characteristics, or liver abscess frequency.

**Impact Statements**

The prevalence of liver abscesses in feedlot cattle is an industry-wide challenge that affects both the production and processing sectors of the beef industry. The current liver abscess etiology paradigm indicates that rumen lesions from acidosis are the primary predisposing factor for liver abscesses, as they permit bacterial translocation from the rumen to the hepatic portal vein and ultimately infection in the liver where inflammatory responses result in the classic abscess. However, a lack of knowledge exists about the mode(s) of action that cause the chain of events resulting in liver abscesses, and the prevalence of abscessed livers in feedlot cattle appears to be increasing along with exertion to reduce antimicrobial use.

A reliable model to induce and study liver abscess formation in cattle has not been developed and the relationship between ruminal acidosis and liver abscesses requires further understanding. Our study objective was to induce ruminal acidosis and subsequently liver abscessation via a combined dietary and feed management challenge. This model is relevant to the current cattle feeding industry, repeatable, and can be widely implemented in both research and commercial settings. An additional objective of our research was to identify potential cattle management strategies that can be used to decrease or prevent ruminal acidosis and liver abscesses. Overall, our study was successful in inducing greater liver abscess prevalence, but suggests that changes in dietary formulations may provide the most successful and logistically favorable option to induce liver abscesses in feedlot cattle.

**Selected Written Works**

Schneid, K. N., J. D. Young, T. E. Lawrence, J. T. Richeson, and **K. L. Samuelson**. 2024. Effects of dietary composition and feeding management regimen on liver abscess prevalence, growth performance, and carcass characteristics of feedlot steers. Appl. Anim. Sci. Accepted.

Kobza, A. M., D. Young, T. E. Lawrence, J. T. Richeson, and K. L. Samuelson. 2024. Fiber inclusion in feedlot diets. Beef Magazine. <https://informamarkets.turtl.co/story/beef-januaryfebruary-2024/page/5>

Kobza, A. M., J. D. Young, J. T. Richeson, T. E. Lawrence, M. E. Youngers, and **K. L. Samuelson**. 2023. Effects of starch dilution with corn stalks or wet distillers grains with solubles on growth performance and carcass characteristics of feedlot steers. Appl. Anim. Sci. In Press.

Pfau, A. P., M. T. Henniger, **K. L. Samuelson**, K. E. Hales, C. A. Lowest, M. E. Hubbert, A. K. Lindholm-Perry, A. M. Egert-McLean, K. Mason, E. A. Shepherd, B. H. Voy, and P. R. Myer. 2023. Effects of protein concentration and beta-adrenergic agonists on ruminal bacterial communities in finishing beef heifers. PLos One: e-0296407

Martinez, S. L., A. B. Word, B. P. Holland, K. J. Karr, J. P. Hutcheson, L. J. Walter, J. T. Richeson, T. E. Lawrence, and **K. L. Samuelson**. 2023. Effects of growth-implant regimen on performance, carcass outcomes, activity, and rumination of finishing steers fed to different days on feed. Appl. Anim. Sci. 39:456-471.

**Scientific and Outreach Oral Presentations**

**Samuelson, K. L.** 2024. Understanding liver abscess in beef × dairy crossbred cattle. Ranchers Roundtable Series, Oklahoma State University. Online webinar.

**Samuelson, K. L.** 2023. Relationships between diet, management, performance, and gut health in feedlot cattle. Improving the Quality of Dairy Cross Cattle Research Meeting. Gray Summit, Missouri.

**Samuelson, K. L.** 2023. Understanding the interactions between starch and fiber concentrations in U. S. feedlot cattle diets. Research Seminar at University of Saskatchewan. Saskatoon, Saskatchewan, Canada.

**Samuelson, K. L.** 2023. Interactions between starch and fiber concentrations in feedlot cattle diets. Research Seminar at New Mexico State University. Las Cruces, New Mexico.

Kobza, A. M., J. D. Young, J. T. Richeson, T. E. Lawrence, T. C. Tennant, and **K. L. Samuelson**. 2023. Dietary starch dilution strategies to improve feedlot cattle performance and rumen health. American Society of Animal Science National Meeting. Albuquerque, New Mexico.

**NCCC308 Station Report – Oklahoma State University**

1. **Foote**

**1. Impact Nugget:  A concise statement of advancements, accomplishments and impacts.  (Limit to 1-2 sentences)**

Phase-feeding crude protein can reduce nitrogen excretion from dairy-beef steers without impacting performance.

**2. New Facilities and Equipment. Include production areas, sensors, instruments, and control systems purchased/installed.**

None.

**3. Unique Project Related Findings.  List anything noteworthy and unique learned this year.**

A study in collaboration between Oklahoma State University and USDA-ARS in Bushland, TX has shown that phase-feeding crude protein to dairy-beef steers and using a moderate implant strategy can decrease nitrogen excretion and improve performance in the feedlot. Another study performed at Oklahoma State University has shown that cattle with altered glucose metabolism indicative of insulin resistance have improved feed efficiency in the finishing phase.

**4. Accomplishment Summaries.  Draft one to three short paragraphs (2 to 5 sentences each) that summarize research or outreach accomplishments that relate to the project objectives.  Please use language that the general public can readily comprehend.**

In an experiment conducted at Oklahoma State University, Holstein × Angus steers were fed a constant crude protein (CP) concentration (control), or the CP content of the diet was reduced every 49 days (phase-fed), and cattle received either an aggressive or moderate implant strategy. The results showed that treatments did not affect overall feed intake and growth, but the phase-fed group tended to have improved feed efficiency. Phase-fed steers with the moderate implant treatment excreted less urinary nitrogen overall than aggressive implant cattle on the phase-fed treatment. Additionally, marbling scores were reduced in the aggressive implant group. While these management practices can have beneficial environmental impacts, the economics of phase-feed crude protein is likely dependent on the specific operation and market conditions.

An experiment conducted at Oklahoma State University explored the association of glucose metabolism and insulin resistance with feed intake, growth, and efficiency of finishing beef cattle. Angus steers underwent a glucose tolerance test prior to a feed intake and growth measurement period. The results indicated that there is a relationship between insulin resistance and improved feed efficiency. The findings of this experiment are novel as they show a relationship between insulin resistance and feed efficiency.

**5. Impact Statements.  Please draft 2 or 3 impact statement summaries related to the project objectives.  Statements should be quantitative when possible and be oriented towards the general public.  This is perhaps the most difficult yet most important part of the report.**

**6. Published Written Works.  Include scientific publications, trade magazine articles, books, posters, websites developed, and any other relevant printed works produced.  Please use the formatting in the examples below.**

Foote, A. P., C. M. Salisbury, M. E. King, A. R. Rathert-Williams, H. L. McConnell, and M. R. Beck. 2024. Association of insulin resistance with feed efficiency and production traits of finishing beef steers. J. Anim. Sci. 102: skae050.

King, M. E. and A. P. Foote. 2023. Technical Note: Validation of energy dispersive X-ray fluorescence for determination of indigestible markers in ruminant digesta samples. J. Anim. Sci. 101: skad285.

Rathert-Williams, A. R., H. L. McConnell, C. M. Salisbury, A. K. Lindholm-Perry, D. L. Lalman, A. Pezeshki, and A. P. Foote. 2023. Effects of adding ruminal propionate on dry matter intake and glucose metabolism in steers fed a finishing ration. J. Anim. Sci. 101: skad072.

**7. Scientific and Outreach Oral Presentations.  Include workshops, colloquia, conferences, symposia, and industry meetings in which you presented and/or organized.  See below for formatting.**

None

**8. Fund leveraging, specifically, collaborative grants between stations and members.**

None

**9. Other relevant accomplishments and activities.**

None

**University of Nebraska-Lincoln NCCC-308 Experiment Station Report**

**G. Erickson & J. Sperber**

1. **Impact Nugget:**

Enteric methane is predictable but variable based on diet quality and byproduct use in finishing diets. Dietary mitigation strategies will be available if approved for use to decrease emissions by 50% or more in feedlot systems. New research at UNL will evaluate animal-to-animal variation due to host and microbial genetics, but also individual variation in metabolizable energy utilization.

Varying distillers grains inclusion in diets is not as impactful as hypothesized, and new products will still be fed in beef systems although energy content has to be tested.

**2. New Facilities and Equipment**

A new $7.2 million feedlot innovation center was constructed at the Eastern Nebraska Research Extension and Education Center that provided 36, 60-head pens across 4 different housing systems, along with a processing/handling center contained two unique handling equipment designs, and a 240-head individual feeding system (Hokofarms, insentec). The new center is expected to open on August 1, 2024.

**3. Unique Project Related Findings.**

Varying distillers grains inclusion by 10% around a targeted average on a weekly basis resulted in similar performance for finishing cattle as including a constant 25% inclusion of modified distillers grains plus solubles.

**4. Accomplishment Summaries.**

* **Enhance the utilization of C from energy feeds to compete in an energy economy and improve national food security.**

Our research illustrates that distillers grains will still increase gain and intakes but the response is variable on impact of feed efficiency depending on inclusion, type of distillers grains or production method, and other ingredients in the diet such as corn processing method used. More recent research with distillers has focused on fractionated products and concluded that fractionated distillers have a little less (95 to 98%) energy compared to traditional production processes. Because supply has been variable, it is common for dietary inclusion to vary over the feeding period. Varying distiller randomly between 15 and 35% (average of 25% inclusion) was not impactful on gain or feed efficiency compared to a constant inclusion of 25% over the entire feeding period, and follow-up research is evaluating other inclusions and corroborating the observations so far. Research continues with wet milling byproducts such as Sweet Bran for grain adaptation and impact on methane and performance, and ways to further improve value for feedlot cattle by modifying ingredient makeup of Sweet Bran or production process.

* **To enhance the environmental sustainability of the feedlot industry through conservation and nutrient management.**

Understanding mineral retention will improve estimates of environmentally sensitive minerals such as phosphorus (P). We have concluded that NASEM (2016) predictions are accurate for estimating retained minerals for most macrominerals using samples from previous serial slaughter experiments.

Beef systems monitoring for total greenhouse gas (GHG) emissions and uptake (flux) is continuing, with 6 consecutive years that vary in grass production being monitored. More recently, full GHG flux measurements are being performed on pastures with a 16 year history of fertilization or not, along with comparison to supplementing distillers grains as a protein supplement and the cattle ‘fertilizing’ the pasture.

Minimizing enteric methane is a major goal while maintaining or improving performance of finishing cattle. Feeding biochar has no impact on enteric methane based on 5 experiments from UNL, yet continues to be touted as a possible mitigation strategy. But, feeding red seaweed with bromoform does dramatically decrease enteric methane and should be evaluated for safety to get approval for use in the U.S.

* **To enhance the production efficiency and quality of feedlot cattle through management strategies and technologies.**

Research is continuing to evaluate natural feed additives and the impact (or not) on performance, carcass traits, and/or health outcomes. More research in this area will be coming in 2025. Traditional technologies are also continuing to be tested for improving feedlot performance and efficiency that is either new research or publishing previously collected data in peer-reviewed publications.

* **To enhance management strategies that improves animal health and well-being.**

Many feedyards are limit-feeding calves at receiving as a method to improve animal health status. Our work suggests that limit-feeding does not improve health status based on pull rates so does not make cattle healthier. This management strategy may make checking for and identifying sick cattle easier though. We have also been evaluating new products that may impact immune function in newly received feedlot calves as well as precision technologies to enhance identification of sick cattle.

The new feedlot innovation center at UNL will provide a mechanism to evaluate worker competence and cattle behavior when processed through two different handling systems, and all trials will evaluate cattle behavior as a routine phenotype.

**6. Published Written Works.**

Refereed Journal Articles

Gibbons, J. C., B. M. Boyd, H. C. Wilson, J. W. Wilson, K. H. Wilke, G. E. Erickson, and A. K. Watson. 2023. Evaluation of condensed algal residue solubles as an ingredient in cattle finishing diets and the effects on digestibility and fatty acid flow. Appl. Anim. Sci. 39:133-145. <https://doi.org/10.15232/aas.2022-02349>

Mazis, A., T. Awada, G. E. Erickson, B. Wardlow, B. J. Wienhold, V. Jin, M. Schmer, A. Suyker, Y. Zhou, and J. Hiller. 2023. Synergistic use of optical and biophysical traits to assess *Bromus inermis* pasture performance and quality under different management strategies in Eastern Nebraska, U.S. Agric. Ecosys. Environ. 348;108400 <https://doi.org/10.1016/j.agee.2023.108400>

McDermott, R. L., B. C. Troyer, M. E. Youngers, R. A. Stock, G. E. Erickson, and J. C. MacDonald. 2024. Interaction of Sweet Bran inclusion and corn processing method in beef finishing diets. Transl. Anim. Sci. 8:1-8 <https://doi.org/10.1093/tas/txae023>

Watson, A. K., T. J. McEvers, L. J. Walter, N. D. May, J. A. Reed, J. C. MacDonald, G. E. Erickson, N. A. Cole, J. P. Hutcheson, and T. E. Lawrence. 2023. Mineral composition of serially slaughtered Holstein steers supplemented with zilpaterol hydrochloride. J. Anim. Sci. 101:1-11. <https://doi.org/10.1093/jas/skad209>

Experiment Station Reports

Cronk, H., H. Heil, R. McDermott, M. Norman, G. Erickson, and A. Watson. 2024. Effect of biochar on enteric methane and cattle performance. Neb. Beef Cattle Rep. MP118:52-54.

Hodges, M., H. Heil, R. McDermott, A. Mazis, T. Awada, G. Erickson, and A. Watson. 2024. Long-term performance of steers grazing smooth bromegrass pastures. Neb. Beef Cattle Rep. MP118:32-34.

Lemon, G. N., R. L. McDermott, A. DiCostanzo, G. E. Erickson, and P. l. Loza. 2024. Comparison of corn silage and earlage in finishing diets when fed as a roughage on a neutral detergent fiber basis. Neb. Beef Cattle Rep. MP118:62-64.

Lemon, G. N., R. L. McDermott, G. E. Erickson, J. Heldt, and P. L. Loza. 2024. Evaluation of vivalto on growth performance and carcass characteristics in growing and finishing beef steers. Neb. Beef Cattle Rep. MP118:72-73.

Mansfield, C. D., R. L. McDermott, B. C. Troyer, M. M. Norman, M. Youngers, A. K. Watson, R. Stock, and G. E. Erickson. 2024. Evaluation of gas emissions from cattle on different diet adaptation strategies using either forage or RAMP. Neb. Beef Cattle Rep. MP118:55-58.

Sousa, D. G., R. L. McDermott, M. M. Norman, J. C. MacDonald, R. Stock, R. A. Mass, and G. E. Erickson. 2024. Impact of feeding new fractionated distillers grains (fiber plus syrup) on feedlot cattle performance and carcass characteristics. Neb. Beef Cattle Rep. MP118:65-68.

Sousa, D. G., R. L. McDermott, M. M. Norman, J. C. MacDonald, R. Stock, and G. E. Erickson. 2024. Impact of varying inclusion of modified distillers grains plus solubles compared to constant inclusion on feedlot cattle performance and carcass characteristics. Neb. Beef Cattle Rep. MP118:69-71.

**7. Scientific and Outreach Oral Presentations.**

Colin, R. L., K. K. Buse, A. K. Watson, G. E. Erickson, and P. J. Kononoff. 2023. 261 Effect of Alga 1.0 on reducing enteric methane emissions from cattle. J. Anim. Sci.101(Suppl. 2):221-222 <https://doi.org/10.1093/jas/skad341.248>

Cronk, H. K., H. A. Heil, R. L. Sjostrand, M. M. Norman, G. E. Erickson, and A. K. Watson. 2023. 260 Effect of biochar inclusion in finishing beef cattle diets on enteric methane production and performance. J. Anim. Sci.101(Suppl. 2):217-218 <https://doi.org/10.1093/jas/skad341.243>

Funk, R. A., B. C. Troyer, M. M. Norman, L. J. McPhillips, and G. E. Erickson. 2023. 185 Effect of ad libitum versus limit-feeding program at receiving on morbidity and performance of feedlot calves. J. Anim. Sci.101(Suppl. 2):8-9 <https://doi.org/10.1093/jas/skad341.008>

Heil, H. A., B. Zhao, B. C. Troyer, R. L. Sjostrand, J. Xiong, A. K. Watson, G. E. Erickson, J. Okalebo, Y. Shi, and Y. Xiong. 2023. 94 Characterizing yearling beef steers grazing on smooth bromegrass pasture using global positioning technology. J. Anim. Sci.101(Suppl. 2):11-12 <https://doi.org/10.1093/jas/skad341.013>

Mansfield, C., R. L. Sjostrand, B. C. Troyer, M. M. Norman, T. Spore, M. Corrigan, G. E. Erickson, and J. C. MacDonald. 2023. 309 Evaluation of encapsulated Megasphaera Elsdenii Ncimb 41125 in an accelerated beef step-up program and acidosis challenge model. J. Anim. Sci.101(Suppl. 2):224-225 <https://doi.org/10.1093/jas/skad341.252>

Suarez-Lorences, S., B. C. Troyer, M. M. Norman, J. C. MacDonald, and G. E. Erickson. 2023. 159 Impact of constant inclusion or decreasing inclusion of distillers grains with high-quality or low-quality roughage on finishing cattle performance. J. Anim. Sci.101(Suppl. 2):212-213 <https://doi.org/10.1093/jas/skad341.236>

**University of Nebraska-Lincoln NCCC-308 Experiment Station Report**

Pablo Loza

**1. Impact Nugget:**

At the UNL, Panhandle Research and Extension Center Research Feedlot we have completed two experiments, the first on Earlage and silage use in finishing diets and the second on Protected B Vitamins in feedlot steers.

**2. New Facilities and Equipment**

We update our handling facility by purchasing a new Arrowquip snake that would allow us to work cattle with the size .

**3. Unique Project Related Findings.**

In our Silage to Earlage comparison, we observed lower DMI in cattle fed the Earlage diets when comparing with Silage at the same NDF content.

**4. Accomplishment Summaries.**

The research performed and the results published last year align with the objective of enhancing production efficiency. Experiments on Earlage and silage evaluation as forage source were designed to optimize the use of ingredients that are grown by the producers or must be locally sourced. By testing protected B vitamins when receiving high risk calves, we are increasing the number of tools available to minimize the impact of stress for handling, shipping, and diet change in those animals.

**5. Impact Statements.**

By quantifying the differences on including silage and Earlage at the same fiber levels, we can better predict the animal responses, by adding this information to the existing prediction models. The predicted performance result would aid producers in budgeting all diet ingredients, saleable volumes of beef, and the crop area needed for their forages when producing them on site.

**6. Published Written Works.**

[N. R. Meier](javascript:;), [K. Wilke](javascript:;), [G. .E Erickson](javascript:;), [P. L. Loza](javascript:;). Effects of Corn Processing and Silage Inclusion Levels in Feedlot Diets on Steer Performance. 2022. J. Anim. Sci.100 (Suppl. 2), 96

Miller, J., [K. Wilke](javascript:;), [G. .E Erickson](javascript:;), [P. L. Loza](javascript:;). Effect of Enogen Feed Corn Inclusion in Conventional and Natural Finishing Cattle Diets. 2023, Nebraska Beef Cattle Report, 64-66.

Miller, J., [N. R. Meier](javascript:;), [K. Wilke](javascript:;), [G. .E Erickson](javascript:;), [P. L. Loza](javascript:;). Effects of Corn Processing and Silage in Feedlot Diets on Steer Performance. 2023, Nebraska Beef Cattle Report, 67-69.

**7. Scientific and Outreach Oral Presentations.**

**Poster Presentation, Effect of corn silage inclusion and corn processing method on finishing cattle performance and carcass characteristics,** Miller, J., [K. Wilke](javascript:;), [G. .E Erickson](javascript:;), [P. L. Loza](javascript:;). Plains Nutrition Conference, San Antonio, TX. April 6 and 7th , 2023.

Oral Presentations, Beef Feedlot Roundtable Series at Bridgeport, North Platte, and West Point. Research Update, Site Specific Research. February 22 to the 24th, 2023.

**Penn State NCCC308 Station Report**

**T. Felix**

Impact Nugget

Pennsylvania State University finalized collaboration with the University of Connecticut to determine the impacts of beef x dairy in the northeast through survey outreach (see publications).

While Angus sires continue to dominate beef x dairy matings, the frequency of other beef sire breeds in beef x dairy matings is increasing. Penn State has completed the 4-year feedlot trial investigating the optimal genetics of beef-sired steers born to Holstein dams (beef × Holstein).

We have initiated studies to examine a) the replacement of corn silage with sorghum sudangrass in farmer-feeder operations and b) the long-term impacts of early calf lung consolidation.

New Facilities and Equipment

None added.

Unique Project Related Findings.

Angus sires generate the most consistent progeny out of dairy systems. However, growth performance and carcacass characteristics were similar among Angus, Charolais, Red Angus, and Hereford sired beef x dairy progeny. Limousine-sired progeny suffered reduction in marbling while Simmental-sired progeny suffered reduction in tenderness. These attributes are likely more a function of the individual sire selection than the breed. Interestingly, dairy herd of origin impacts economically relevant calf traits, independent of successful transfer of passive immunity, suggesting Holstein dam genetics *and/or* other events prior to 2 to 4 days of age contribute to feedlot outcomes.

Accomplishment Summaries

*BeefxDairy in the Feedlot*

A total of three groups of steers were finished over 2021 (n = 31), 2022 (n = 127), and 2023 (n =103) for this study. Single-born, male calves born to commercial Holstein dams and sired by Angus, SimAngus, Simmental, Limousin, Charolais, Hereford, or Wagyu bulls in commercial AI programs were sourced for the project. Calves were managed similarly throughout life; from birth to weaning they were raised at a commercial wet calf facility. Calves were weaned at 7.5 ± 2.5 weeks of age and moved to a bedded pack commercial growing facility. Steers were fed corn grain, pelleted grain, and free choice hay until they were approximately 6 ± 2 months old; then, they were transitioned to a corn silage-based diet that provided 1.36 Mcal NEg /kg. Steers received two implants containing progesterone and estradiol benzoate (two Synovex-C in 2021 and a Synovex-C followed by a Synovex-S in 2022 and 2023) while housed at the commercial facility. Steers were transported to the Pennsylvania Department of Agriculture Livestock Evaluation Center (LEC) feedlot at 9.5 ± 2.5 months old to be finished. There, they were transitioned to a high-energy feedlot diet and implanted with a terminal implant containing TBA and estradiol (Revalor XS in 2021, Revalor S in 2022, and Synovex One Grower in 2023).

Individual feed intakes were monitored using the GrowSafe Feed Intake System (Model 4000E; Vytelle, LLC., Lenexa, KS). Steers were weighed on two consecutive days after feedlot arrival and two consecutive days prior to slaughter to calculate feedlot average daily gain (ADG). Slaughter groups were based on a combination of visual appraisal of finish and body weight. Steer groups were on feed from 90 to 153 days prior to slaughter at a commercial beef processing facility. Three days following slaughter, trained research personnel evaluated carcass characteristics. A section of the longissimus muscle (LM), from the 10th to 12th rib, was cut from each carcass and transported to the Penn State Meat Science Laboratory for Warner-Bratzler Shear Force (WBSF) tenderness and intramuscular fat (IMF) evaluation. Feedlot growth performance and carcass characteristics were fit by linear mixed models, where sire breed was a fixed effect and individual sire, year on feed, and dairy herd of origin were random effects.

Steers sired by Angus bulls had the greatest ADG (1.76 kg/day). Wagyu × Holstein steers gained the least (1.39 kg/day; *P* < 0.05). Charolais (1.73 kg/day), Simmental (1.68 kg/day), and Hereford-sired steers (1.66kg/day) were intermediate and their ADG did not differ from Angus-sired steers. also had greater ADG Limousin-sired steers (1.55 kg/day; *P* < 0.05). Red Angus (1.62 kg/day) and Limousin-sired steers (1.55 kg/day; *P* < 0.05) were also intermediate but gained less than Angus-sired steers. Wagyu × Holstein steers spent at least 5 days on feed (*P* < 0.05), when compared to Limousin-sired steers, and up to 26 days longer on feed when compared to Charolais-sired steers. Angus and Charolais-sired steers were on feed for 19 and 21 days fewer, respectively, than Limousin-sired steers (*P* < 0.05).

Red Angus-sired steers had the greatest marbling scores (*P* < 0.05) while Limousin-sired steers had the least; all other sired breeds were intermediate and not different from each other. Angus-sired steers produced the most tender (*P* < 0.05) beef as evaluated by WBSF (3.82 kg) and Simmental-sired carcasses (4.51 kg) were the least tender; all other sired breeds were intermediate and not different from each other.

Angus-sired steers had the greatest ADG and produced the most tender beef. Wagyu-sired steers had the least ADG and spent the most days on feed. Limousin-sired steers also had reduced ADG and required additional days on feed when compared with Angus-sired steers. Carcasses from Limousin-sired steers had the least marbling and those from Simmental-sired steers were the least tender. Performance of steers sired by other breeds was generally intermediate. The three years’ of results suggest that sire breed can impact the terminal performance of fed beef × Holstein progeny. Current estimates would suggest nearly 20% of our feed beef cattle supply is now beef x dairy crosses. One of the biggest challenges this shift to beef x dairy, from the 20% straight Holstein in the 2016 National Beef Quality Audit, causes is a lack of uniformity in the boxed beef supply. Additional emphasis on sire selection and improving uniformity through sire selection *and* proper nutrition and management will be critical to the future success of beef x dairy feedlot programs.

*Survey of dairies in NE*

A total of 669 surveys were received and a final number of 617 surveys were included in the responses based on completeness and validity of the responses. Because of the broad electronic distribution, a true response rate cannot be calculated. Of these, 463 (75.0%) were completed via returned paper survey, and 154 (25.0%) were completed via web, between November 9, 2021 and February 16, 2022. Of the 617 respondents, 539 were from Pennsylvania. Due to the large variations in returned survey copies by state, results are reported without state separation. Across all respondents, 69.7% reported milking 100 or fewer cows and over 90% of collected responses reported Holsteins as the predominant dairy breed in the Northeast. Only 18.8% of the respondents did not currently, nor plan to, breed with beef semen. Deciding which beef bulls to use on Northeast dairy farms was primarily based on the recommendation of the semen sales representative (54.5%) and the price of the semen purchased (42.3%). In addition, 89.7% of respondents cited using Angus genetics in their beef bull selections. However, there was no difference in reported profitability of crossbreeding between respondents who indicated using other beef breeds versus those who indicated just using Angus (*P* ≥ 0.19). In conclusion, using beef sires on dairy females, regardless of the breed of beef sire, adds value to the resulting progeny from dairy farms in the Northeast.

Impact Statements

Crossbred beef x dairy calves are beginning to replace a portion of the beef supply chain. Researchers at Pennsylvania State University observed that the efficiency of beef x Holstein steers depends on sire breed used and that sire breed used has no impacts on subsequent lactations or post-partum events in the dairy.

Published Written Works

*Scientific works relevant to the committee*

1. Basiel, B.L., J.A. Campbell, C.D. Dechow, and T.L. Felix. 2024. The impact of sire breed on feedlot performance and carcass characteristics of beef × Holstein steers. Transl Anim Sci. 2024 Mar 23;8:txae043. doi: 10.1093/tas/txae043.
2. Bierly, S. A., VanSyoc, E. P., Westphalen, M. F., Gaeta, N. C., Felix, T., Hristov, A. N., & Ganda, E. 2024. Alterations of rumen and fecal microbiome in growing beef and dairy steers fed rumen-protected Capsicum oleoresin. Journal of Animal Science. DOI: 10.1093/jas/skae014
3. Basiel, B.L., A. Barragan, T.L. Felix, and C.D. Dechow. 2023. The impact of beef sire breed on dystocia, stillbirth, gestation length, health, and lactation performance of cows that carry beef × dairy calves. J. Dairy Sci. DOI: 10.3168/jds.2023-24112
4. Felix, T.L., J.C. Emenheiser, K.E. Govoni, S.A. Zinn, and S.A. Reed. 2023. Survey of the use of beef semen in dairy herds in Pennsylvania and nearby states. Trans. Anim. Sci. DOI: 10.1093/tas/txad038

*Extension or public works relevant to the committee*

1. Basiel, B.L. and T.L. Felix. 2024. Value beyond the sale barn: growth performance, carcass characteristics, and an economic snapshot of beef × Holstein steers. Hoards Dairymen.
2. Felix, T. (70%), & Basiel, B. L. (2024). "Meat quality of beef x dairy crosses." Progressive Cattle. <https://www.agproud.com/articles/57438-dairy-producer-attitudes-about-beef-on-dairy>
3. Felix, T. (2023). "It's more about the bull than the breed: Beef x Dairy Project Enters Final Year." Lancaster Farming.
4. Basiel, B.L. and T.L. Felix. 2023. 2023 Beef-sired progeny from dairy cows. Lancaster Farming.
5. Felix, T. L. (2023). ""Free Choice" minerals Fed to Beef Cattle." Keystone Cattlemens Magazine.
6. Felix, T. (2023). "How to Make the Most of Risign Prices for Weaned Calves." Lancaster Farming.
7. Basiel, B. L., & Felix, T. L. (50%) (2023). 2023 Beef-sired progeny from Dairy Cows. https://extension.psu.edu/2023-beef-sired-progeny-from-dairy-cows
8. Felix, T. (2023). Reading Mineral Tags. https://extension.psu.edu/reading-cattle-mineral-tags
9. Felix, T. L., & Williamson, B. (2023). Nutritional Development of Bulls for Breeding Programs. https://extension.psu.edu/nutritional-development-of-bulls-for-breeding-programs

Scientific and Outreach Oral Presentations

*Scientific meetings*

1. Basiel, B.L., T J.A. Campbell, C.D. Dechow, and T.L. Felix. 2024. The influence of sire breed on feedlot performance, carcass characteristics, and carcass value of beef × Holstein steers. Plaines Nutrition Council. San Antonio, TX
2. Basiel, B. L., & Felix, T. L. (2023). "Growth performance and carcass characteristics of beef-sired steers born to Holstein dams." Journal of Animal Science., 101(Supp\_2), (pp. 41). DOI: 10.1093/jas/skad341.045
3. Carter, R., Zinn, S. A., Govoni, K., Emenheiser, J., Felix, T. (Co-Author, 10%), & Reed, S. A. (2023). "PSIII-3 Effects of Milk Replacer Composition on Beef X Dairy Calf Growth and Muscle Fiber Cross-Sectional Area." Journal of Animal Science., 101(E-Suppl. 3) . DOI: 10.1093/jas/skad281.459
4. Felix, T. (2023). National attitudes by dairy producers about crossbreeding beef on dairy. I-29 Dairy Beef Short Course. *Presented virtually*
5. Basiel, B. L., Felix, T. L., & Dechow, C. D. (2023). "Early-lactation health event frequency of cows that carried beef or Holstein-sired calves." Journal of Dairy Science.
6. Dechow, C. D., Basiel, B. L., & Felix, T. L. (2023). "Genetic selection considerations when using beef sires on dairy cows." Journal of Dairy Science.

*Invited presentations*

1. Attitudes about beef on dairy breeding and raising/marketing calves, Instructor, On-Line, External to Penn State, I-MOO University, WEB. Spring (March 28, 2023).
2. Invited to advanced beef cattle production classroom to instruct students in Belize.What every beef producer should know about beef x dairy, Instructor, Lecture, External to Penn State, Minnesota Extension, Carver County, MN. Spring (February 20, 2023).
3. What every dairy producer should know about beef x dairy, Instructor, Lecture, External to Penn State, Minnesota Extension, Carver County, MN. Spring (February 20, 2023).
4. Beef cattle management, production and related topics, Guest Lecturer, On-Line, External to Penn State, University of Belize, WEB, Professional. Spring (May 23, 2023 - April 17, 2023).
5. How to optimize feed efficiency, Instructor, Extension Program, External to Penn State, Berks County Cattlemens Association, Mohrsville, PA, Professional. Fall (September 30, 2023).
6. How feedlot stress affects profitability, Instructor, Extension Program, External to Penn State, Pennsylvania Cattlemens Association, Bedford, PA, Professional. Spring (April 15, 2023).

*Selected Outreach (Extension talks presented by Tara Felix around PA)*

1. Winter Cow Maintenance, Instructor, Resident Instruction, External to Penn State, Armstrong-Idiana County Cattlemens Association, Armstrong County, 32 participants, Academic. Spring (March 25, 2024).
2. Cow Efficiency: Tools to manage your cow herd, Co-Director and Instructor, Extension Program, Both, Pa Beef Producers Working Group, Ford City, PA, 22 participants, Professional. Fall (October 21, 2023).
3. Nutrition calculations, Instructor, On-Line, External to Penn State, Penn State 4-H, WEB, 5 participants, Academic. Fall (October 17, 2023).
4. Seventh Annual Penn State Beef Cattle Short Course, Director and Instructor, Extension Program, External to Penn State, PA Beef Producers Working Group, State College, PA, 44 participants, Professional. Fall (October 3, 2023 - October 4, 2023).
5. Cow Efficiency: Tools to manage your cow herd, Co-Director and Instructor, Extension Program, Both, Pa Beef Producers Working Group, Damascus, PA, 49 participants, Professional. Fall (September 23, 2023).
6. Cow Efficiency: Tools to manage your cow herd, Co-Director and Instructor, Extension Program, Both, Pa Beef Producers Working Group, East Berlin, PA, 43 participants, Professional. Fall (September 9, 2023).
7. Ruminant Digestion, Instructor, Classroom, External to Penn State, Penn State 4-H, Pa Furnace, PA, 36 participants, Academic. Summer (May 20, 2023).
8. Modifying your Infrastructure for Beef Cattle - Space Requirements, Co-Instructor, Extension Program, External to Penn State, Penn State Extension, Honesdale, PA, 13 participants, Professional. Spring (May 5, 2023).
9. Modifying your Infrastructure for Beef Cattle - Space Requirements, Co-Instructor, Extension Program, External to Penn State, Penn State Extension, Wellsboro, PA, 32 participants, Professional. Spring (February 28, 2023).
10. Modifying your Infrastructure for Beef Cattle - Space Requirements, Co-Instructor, Extension Program, External to Penn State, Penn State Extension, Chambersburg, PA, 56 participants, Professional. Spring (February 16, 2023).
11. Modifying your Infrastructure for Beef Cattle - Space Requirements, Co-Instructor, Extension Program, External to Penn State, Penn State Extension, New Holland, PA, 56 participants, Professional. Fall (February 14, 2023).

Fund Leveraging

Felix, T. (Principal Investigator), Grant, "Breeding beef on Holstein: producing crossbred calves that are profitable from the dairy to the meat packer (**Fellowship: Bailey Lauren Basiel**)," USDA National Institute of Food and Agriculture, Federal Agencies. Total requested: $169,755.00. Total awarded: $1.00. (submitted: May 21, 2021, date funding awarded: January 18, 2022, funded: December 15, 2021 - December 14, 2024).

Dechow, C. D., Harvatine, K. J., Dechow, C. D. (Co-Investigator), Felix, T. (Principal Investigator), Harvatine, K. J. (Co-Investigator), Grant, "Enhancing the value of beef sired progeny from dairy cattle," USDA National Institute of Food and Agriculture, Federal Agencies. Total requested: $299,556.00. Total awarded: $299,556.00. (submitted: August 21, 2019, date funding awarded: May 14, 2020, funded: May 15, 2020 - May 14, 2024).

Felix, T. (Principal Investigator), Grant, "Nutritional management strategies for improving growth and carcass composition of beef x dairy crossbred calves," Connecticut, University of, Universities and Colleges. Total requested: $60,003.00. Total awarded: $34,931.00. (submitted: October 14, 2020, date funding awarded: July 27, 2021, funded: March 1, 2021 - February 28, 2024).

Diller, L. (Undergraduate student), Felix, T., Grant, "2023-2024 College of Ag Sciences Undergraduate Research Award," College of Ag Sciences Undergraduate Office, Penn State. Total requested: $1,702.00. Total awarded: $1,452.00. (submitted: November 13, 2023, date funding awarded: December 8, 2023, funded: January 1, 2024 - Present).

Other Relevant Accomplishments

Initiation of the “Advanced Beef Nutrition Course”. 30 professional nutritionists attended the inaugural meeting in May 2023.

BQA training was provided for 8 inmates at Rockview Correctional Dec 2023. Additional training request May 2024.

1. **NCCC308 Project Station Report – Michigan State University**

**J. Jaborek**

1. **Impact Nugget:** No new research findings since last year’s report (2023). Continuation and development of Extension programs for producers feeding cattle for beef production.
2. **Facilities and Equipment Update:** No feedlot facility and equipment updates.
3. **Unique Project Related Findings:** No new research findings since last year’s report (2023). Continuation and development of Extension programs for producers feeding cattle for beef production.
4. **Accomplishment Summary:** The Michigan State University feedlot is currently feeding Holstein and Beef × Holstein steers to compare feedlot performance and carcass characteristics of these cattle when fed finishing diets containing 20% or 40% corn silage on a dry matter basis as a natural alternative to mitigate liver abscesses. Future results from the ongoing study should offer some insight to the expected performance and incidence of liver abscesses of Holstein and Beef × Holstein steers. Holstein and Beef × Holstein steers and heifers are being raised to feed in the MSU feedlot for future carcass cutability research.
5. **Impact Statements:** No new research findings since last year’s report (2023). Continuation and development of Extension programs for producers feeding cattle for beef production.
6. **Published Written Works:**

*Scientific Journal Articles and Abstracts:*

M. Pimentel-Concepción, **J. R. Jaborek**, J. P. Schweihofer, A. J. Garmyn, M.-G.-S. McKendree, B. J. Bradford, A. Hentschl, and D. D. Buskirk. 2023. Growth performance, carcass traits, and feeder calf value of beef × Holstein and Holstein feedlot steers. Appl. Anim. Sci. 40:56–68.

*Extension Articles:*

M. Pimentel-Concepción, **J. R. Jaborek**, J. P. Schweihofer, A. J. Garmyn, M.-G.-S. McKendree, B. J. Bradford, A. Hentschl, and D. D. Buskirk. 2024. Growth performance, carcass traits and feeder calf value of beef x Holstein and Holstein feedlot steers. Michigan State University Extension News.

**Jaborek, J. R.** 2024. Grain processing increases starch digestibility of feedlot cattle diets. Michigan Cattleman Magazine.

**Jaborek, J. R.** 2024. White muscle disease in cattle is caused by nutrient deficiency. Michigan State University Extension News.

**Jaborek, J. R.** 2024.Winter hay supplies getting low? Consider limit-feeding grain to your beef cows. Michigan Cattleman Magazine.

M. Pimentel-Concepción, **J. R. Jaborek**, J. P. Schweihofer, A. J. Garmyn, M.-G.-S. McKendree, B. J. Bradford, A. Hentschl, and D. D. Buskirk. 2023. Growth performance, carcass traits and feeder calf value of beef x Holstein and Holstein feedlot steers. Michigan Cattleman Magazine.

M. Pimentel-Concepción, **J. R. Jaborek**, J. P. Schweihofer, A. J. Garmyn, M.-G.-S. McKendree, B. J. Bradford, A. Hentschl, and D. D. Buskirk. 2023. Growth performance, carcass traits and feeder calf value of beef x Holstein and Holstein feedlot steers. Beef Magazine.

**Jaborek, J. R.** 2023. How much vomitoxin is too much for feedlot cattle? Michigan State University Extension News.

**Jaborek, J. R.** 2023. There’s hormones in beef? MSU Extension addresses common misconceptions. Michigan State University Extension News.

**Jaborek, J. R.** 2023. A valid veterinarian-client-patient relationship is key to successful cattle health. Michigan State University Extension News.

**Jaborek, J. R.** 2023. Safe and effective use of cattle steroid ear implants. Michigan State University Extension News.

**Jaborek, J. R.** 2023. Managing heat stress in the feedlot with nutrition. Michigan State University Extension News.

1. **Oral Presentations:**

*Scientific Presentations:*

Pimentel-Concepción, M., **J. R. Jaborek**, J. P., Schweihofer, A. J. Garmyn, M. G.S. McKendree, B. J. Bradford, A. F. Hentschl, and D. D. Buskirk. 2024. Feedlot performance, carcass traits, and feeder calf value of beef × Holstein and Holstein steers. Driftless Region Beef Conference. Jan. 25-26, 2024. Dubuque, IA.

*Extension Presentations:*

Penn State University Advanced Beef Cattle Short Course. Invited Speaker (**J. R. Jaborek**). The past, present, and future of beef cattle protein requirements. May 16, 2024. 26 participants - In-person.

Veal Summit. Invited Speaker (**J. R. Jaborek**). Impact of the Rising Beef x Dairy Industry. April 9, 2024. 34 participants - Virtual meeting.

MSU Feedlot Educational Series - Results from the 2022 National Beef Quality Audit. Instructor (**J. R. Jaborek**), Speakers (George Quackenbush and **J. R. Jaborek**). April 10, 2024. 10 participants - in-person/virtual hybrid.

MSU Feedlot Educational Series - Feeding a liquid versus dry supplement. Instructor (**J. R. Jaborek**), Speaker (Scott Roskens). March 13, 2024. 36 participants - In-person/virtual hybrid.

MSU Michigan Ag Ideas to Grow With - Grain Processing and its Effects on Rumen Health in Beef Cattle. Speaker (**J. R. Jaborek**). Feb. 28, 2024. Virtual.

MSU Feedlot Educational Series - Using livestock risk management tools to increase profitability. Instructor (**J. R. Jaborek**), Speaker (Jeff Harding). February 7, 2024. 24 participants - In-person/virtual hybrid.

MSU Feedlot Educational Series - Financial opportunity with environmental sustainability and the use of Experior, a β3- agonist. Instructor (**J. R. Jaborek**), Speakers (Nathan Pyatt and Matt Costigan). January 10, 2024. 39 participants – In-person/virtual hybrid.

MSU Thumb Ag Day - Limit Feeding Corn to Beef Cattle when Forage Supplies are Low. Speaker (**J. R. Jaborek**). Dec. 13, 2023. 9 participants.

Thumb Cattleman’s Summer Picnic: Zoetis brand of ear implants. Instructor (S. Messing, **J. R. Jaborek,** J. VanLoon), Speaker (J. Serels). Aug 16, 2023. 39 participants.

Zoetis/MSU Implant Boot Camp – Peck, MI. Speakers (S. Messing and **J. R. Jaborek**). Aug. 24, 2024. 25 participants. In-person/hands-on experience.

Zoetis/MSU Implant Boot Camp – Bad Axe, MI. Speakers (S. Messing and **J. R. Jaborek**). Aug. 23, 2024. 16 participants. In-person/hands-on experience.

1. **Fund Acquisition:**

**Jaborek, J. R**., Buskirk, D. D., Garmyn, A. J, Kim, J. 2023. Effect of corn silage inclusion rate in the finishing diet on feedlot performance, carcass characteristics, and liver abscess prevalence of Beef x Holstein and Holstein steers. $149,999. Michigan Alliance for Animal Agriculture.

**Jaborek, J. R.**, Buskirk, D. D., Schweihofer, J. P., Garmyn, A. J. 2022. Evaluation of Feedlot Performance, Carcass Traits, and Sensory Characteristics of SimAngus × Holstein Steers and Heifers, Holstein Steers, and SimAngus Beef Steers. $193,897.64. Holstein Association USA.

1. **Other Accomplishments:** Multiple Extension programs have been conducted to educate producers about beef × dairy crossbreeding with collaborative efforts made between Michigan State University and other Midwestern Universities.

**2024 NCCC-308 Project Station Report –Carvalho (CSU/DREC)**

1. **Impact Nugget:**

Cattle breed impacted feedlot growth performance and carcass characteristics in the feedlot. Regardless of if it is in a beef on dairy calf-fed system, or a traditional feedlot systems with beef breeds.

2. **New Facilities and Equipment.**

NA.

3. **Unique Project Related Findings.**

Angus x Holstein cross calf-fed steers increased ADG, DMI, FBW, and fat deposition in the carcass compared to Charolais x Holstein crosses calf-fed steers. However, Charolais crosses increased REA compared to Angus crosses. Overall, there were no breed effect on feed efficiency and liver abscess incidence, which averaged 19%.

Feeding beta-agonist with rumen protected amino acids enhanced calf-fed Holstein steers growth performance in the last 100 days of the feedlot period.

Boss taurus cattle had greater feedlot growth performance and carcass characteristics compared to boss indicus cattle. Moreover, cattle fed in a conventional system (with hormonal implant, beta-agonist, and feed additives) had greater feed growth performance compared to cattle fed in all natural systems (without growth promoting technologies), regardless of cattle breed.

4. **Accomplishment Summaries.**

Angus cross cattle enhanced feedlot growth performance compared to other cattle breeds.

Conventional fed cattle had greater growth performance compared to Natural fed cattle.

5. **Impact Statements**.

Angus cross cattle fed in a conventional feeding system had greater growth performance than other crosses and type of cattle.

6. **Published Written Works**.

Salinas-Chavira, **P. H. V. Carvalho**, B. C. Latack, M.V.D.C. Ferraz Junior, M. F. Montano, and R. A. Zinn. 2024. Influence of metabolizable protein and methionine supplementation on growth-performance of Holstein steer calves during the initial 112-d feedlot growing phase. Translational Animal Science, <https://doi.org/10.1093/tas/txae003>

Montano, M. F., **P. H. V. Carvalho**, B. C. Latack, M.V.D.C. Ferraz Junior, and R. A. Zinn. 2023. Influence of level of DDGS substitution for steam-flaked corn on characteristics of growth-performance, and dietary energetics of calf-fed Holstein steers during the initial 16-week growing phase: metabolizable protein vs metabolizable amino acids. Translational Animal Science, <https://doi.org/10.1093/tas/txad024>

**Carvalho, P. H. V.**, B. C. Latack, M. F. Montano, and R. A. Zinn. 2023. The effects of NutraGen supplement on cattle growth performance, energetic efficiency, carcass characteristics, and characteristics of digestion in calf-fed Holstein steers. Frontiers in Veterinary Science. <https://doi.org/10.3389/fvets.2023.1039323>

Jaborek, J. R., **P. H. V. Carvalho**, and T. L. Felix. 2023. Post-weaning management of modern dairy cattle genetics for beef production: a review, Journal of Animal Science, <https://doi.org/10.1093/jas/skac345>

Ferraz, M. V. C., M. H. Santos, G. B. Oliveira, D. M. Polizel, J. P. R. Barroso, G. P. Nogueira, V. N. Gouvea, **P. H. V. Carvalho**, J. S. Biava, E. M. Ferreira, and A. V. Pires. 2023. Effect of growth rates on hormonal and pubertal status in Nellore heifers early weaned. Tropical Animal Health and Production, 55(3), pp.1-13. <https://doi.org/10.1007/s11250-023-03588-2>

da Silva, T. A. S., E. M. Ferreira, T. T. de Souza, J. P. R. Barroso, J. S. Biava, A. V. Pires, **P. H. V. Carvalho**, and M. V. D. C. Ferraz Junior. 2023. Effects of injectable and intravaginal progesterone on ewes’ reproductive performance at breeding season beginning. Tropical Animal Health and Production, 55(1), pp.1-6. <https://doi.org/10.1007/s11250-023-03480-z>

**Carvalho, P. H. V.**, B. C. Latack, M. F. Montano, and R. A. Zinn. 2023. Influence of supplemental flavomycin on growth performance, carcass characteristics, and nutrient digestibility in calf-fed Holstein steers. Translational Animal Science. <https://doi.org/10.1093/tas/txad005>

7. **Scientific and Outreach Oral Presentations.**

*In person*

Future of Ag and Sustainability; Winter Round of Colorado Corn Board, Greeley, CO

Beef on Dairy – Research Update; International Livestock Forum, Denver, CO

Measuring Emissions on Pasture with Greenfeed Technology; Rangland Beef Cow Symposium, Loveland, CO.

Grazing Bullpen Sessions; Rangland Beef Cow Symposium, Loveland, CO.

Nutritional and management strategies to improve sustainability of the beef industry; AMVEG, Torreon, Mexico

BeefPoint – Brazilian group tour to CSU (2 days), Fort Collins, CO. Received 21 producers from Brazil for a 2 day event visiting CSU facilities and coordinating presentations with other AgNext/CSU faculties.

Nutritional and management strategies to improve sustainability of the beef industry; Minnesota Nutrition Conference, Mankato, MN.

Beef on Dairy, what we know?! Where should we go? Minnesota Nutrition Conference, Mankato, MN.

Beef on Dairy – Research Update; Purina – Beef on dairy meeting, Saint Louis, MO

Optimizing Beef Production from Pasture to Plate; Global Beef Summit, Denver

Using Alternative Antibiotics in the Feedlot Industry; Colorado Farm Show – Beef Day, Greeley, CO.

Beef Production from the Dairy Herd; Colorado Farm Show – Dairy Day, Greeley, CO.

*Online*

Beef Production from the Dairy Herd; University of Chihuahua, Mexico.

Nutritional and management strategies to improve sustainability of the beef industry; Virginia Tech – Extension Symposium.

Nutritional and management strategies to improve sustainability of the beef industry; University of Minnesota – Sustainable Animal Agriculture Group.

Nutritional and management strategies to improve sustainability of the beef industry; UNESP – Sao Paulo, Brazil.

Beef Production from the Dairy Herd; UNESP – Dracena, Brazil.

Beef Production from the Dairy Herd; Montana State University – Ruminant production class.

Nutritional and management strategies to improve sustainability of the beef industry – Brazilian producers.

***AgNext Podcast***

Since May of 2023 we have been producing the AgNext podcast where in each episode we dive into the latest innovations and best practices that are shaping the future of the animal agriculture industry. We interview experts and producers about animal agriculture research, career paths, and advancements. Six episodes have been produced since May of 2023 and have reached over 1000 plays across different platforms of audio and video.

Rieskamp, J.; **Carvalho, P.H.V.,** Giesenhagen, E.M.S. (2023). AgNext Podcast Trailer. <https://www.youtube.com/watch?v=rOQSDGKKJeQ&list=PL1w1YaDogeti5vnA-5QbCca5O0ViVxSDy&index=6>

Rieskamp, J.; **Carvalho, P.H.V.,** Giesenhagen, E.M.S.; Stackhouse-Lawson, K. (2023). Ep. 1 – Conversation with Dr. Kim Stackhouse-Lawson. <https://open.spotify.com/episode/0qnyE4vLKD7QgtIY4iWRHY>

Rieskamp, J.; **Carvalho, P.H.V**.; Giesenhagen, E.M.S.; Place, S. (2023). Ep. 2 – Welcoming Dr. Sara Place. <https://open.spotify.com/episode/769Xuylatw4Jwt7Nu9CWLf>

Rieskamp, J.; **Carvalho, P.H.V**.; Giesenhagen, E.M.S.; Manriques, D. (2023). Ep. 3 – Discussion with Dr. Diego Manriquez. <https://open.spotify.com/episode/2sKHTlGfERhsjSXx0UazUC>

Rieskamp, J.; **Carvalho, P.H.V**.; Giesenhagen, E.M.S.; Ritten, J. (2023). Ep. 4 – Talking Sustainability, Economics, and Extension with Dr. John Ritten. <https://open.spotify.com/episode/7bgRg99tfcJ1jF3Lr1i8PY>

Rieskamp, J.; **Carvalho, P.H.V**.; Giesenhagen, E.M.S.; DeLay. (2023). Ep. 5 – Dr. Nathan DeLay on Teaching, Grants, and Tradeoffs. <https://open.spotify.com/episode/1bHaMNr4vlyaAzFSa9RM8i>

8. **Fund leveraging**,

Grant

2023, Effects of an extended-release capsule containing monensin on enteric methane production in grazing cattle for 140 days. Kim Stackhouse-Lawson, Pedro Carvalho, Sara Place and Edward J Raynor. Contract. $312,999.00.

2023, Interaction of supplemental lysine and methionine and supplemental ractopamine on feedlot growth performance and carcass characteristics of calf-fed dairy steers. Pedro Carvalho Richard Zinn Brooke Latack. Adisseo (Gift). $18,000.00.

2023 – 2025, Assessing the impact of production technologies on sustainability of beef and dairy industries. Zoetis. $276.042,00.

2022 – 2026, Effects of extended colostrum feeding to calf-fed Holstein steers on health, performance, fecal resistome, and carcass characteristics. Pedro Carvalho, Xiang Yang, Munashe Chigerwe. California Department of Food and Agriculture. $575,758.00.

9. **Other relevant accomplishments and activities**.

NA

**June 2023 – May 2024 University of Florida NCCC308 Station Report**

**Nicolas DiLorenzo**

Impact Nugget

At the annual meeting of the NCCC 308 a discussion took place about he potential to collaborate among members of this committee in a way that calves from states such as Florida and Georgia are backgrounded and shipped to the Midwest or Southern plains to be finished. These types of collaborations would leverage funding from different universities and commodity groups, and more importantly, it would generate research that mimics the reality of our production system.

New Facilities and Equipment

A new gas chromatographer (Thermo Greenhouse Gas Analyzer) equipped with ECD+TCD-FID detectors and auto sampler was purchased to enhance greenhouse gas measurements capabilities at UF.

Unique Project Related Findings.

Feeding 5 g/d of cashew nutshell extract to finishing beef cattle reduced enteric methane emissions by 25% while shifting the volatile fatty acid concentrations in the rumen. This feed additive could present an interesting alternative to reduce the carbon footprint of beef production in the finishing phase.

Accomplishment Summaries

A $5 million grant was recently awarded to the University of Florida (PI: Nicolas DiLorenzo) to develop the next generation of feed additives to reduce enteric methane emissions. This project will last 5 years and will tackle emissions across all segments of beef production. Collaborating institutions in this project are Auburn University and Clemson University.

Impact Statements

A mixture of biuret, urea and nitrates show potential as a novel non-protein nitrogen (NPN) to potentially reduce methane while providing nitrogen and maintaining performance relative to the same amount of NPN in the form of urea

Providing artificial shade to grazing growing heifers improved average daily gain by 0.2 kg/d when compared to control heifers grazing without shade in the Florida summer.

The potential of cashew nutshell extract as a feed additive for finishing cattle (see accomplishment summary above) represents a timely discovery with great potential of use in operations where antibiotic feed additives are not an option.

Published Written Works

*Scientific works relevant to the committee*

1. Vargas J., F. Tarnonsky, F. Podversich, A. Maderal, I. Fernandez-Marenchino, W. Cuervo, T. M. Schulmeister, I. Ruiz-Ascacibar, I. R. Ipharraguerre, and **N. DiLorenzo**. 2024. Non-protein nitrogen supplementation on in vitro fermentation profile, methane production, and microbial nitrogen synthesis in a corn silage-based substrate. Trans. Anim. Sci. 8:1-8. doi: 10.1093/tas/txae065
2. Vargas J., F. Tarnonsky, F. Podversich, A. Maderal, I. Fernandez-Marenchino, C. Gomez-López, D. Heredia, T. M. Schulmeister, I. Ruiz-Ascacibar, A. Gonella-Diaza, I. R. Ipharraguerre, and **N. DiLorenzo**. 2024. Impact of supplementing a backgrounding diet with non-protein nitrogen on in vitro methane production, nutrient digestibility, and steer performance. J. Anim. Sci. 102:1-10. doi: 10.1093/jas/skae048

1. Vining, T. P., P. A. Lancaster, **N. DiLorenzo**, G. C. Lamb, and J. M. B. Vendramini. 2024. Similar feed intake levels yield no differences in energy utilisation between beef heifers identified as low (efficient) and high (inefficient) residual feed intake. Anim. Prod. Sci. 64:1-12. doi:10.1071/AN23269
2. Vargas, J., F. Tarnonsky, A. Maderal, I. Fernandez-Marenchino, F. Podversich, T. M. Schulmeister, and **N. DiLorenzo**. 2024. Increasing levels of *Chlorella* spp. on in vitro fermentation and methane production in a corn silage-based diet. Rev. Colomb. Cienc. Pecu. 37(1):42-51. <https://doi.org/10.17533/udea.rccp.v37n1a2>
3. Silva, G. M., J. Laporta, F. Podversich, T. M. Schulmeister, E. R. S. Santos, J. C. B. Dubeux, A. Gonella-Diaza, and **N. DiLorenzo**. 2023. Artificial shade as a heat abatement strategy to grazing beef cow-calf pairs in a subtropical climate. PLoS One E 18(7):e0288738. <https://doi.org/10.1371/journal.pone.0288738>
4. Jaramillo, D. M., M. Ruiz-Moreno, J. M. B. Vendramini, L. E. Sollenberger, **N. DiLorenzo,** L. M. D. Queiroz, E. R. S. Santos, L. Garcia, D. S. Abreu, and J. C. B. Dubeux Jr. 2023. Methane emissions and 13C composition from beef steers consuming binary C3-C4 diets. J. Anim. Sci. 101:1-7. <https://doi.org/10.1093/jas/skad181>

1. Amorín, R., L. Liu, P. Moriel, **N. DiLorenzo**, P. A. Lancaster, and F. Peñagaricano. 2023. Maternal diet induces persistent DNA methylation changes in the muscle of beef calves. Sci. Reports 13:1587. <https://doi.org/10.1038/s41598-023-28896-3>

*Extension works relevant to the committee*

1. In-service training for County Agents in Florida: Beef Cattle Nutrition and Management Research update. April 17, 2024, Marianna, FL
2. Florida Bull Test 2023-24: Coordinating the Florida Bull Test and providing timely information to producers about bull performance.

Scientific and Outreach Oral Presentations

*Scientific meetings*

1. Environmental impact of improving forage use efficiency in beef cattle. ASAS Annual meeting. Albuquerque, NM, July 17, 2023

*Invited presentations*

1. Reducing the carbon footprint of beef production: current alternatives to mitigate enteric methane emissions. Florida Ruminant Nutrition Symposium. Gainesville, FL. February 28, 2024

*Outreach (Extension talks presented by Nicolas DiLorenzo)*

1. Overview of the Florida Bull Test. Gadsden County, February 8, 2024. (Invited)
2. Impact of Brahman genetics on feed efficiency and methane emissions. 2024. Florida Beef Cattle Short Course. May of 2024. (Invited)

Fund Leveraging

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Role** | **Reporting**  **Agency** | **Grant Title** | **Dates** | **Awarded/**  **Anticipated** | **Candidate Allocation ($Amount)** |
|  |  |  |  |  |  |
| Co-PD | USDA-AFRI | Parasite control as a means to reduce methane emissions in cow-calf production | 2023-2025 | $300,000 | $176,923 |
| PI/PD | FFAR Fellowship | Optimizing beef cattle systems in North Florida | 2022-2025 | $165,000 | $165,000 |
| PI/PD | US Dept. of Commerce Sea Grant Program | Exploring the potential of marine algae in mitigating enteric methane emissions from Florida livestock systems | 2024-2028 | $199,493 | $141,033 |
| PI/PD | Yara International ASA | Safety and efficacy of increasing inclusion levels of a biuret-urea mixture on beef cattle | 2023-2024 | $434,110 | $434,110 |
| PI/PD | FDACS – FCA | Addressing labor shortage: Use of intake limiters to design free-choice supplementation programs | 2023-2024 | $50,687 | $50,687 |

Other Relevant Accomplishments

None to report.

**Kansas State University NCCC-308 Experiment Station Report**

1. **Impact Nugget:**

Precision feeding in both the beef growing and finishing sectors is presently being evaluated as a management tool for improving growing efficiency and reducing the environmental footprint.

**2. New Facilities and Equipment**

Plans are underway to construct a new feedlot (120 – 10 head pens) and feedmill. The new facility is expected to open January, 2026.

**3. Unique Project Related Findings.**

Restricting feed intake while maintaining energy intake does not negatively influence growth performance for newly received growing beef calves.

Finishing phase results suggest precision feeding may positively impact methane emissions but could negatively impact performance.

**4. Accomplishment Summaries.**

* **Enhance the utilization of C from energy feeds to compete in an energy economy and improve national food security.**

Enteric CH4 and carbon dioxide (**CO2**) production was determined utilizing 2 GreenFeed Emission Measurement Systems. Only visits greater than 3 minutes in duration were used for analysis. Preliminary results are reported here, but do not reflect the last approximately 30 d of the finishing period. Average Daily Gain (ADG) and gain to feed (G:F) did not differ among treatments (*P* =0.17, *P* = 0.8), but ADG had a tendency to decrease (linear; *P* = 0.09). DMI was greatest for CON and least for TRT2 (*P* ≤ 0.01). CH4 (g/d) output differed between treatments (*P* ≤ 0.007). There was a tendency for a quadratic relationship for MY (g CH4 /kg DM) among treatments (*P* = 0.10). Emission intensity (g CH4 /kg BW gain) was not different across treatments (*P* = 0.40). These results suggest precision feeding may positively impact methane emissions but could negatively impact performance.

* **To enhance feedlot cattle's production efficiency and quality through management strategies and technologies.**

Angus-cross steers (n= 48, BW = 447 ± 4.4kg) were blocked by body weight (**BW**) and assigned to one of three treatment groups. Treatments consisted of a control (CON) where steers were fed ad-libitum, Treatment 1 (**TRT1**) 96 percent of ad-libitum and Treatment 2 (**TRT2**) 92 percent of ad-libitum. TRT1 and TRT2 were adjusted once weekly based on the CON steers average intakes from the previous week. BW was measured on d 0, 1, 28, 56, and 84 and dry matter intake (DMI) (kg/d) was measured using an Insentec Roughage Intake Control System (Insentec, Markenesse, The Netherlands). Enteric CH4 and carbon dioxide (**CO2**) production was determined utilizing 2 GreenFeed Emission Measurement Systems. Only visits greater than 3 minutes in duration were used for analysis. Preliminary results are reported here, but do not reflect the last approximately 30 d of the finishing period. Average Daily Gain (ADG) and gain to feed (G:F) did not differ among treatments (*P* =0.17, *P* = 0.8), but ADG tended to decrease (linear; *P* = 0.09). DMI was greatest for CON and least for TRT2 (*P* ≤ 0.01).

* **To enhance management strategies that improve animal health and well-being.**

Limit feeding a high-energy diet based on corn and corn co-products can improve feed efficiency, reduce manure output, and improve health detection in growing cattle (Spore et al., 2019). One concern associated with limit-fed diets is the potential need to increase bunk allotments to allow all cattle to eat at one time. Recent work suggests that bunk allotments as low as 6 inches per head do not reduce the growth performance of limit-fed growing cattle during a 56-day receiving period.

**6. Published Written Works.**

Refereed Journal Articles

**Scilacci, M.A., E.C. Titgemeyer, Z.M. Duncan, T.J. Spore, S.P. Montgomery, T.G. O’Quinn, A.J. Tarpoff, W.R. Hollenbeck and D.A. Blasi. 2024. Effect of traditional roughage-based or limit-fed, high-energy diets on growth performance and digestion in newly received growing cattle and subsequent implications on feedlot growth performance and carcass characteristics. Translational Animal Science, txae082,** <https://doi.org/10.1093/tas/txae082>

End of 2024 Combined NCCC308 Report