2023 NCCC308
Collated Reports

Host: University of Florida

Location: Panama City Beach, FL and Marianna, FL

Dates: May 16 to 18

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

Hosted by University of Florida

Guests:
NCCC-308 members
UF ruminant nutrition grad students and faculty/extension educators involved with beef cattle nutrition

Contact Info:
Nicolas DiLorenzo cell: 850-557-8319

Air Travel Accommodations:
Preferred: Northwest Florida Beaches International Airport (ECP), Panama City, FL
Alternative: Destin-Forth Walton Beach Airport (VPS), Valparaiso, FL

The ECP airport is 14 miles from the hotel, and the VPS airport is 59 miles from the hotel.

Check hotel shuttle availability (814-862-9808) or arrange pickup with Nico (cell: 850-557-8319). Car rentals are available at both ECP and VPS airports.

Hotel Accommodations:
Hyatt Place Panama City Beach/Beachfront
15727 Front Beach Road, Panama City Beach, FL 32413
(850) 234-6100
$189/night (special rate for this event until April 15, 2023)

Reservations: Use this link https://www.hyatt.com/en-US/group-booking/ECPZP/G-BEEF to access the group rate. Self-parking is available in the hotel garage. **Note:** The group rate of $189 is active starting on May 15th until the 18th.

NCCC 308 Registration fee: $50

AGENDA (all times CT)

Tuesday May 16th

2:00 pm	Welcome to Florida: John Arthington, Department Chair
2:15 pm	Discussion of 2024 location for NCCC308
2:30 pm	Report of Journal of Animal Science Special Issue – Kendall Swanson

2:45 pm	JAS report from Editor in Chief Dr. Elisabeth Lonergan – discussion on criteria to move journal articles from JAS to TAS
3:00 pm	Experiment Station Reports
6:00 pm	Dinner at the hotel

Wednesday May 17th

7:30 am	Transport to University of Florida/IFAS, Jackson County Extension Office: 2741 Penn Ave, Marianna, FL 32448
9:00 am	(coffee and snack provided) Welcome to NFREC, Dean Pringle, NFREC Director Committee administration meeting and plans for 2023
9:15 am	Experiment Station Reports
12:30 pm	Lunch (Catered)
1:30-5:00	Transport to University of Florida, North Florida Research and Education Center (UF-NFREC) for Facility Tours. Address: 3925 Hwy 71, Marianna, FL 32446.
6:00 pm	Dinner at Mr. Bruce and Ms. Nola (Dr. Che Trejo's family), sponsored by Merck Animal Health. Location: 4297 Old US Rd., Marianna, FL
8:00 pm	Bus departs to Hotel in Panama City, FL

Thursday May 18th

7:00 am	Breakfast
8:00 am	Start meetings (coffee and snacks provided)
8:05 am	Administrative update- Steve Loerch
	- Committee expires 9/30/2023; Renewal already approved.
8:15 am	NIFA Rep Report—Angelica Van Goor, NIFA National Program Leader for NCCC308, and Bob Godfrey Director, Division of Animal Systems (Zoom)

9:00 am	Experiment Station Reports (and/or further discussions)
12:00 pm	Lunch (on your own)
12:30 pm	Adjourn

Attendance Confirmed

Steve Loerch, Pennsylvania State University *
Tara Felix, Pennsylvania State University *
Nicolas DiLorenzo, University of Florida *
Alfredo DiCostanzo, University of Nebraska *
Zachary Smith, South Dakota State University *
Warren Rusche, South Dakota State University *
Pedro Carvalho, Colorado State University *
John Wagner, Colorado State University *
Jon Schoonmaker, Purdue University *
Kendall Samuelson, West Texas A&M University
Dan Schaefer, University of Wisconsin *
Josh McCann, University of Illinois *
Alejandro Pittaluga, Ohio State University
Pablo Loza**,** University of Nebraska *
Jessica Sperber, University of Nebraska *
Jerad Jaborek, Michigan State University *
Kendall Swanson, North Dakota State University *

* Attending the presymposium on Tuesday AM

Not Attending

Galen Erickson, University of Nebraska
Stephanie Hansen, Iowa State University
Jim Oltjen, University of California Davis
Alejandro Relling, Ohio State University
Dan Loy, Iowa State University
Derek Brake, University of Missouri
Vinicius Gouvea, Texas A&M University
Andrew Foote, Oklahoma State University

UF graduate student attendees

Tessa Schulmeister
Juan Vargas

Wilmer Cuervo
Federico Podversich
Federico Tarnonsky
Araceli Maderal
Ignacio Fernandez Marenchino
Andres Fernandez Lehmann
Georgia Dubeux
Camila Gomez

Meeting Minutes

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

Hosted by University of Florida

Tuesday May 16th

2:00 pm Welcome to Florida: John Arthington, Department Chair

Secretary: Jessica Sperber

Goal: Generate discussion and collaboration

$50 fee per member

Report turned in 60 d after the date of this meeting

Transferring the Iowa State email list

- Stations with 2 members currently at risk of not receiving the email (Loerch will email Dan Loy to figure out best email option moving forward)

Submitting Appendix E - new members need to get submitted to be an official member

2:15 pm Discussion of 2024 location for NCCC308

UNL - 2024

Fort Collins - 2025

Illinois - 2026

Texas - 2027

SDSU - 2028

2:30 pm Report of Journal of Animal Science Special Issue – Kendall Swanson

25 papers and was well commended

2:45 pm JAS report from Editor in Chief Dr. Elisabeth Lonergan – discussion on criteria to move journal articles from JAS to TAS

Dr. Lonergan commended the committee on special collection

JAS: Focus on fundamental/basic papers, can be applied, but focus needs to be "new & novel", the question has to have a significant aspect to it, aspect driven

- Papers need to be "unique"
- Global appeal (geographically or biologically)

TAS: Focus on applied work, ready to be translated to industry, extension, etc

- Includes papers focused on validation of established concepts, regional work, limited to breed or type, research that is easily extrapolated to broader region
- Work that is ready to be used by practitioners

Encouraged in cover letter to make a statement on which journal you believe your article should get published in. Be more clear that your idea is a “novel” idea if you believe that it is.

Need more reviewers.

Are we creating an elite journal vs. a non-elite journal?

Anticipated that TAS will have an impact factor next year

Comments

Tara Felix: If the author disagrees with section editor- is there opportunity for discussion?
Response: Happy to discuss, possible resubmission - encourage author to push more on the new & novel aspect

Zach Smith: Used to be an applied section in JAS - how is it determined that papers are pushed from JAS to TAS? Is it possible to have one specific section editor for each specialization?

Response: Open to doing a pre-submission or post-submission discussion

Kendall Samuelson: Where did the process come from? What is the intent to divide JAS & TAS?

Response: TAS has had growing pains while getting started - not the intent to divide

3:00 pm Experiment Station Reports

Station reports have been submitted by committee members & will be attached in the final report

6:00 pm Dinner at the hotel

Wednesday May 17th

7:30 am Depart for University of Florida, North Florida Research and Education Center (UF-NFREC) for Facility Tours. Address: 3925 Hwy 71, Marianna, FL 32446.

9:00am Tour of UF-NFREC

12:00pm Transport to University of Florida/IFAS, Jackson County Extension Office: 2741 Penn Ave, Marianna, FL 32448

1:00pm Lunch

1:30-4:30pm Experiment Station Reports

6:00 pm Dinner at Mr. Bruce and Ms. Nola (Dr. Che Trejo's family), sponsored by Merck Animal Health. Location: 4297 Old US Rd., Marianna, FL

8:00 pm Bus departs to Hotel in Panama City, FL

Thursday May 18th

7:00 am Breakfast

8:00 am Start meetings (coffee and snacks provided)

8:15 am NIFA Rep Report—Angelica Van Goor, NIFA National Program Leader for NCCC308, and Bob Godfrey Director, Division of Animal Systems (Zoom)

- Focus on climate change, resiliency, competitive marketplace, provide safe food, economic development, build agricultural workforce
- Consideration for AFRI: FY2023= $455 M
- Aug 10 due date
- Partnership opportunities
- Have emphasis on new investigator seed grants
- 6 farm bill priority areas & cross cutting
- Feb 17, 2023: call for mitigating methane emissions in ruminants
- Secretary Villsak stated they have interest in doubling the awards for mitigating methane emissions, 2 awards of $5M (will use letters of intent that were submitted)
    - Main priorities: Climate, bioeconomy, nutrition security

Inter-disciplinary engagement in animal systems

- 2019 new program with focus on precision management
- Angelica is open to meeting one-on-one and discussing review packages

IDEAS integrated program

- Research
- Extension: Informal education
- Education: formal classroom/lab instruction, teaching methodologies

    - Does not consider grad student routine use
- *no more than 2/3 of a project budget can be allocated to any single activity)

Pedro suggested we consider volunteering on USDA panel

8:45 am Administrative update- Steve Loerch

- Committee expires 9/30/2023; Renewal already approved.
    - Critical to get all information turned in within the 60 d time frame after the meeting
    - Concern for facilities & infrastructure
        - Suggests to lobby through farm bill, state departments of Ag, commodity groups

Proposed dates for next year:
May 21-23, 2024 (not earlier than May 20)

9:00am Experiment station reports (and/or further discussion)

Overall meeting thoughts/comments:

- Committee should go to BIF to suggest that a marbling score standard is created – important for publications to all have footnote
- Include corn silage nutrient analysis in publications (specifically starch)
- Submit an annual white paper to TAS each year that highlights a topic (state of the science) – Review paper

Order of station reports:
Tara Felix, Pennsylvania State University *
Kendall Samuelson, West Texas A&M University
Zachary Smith, South Dakota State University *
Jerad Jaborek, Michigan State University *
Jon Schoonmaker, Purdue University *
Jessica Sperber & Pablo Loza, University of Nebraska *
Josh McCann, University of Illinois *
Pedro Carvalho, Colorado State University *
Alejandro Pittaluga, Ohio State University
Kendall Swanson, North Dakota State University *
Nicolas DiLorenzo, University of Florida *

June 2022 – May 2023 University of Florida NCCC308 Station Report

Nicolas DiLorenzo

Impact Nugget

The University of Florida worked in collaboration with Dr. Alfredo DiCostanzo at the University of Minnesota to conduct a study aimed at assessing the value of alfalfa haylage in backgrounding diets when replacing corn silage. A student from UFL went to UMN during the summer of 2022 to help during the study. This study led to a publication (Tarnonsky et al., 2023; https://doi.org/10.1093/jas/skac397) in the special issue of the Journal of Animal Science highlighting the work done within the NCCC-308 multistate committee (Swanson et al., 2023; https://doi.org/10.1093/jas/skad003).

Results from the Tarnonsky et al. (2023) study demonstrated that greater substitution of corn silage with alfalfa haylage in growing diets resulted in greater intake but reduced rate of gain and gain:feed. Despite slower rate of gain, cattle fed alfalfa haylage at increasing proportions during the growing period were able to compensate in BW gains during the finishing period and reached harvest weight and backfat thickness at similar days on feed than those fed corn silage. Based on those results the energy value of corn silage and alfalfa haylage were 3.05 and 2.39 Mcal ME/kg of DM, respectively, when included at 50% of the diet DM. Discovering the energetic density of alfalfa haylage when included in corn-silage based diets was one of the main objectives of the study and will help in the formulation of growing beef cattle diets in the future.

New Facilities and Equipment

A GreenFeed unit (C-Lock Inc., Rapid City, SD) was purchased and installed in October 2022 to measure enteric methane and CO_2 emissions.

Unique Project Related Findings.

Another publication from the NCCC-308 special issue of the Journal of Animal Science, showed that when an *Aspergillus oryzae* (AO) prebiotic was included in growing diets based on byproducts, a 15% improvement in feed efficiency was observed (Podversich et al., 2023; https://doi.org/10.1093/jas/skac312). This may help in the development of feeding strategies to improve the sustainability of beef cattle systems.

Accomplishment Summaries

The University of Florida continues to do research on backgrounding systems and their impact on overall performance and sustainability of the beef industry. A study by Tarnonsky et al. (2023; https://doi.org/10.1093/jas/skac402) showed that *Brassica cari*nata meal, a novel high-protein byproduct from renewable jet fuel production, was as good as cottonseed meal when fed to growing cattle. In the same study, it was concluded that the rates of weight gain from growing cattle fed sorghum silage as were almost 1 lb/d less than those in corn silage-based diets using

the same protein source. Sorghum silage fed ad libitum and supplemented with a protein source, may be a good alternative for growing replacement heifers and avoid excessive fat deposition.

Finishing cattle on common diet after receiving wither corn silage or alfalfa haylage as the main forage source during backgrounding, did not impact carcass characteristics, with 52.9% of the steers grading USDA Choice or better, and 6.2% grading USDA Prime at harvest. This study was done in collaboration with the University of Minnesota (Tarnonsky et al., 2023; https://doi.org/10.1093/jas/skac397).

Impact Statements

Carinata meal, a novel high-protein byproduct from renewable jet fuel production, was proved to be as good as cottonseed meal when used in backgrounding diets.

Alfalfa haylage can replace corn silage in growing diets without impacting carcass characteristics in finishing feedlot cattle.

Novel prebiotics based on *Aspergillus oryzae* can lead to improvements of feed efficiency of 15% when fed to growing beef cattle.

Published Written Works

Scientific works relevant to the committee

1. Vargas, J., F. Tarnonsky, A. Maderal, I. Fernandez-Marenchino, F. Podversich, W. Cuervo, C. Gomez-Lopez, T. Schulmeister, and N. DiLorenzo. 2023. Effects of processing methods and inclusion levels of dried garlic on in vitro fermentation and methane production in a corn silage-based substrate. Animals 13, 1003. https://doi.org/10.3390/ani13061003

2. Tarnonsky, F., K. Hochmuth, A. DiCostanzo, and N. DiLorenzo. 2023. Effects of replacing corn silage with alfalfa haylage in growing beef cattle diets on performance during the growing and finishing period. J. Anim. Sci. 101:1-9. https://doi.org/10.1093/jas/skac397

3. Tarnonsky, F., J. Vargas Martinez, A. Maderal, D. Heredia, I. Fernandez-Marenchino, W. Cuervo, F. Podversich, T. M. Schulmeister, R. C. Chebel, A. Gonella-Diaza, and N. DiLorenzo. 2023. Evaluation of carinata meal or cottonseed meal as protein sources in silage-based diets on behavior, nutrient digestibility, and performance in backgrounding beef heifers. J. Anim. Sci. 101:1-10. https://doi.org/10.1093/jas/skac402

4. Podversich, F., F. Tarnonsky, J. M. Bollatti, G. M. Silva, T. M. Schulmeister, J. Vargas Martinez, D. Heredia, I. R. Ipharraguerre, F. Bargo, A. Gonella-Diaza, J. C. B. Dubeux Jr, L. F. Ferraretto, and N. DiLorenzo. 2023. Effects of Aspergillus oryzae prebiotic on animal performance, nutrients digestibility, and feeding behavior of backgrounding beef heifers fed with either a sorghum silage- or a byproducts-based diet. J. Anim. Sci. 101:1-9. https://doi.org/10.1093/jas/skac312

5. Abreu D. S., J. C. B. Dubeux Jr., L. M. Dantas Queiroz, D. M. Jaramillo, Santos, E. R. S., F. Van Cleef, C. C. Vela Garcia, N. DiLorenzo, and M. Ruiz-Moreno. 2022. Supplementation of molasses-based liquid feed for cattle fed on limpograss hay. Animals 12:2227. https://doi.org/10.3390/ani12172227

6. Jaramillo, M. D., J. C. B. Dubeux Jr., M. Ruiz-Moreno, N. DiLorenzo, J. M. B. Vendramini, L. E. Sollenberger, C. Mackowiak, L. M. Dantas Queiroz, Abreu, D. S., L. Garcia, E. R. S. Santos, and B. A. Kieke Jr. 2022. Stable isotopes of C and N differ in their ability to reconstruct diets of cattle fed C3–C4 forage diets. Sci. Reports. 12:17138. https://doi.org/10.1038/s41598-022-21051-4

7. van Cleef, F. O. S., J. C. B. Dubeux Jr., C. Wheeler, C. V. Garcia, M. Ruiz-Moreno, L. E. Sollenberger, J. M. B. Vendramini, N. DiLorenzo, and H. D. Naumann. 2022. Stable isotopes provide evidence that condensed tannins from sericea lespedeza are degraded by ruminal microbes. Scientific Reports 12:14318. 12:14318. https://doi.org/10.1038/s41598-022-18566-1

8. van Cleef, F. O. S., J. C. B. Dubeux Jr., F. M. Ciriaco, D. D. Henry, M. Ruiz-Moreno, D. M. Jaramillo, L. Garcia, E. R. S. Santos, N. DiLorenzo, J. M. B. Vendramini, H. D. Naumann, and L. E. Sollenberger. 2022. Inclusion of a tannin-rich legume in the diet of beef steers reduces greenhouse gas emissions from their excreta. Scientific Reports 12:14220. https://doi.org/10.1038/s41598-022-18523-y

9. Silva, G. M., F. Podversich, T. M. Schulmeister, E. R. S. Santos, C. D. Sanford, M. C. B. Siqueira, and N. DiLorenzo. 2022. Polyclonal antibody preparations from avian origin as a feed additive to beef cattle: Ruminal fermentation during the step-up transition diets. Trans. Anim. Sci. 6:1-11. https://doi.org/10.1093/tas/txac070

10. Cangiano L. R., D. D. Henry, F. M. Ciriaco, J. C. Quintela, N. DiLorenzo, and I. R. Ipharraguerre. 2022. Triterpenes from *Olea europaea* modulate in vitro ruminal fermentation. Trans. Anim. Sci. 6:1-9. https://doi.org/10.1093/tas/txac056

11. Vargas, J., E. Ungerfeld, C. Muñoz, and N. DiLorenzo. 2022. Feeding strategies to mitigate enteric methane emission from ruminants in grassland systems. Animals 12:1132. https://doi.org/10.3390/ani12091132.

12. Abreu D. S., J. C. B. Dubeux Jr., Santos, E. R. S., L. M. Dantas Queiroz, D. M. Jaramillo, F. Van Cleef, C. C. Vela Garcia, V. Longhini, N. DiLorenzo, R. T. Souza, B. G. C. Homem, M. Ruiz-Moreno. 2022. Canopy characterization and nutritive value of stockpiled 'Floralta' limpograss. Agronomy Journal 114:2407-2414. https://doi.org/10.1002/agj2.21081

13. Silva, G. M., T. M. Schulmeister, F. Podversich, F. Tarnonsky, M. E. Garcia-Ascolani, and N. DiLorenzo. 2022. Impacts of polyclonal antibody preparations from avian origin on nutrient digestibility and performance of backgrounding beef cattle. Trans. Anim. Sci. 6:1-8. https://doi.org/10.1093/tas/txac016

14. Ciriaco, F. M., D. D. Henry, T. M. Schulmeister, C. D. Sanford, L. B. Canal, P. L. P. Fontes, N. Oosthuizen, J. C. B. Dubeux Jr., G. C. Lamb, and N. DiLorenzo. 2022. Intake, ruminal fermentation parameters, and apparent total-tract digestibility by beef steers consuming Pensacola bahiagrass hay treated with calcium oxide. J. Anim. Sci. 100:1-10. https://doi.org/10.1093/jas/skab366

Extension works relevant to the committee

1. Extension talk: "Cost-effective options for backgrounding cattle in Florida". Presented at the University of Florida 2022 Beef Cattle Short Course

Scientific and Outreach Oral Presentations

Scientific meetings

1. "Livestock emissions and the COP26 targets". Symposium organized by Animal Task Force and the EAAP. September 5, Porto, Portugal

Invited presentations

2. Greenhouse Gas and Animal Agriculture. Orlando June 5-9, 2022. Opening remarks and final conclusions of the conference.

Outreach (Extension talks presented by Nicolas DiLorenzo)

1. Nutritional Management and Considerations for freezer beef. Freezer Beef Bootcamp. Holmes County, June 28, 2022. (Invited)

2. Cost-effective options for backgrounding cattle in Florida. 2022. Florida Beef Cattle Short Course. May of 2022. (Invited)

Fund Leveraging

Role (% responsibility)	**Reporting Agency**	**Grant Title**	**Dates**	**Awarded/ Anticipated**	**Candidate Allocation ($Amount)**
Co PD/PI (30%)	USDA-AFRI	Programming of postnatal growth by preimplantation actions of choline	May/20-Apr/23	$499,917	$270,283

Co PD/PI (30%)	USDA-AFRI	Unraveling the genetic mechanism underlying the thermotolerance-production complex	Jan/20-Dec/24	$499,889	$154,000
Co PD/PI (10%)	US DEPT OF AG NATL INST OF FOOD AND AG (2017-68005-26807)	Southeast Partnership for Advanced Renewables from Carinata (SPARC) (AWD02355)	Jul/17 - Jul/23	$14,810,000	$356,542

Other Relevant Accomplishments

None to report.

Multistate Project: NCC - 308

Period the Report Covers: May 2022 to May 2023

Station: South Dakota

Project Director and Contributor(s)

PD: Zachary Smith, PhD, South Dakota State University, Brookings,

Contributor: Warren Rusche, 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 17,198 pen days of 19,710 possible pen days (87.3% of annual capacity). At the SERF pen days were 8,424 pen days of 8,760 possible pen days (96.2% of annual capacity). This has resulted in the need to quickly attend to facility repairs in a timely manner. At the RNC, a new mini-articulated loader was secured to assist in feed ingredient handling and a welder-generator was also purchased to be used for pen repairs. At the SERF, a pair of new-to-us liquid tanks that were formerly used by the Rosemount Research and Outreach Center (12 ton capacity) were donated

to the farm (in-kind gift from Westway Feed Products) to replace older liquid tanks that were showing their age.

Unique Project Related Findings:

We evaluated the use of *Megesphaera elsdenii* (LP) in calves abruptly transitioned from a receiving diet with 4% dietary starch (DM basis) to backgrounding diet with 37% dietary starch. Results from this experiment indicate that use of LP in cattle transitioned from a receiving diet to a growing diet does not appreciable influence intake, gain, or efficiency, but LP alters activity (increased) and rumination (decreased) time. In another experiment, we evaluated dietary roughage manipulation during the feeding of ractopamine HCl as a method to improve ruminal health and control livers abscess severity in feedlot steers. Data gleaned from this experiment indicate that steers fed additional roughage spent more minutes per day ruminating, but growth performance was not appreciably influenced, most carcass traits were not influenced except steers from greater roughage had large ribeye area. Finally, we recently completed an experiment where we evaluated rye processing methods (un-processed, dry-rolled, or hammer-milled) in diets fed to finishing steers when rye replaced one-third of the dry-rolled corn in the diet. The data indicated that rye that is dry-rolled decreases intake compared to control, subsequently reducing daily gain and resulting in a similar feed efficiency to the control diet. Un-processed rye had the greatest intake compared to others resulting in the poorest efficiency.

Impact Statements:

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

Published Written Works:

1) Kang D, Chung K, Park B, Ui Hyung Kim, Sun Sik Jang, Zachary K Smith, Jongkyoo Kim. (2022) Effects of feeding high-energy diet on growth performance, blood parameters, and carcass traits in Hanwoo steers Anim Biosci 2022;35(10):1545-1555.DOI: https://doi.org/10.5713/ab.22.0014
2) Thomas G. Hamilton, Warren, C. Rusche, and Zachary K. Smith. 2023. Evaluation of similar dietary roughage equivalency fed to beef steers during the growing and finishing phase. Journal of Animal Sciences. January 2023.
3) Forest L Francis, Mallorie F Wilken, Zachary K Smith, Replacement of dietary corn with corn bran plus condensed distillers solubles effects on feedlot growth performance and carcass trait responses of beef steers, *Translational Animal Science*, 2022;, txac128, https://doi.org/10.1093/tas/txac128
4) Forest L Francis, Erin R. Gubbels, Thomas G. Hamilton, Julie A. Walker, Warren C. Rusche, Zachary K Smith, Evaluation of the effects of corn silage maturity and kernel processing on steer growth performance and carcass traits, *Journal of Animal Science*, 2023
5) Gubbels, E.R., W. C. Rusche, and Z. K. Smith. 2023. Manger space restriction does not negatively impact growth efficiency of feedlot heifers program fed a concentrate-based diet to gain 1.36 kg daily. Translational Animal Science.
6) Gubbels, E.R., W. C. Rusche, E. Block, T. Rehberger, J. S> Thompson, and Z. K. Smith. 2023. Evaluation of long-term supplementation of a direct-fed microbial and enzymatically hydrolyzed yeast cell culture product on feedlot growth performance, efficiency of dietary net energy utilization, heat stress measures, and carcass characteristics in beef steers. Translational Animal Science. https://doi.org.10.1093/tas/txad016.

Scientific and Outreach Oral Presentations:

1) Kristin E Hales, Michael Galyean, Zachary K Smith, 90 Evaluating the Difference between Formulated Dietary net Energy Values and net Energy Values Determined from Growth Performance and Estimates of Shrunk Body Weight Gain in Finishing Beef Cattle, Journal of Animal Science, Volume 100, Issue Supplement_3, October 2022, Pages 39–40, https://doi.org/10.1093/jas/skac247.077
2) Zachary K Smith, Warren C Rusche, 92 Management, Technology, and Growth Composition: Have They Affected Carcass end Goals?, Journal of Animal Science,

Volume 100, Issue Supplement_3, October 2022, Page 40, https://doi.org/10.1093/jas/skac247.078
3) Gubbels E.R., F.L Francis, W.C. Rusche, Z.K. Smith. Manger Space Restriction Does Not Negatively Impact Efficiency of Growth in Programmed Fed Feedlot Heifers – MNC 2022, 3rd place MNC Poster Competition
4) Gubbels E.R., F.L Francis, W.C. Rusche, T. Rehberger, E. Block, Z.K. Smith. Evaluation of Celmanax and Certillus used alone or in combination on feedlot growth performance, efficiency of dietary net energy utilization, Salmonella and E. coli O157:H7 prevalence, heat stress measures, and carcass characteristics in beef steers fed in confinement for 258 d in the Northern Plains. In: Proceedings of the 2022 Plains Nutrition Council Spring Conference. San Antonio, TX. p. 173
5) Gubbels E.R., F.L Francis, W.C. Rusche, T. Rehberger, E. Block, Z.K. Smith Evaluation of a direst fed microbial and/or enzymatically hydrolyzed cell wall + yeast culture product on growth performance, dietary net energy utilization, and carcass traits in beef steers – Midwest ASAS 2022
6) Gubbels E.R., F.L Francis, W.C. Rusche, T. Rehberger, E. Block, Z.K. Smith Evaluation of a direst fed microbial and/or enzymatically hydrolyzed cell wall + yeast culture product on growth performance, dietary net energy utilization, and carcass traits in beef steers – SDSU Beef Day 2022
7) Gubbels E.R., F.L Francis, W.C. Rusche, T. Rehberger, E. Block, Z.K. Smith Evaluation of a direct fed microbial and/or enzymatically hydrolyzed yeast culture product fed to beef steers provided ractopamine hydrochloride 28 d before harvest during summer months in the Northern Plains – Midwest ASAS 2022
8) Gubbels E.R., F.L Francis, W.C. Rusche, T. Rehberger, E. Block, Z.K. Smith Evaluation of a direct fed microbial and/or enzymatically hydrolyzed yeast culture product fed to beef steers provided ractopamine hydrochloride 28 d before harvest during summer months in the Northern Plains –SDSU Beef Day 2022
9) Erin R Gubbels, Forest L Francis, Warren C Rusche, Zachary K Smith, 331 Effects of on-Arrival Application of a Modified-Live Respiratory and Clostridia Vaccination on Health, Growth Performance, and Antibody Titers of Newly Weaned Calves, Journal of Animal Science, Volume 100, Issue Supplement_3, October 2022, Pages 159–160, https://doi.org/10.1093/jas/skac247.296

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

NC Project Station Report –
Ale Relling, OSU

1. Impact Nugget:

Feedlot steers offered 85% of the feed than ad-libitum steers for 182 days do not showed differences in growth performance or carcass characteristics.

2. New Facilities and Equipment.
None

3. Unique Project Related Findings. List anything noteworthy and unique learned this year.
In the research published in JAS (doi: 10.1093/jas/skac239) we learn that a mild feed restriction (15% restriction compared with ad-libitum fed animals) does not decreased animal growth or carcass characteristics.

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.

Part of our research focuses on how energy is utilized for cattle to grow, improving energy efficiency and meat quality (by increasing the deposition of marbling). In our research we demonstrate that a small feed restriction (15% of restriction compare with cattle eating ad libitum) does not affect 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: We evaluate the effect of feed restricting feedlot cattle during growth and finishing on their growth and carcass characteristics
Impact: Feed restriction decreased the amount of feed offered and consumed by cattle without affecting growth or carcass characteristics. This might be due to an increase the efficiency of energy utilization.

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

Rosa-Velazquez, M., Y. Wang, A. Sanders, S. Pyle, L. G. Garcia, B. M. Bohrer, and A. E. Relling. 2022. Effects of maternal dietary fatty acids during mid-gestation on growth, glucose metabolism, carcass characteristics, and meat quality of lamb progeny that were fed differing levels of dry matter of intake. Meat Science 194. doi:10.1016/j.meatsci.2022.108991.

Pittaluga, A. M., M. Y Ortiz-Fraguada, A. J. Parker, and A. E. Relling. 2022. Effects of calcium salts of palm oil inclusion and ad libitum feeding regimen on growth performance, carcass characteristics, and plasma glucose-dependent insulinotropic polypeptide concentration of feedlot steers, J Anim Sci. 100. doi:10.1093/jas/skac239

Nickles K. R., A. E. Relling, A. Garcia-Guerra, F. L. Fluharty, and A. J. Parker. 2022. Short communication: A comparison between two glucose measurement methods in beef steers during a glucose tolerance test. PLoS ONE 17(7): e0271673. doi:10.1371/journal.pone.0271673. I provided with help in the sampling, design, and analysis of the data. 5% contribution

Nickles K. R., A. Garcia-Guerra, F. L. Fluharty, J. D. Kieffer, A. E. Relling, and A. J. Parker. 2022. Energy restriction and housing of pregnant beef heifers in mud decreases body weight and conceptus free live weight, Translational Animal Science. 6. doi:10.1093/tas/txac101. I provided with help in the sampling, design, and analysis of the data. 10% contribution

Ortiz-Fraguada, M. Y., and A. E. Relling. 2022. Evaluation of the association between plasma glucose-dependent insulinotropic polypeptide, respiratory quotient, and intramuscular fat deposition in feedlot cattle fed different levels of dry matter intake, Translational Animal Science. 6. doi: 10.1093/tas/txac089

Lee-Rangel, H. A., G. D. Mendoza-Martinez, L. Diaz de León-Martínez, A. E. Relling, A. Vazquez-Valladolid, M. Palacios-Martínez, P. A. Hernández-García, A, J. Chay-Canul, R. Flores-Ramirez, and J. A. Roque-Jiménez. 2022. Application of an Electronic Nose and HS-SPME/GC-MS to Determine Volatile Organic Compounds in Fresh Mexican Cheese. Foods.11, doi: 10.3390/ foods11131887. I help in the design of the experiment and revision of the publication. 5% contribution

Nickles K. R., A. E. Relling, A. Garcia-Guerra, F. L. Fluharty, J. Kieffer, and A. J. Parker. 2022. Beef cows housed in mud during late gestation have greater net energy requirements compared with cows housed on wood chip bedding, Translational Animal Science. 6. doi:10.1093/tas/txac045. I provided with help in the sampling, design, and analysis of the data. 10% contribution

Miquilini, M., N. R. Hardy, P. A. Dieter, A. E. Relling, and B. D. Enger. 2022. Estradiol administration in Holstein heifer calves differentially affects the fatty acid composition of subcutaneous adipose and the mammary fat pad tissues. Journal of Dairy Research. 89: 156–159. doi:10.1017/ S0022029922000413. Design the comparation of the tissues, collected the adipose tissues, analyzed the fatty acids, help in the statistical analysis, and review and edit the manuscript. 20% contribution.

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., F. Yang, J. Embree, S. Gilmore, M. Embree, and A. E. Relling. 2022. Effect of Native Rumen Bacteria Supplementation in Methane Emissions, Growth Performance, and Carcass Characteristics of Feedlot Cattle. 2022 ASAS Annual meeting.

Waldon, N., K. Nickles, A. J. Parker, K. C. Swanson, and A. E. Relling. 2022. Effects of Late Gestation Energy and Protein Restriction in Beef Cows on Offspring Growth and Carcass Characteristics. 2022. ASAS Midwest meeting.

Pittaluga, A. M., M. Ortiz, and A. E. Relling. 2022. Effect of Feed Intake and Calcium Salts of Palm Oil Inclusion on Growth Performance and Carcass Characteristics of Feedlot Finishing Steers. 2022 ASAS Midwest meeting.

Flaherty, K., B. J. Campbell, and A. E. Relling. 2022. Evaluating the Effect of Hay, Fed Ad-Libitum or Controlled, or Soybean Hulls During Gestation on Body Weight and Dry Matter Intake of the Ewe and Body Weight on the Offspring Until Weaning. 2022 ASAS Midwest meeting.

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

Relling A. E. Effect of yeast culture extract supplementation on the growth performance of beef steers fed a forage based diet. Arfingor S.A. “Biopremix” $29,978. 100%

Relling A. E. Effect of yeast culture extract supplementation on rumen fermentation of beef steers fed a forage-base diet. Arfingor S.A. “Biopremix” $75,475. 100%

Relling A. E., Pempek J. Association Between Lactating Dairy Cow Welfare and Milk Cortisol Concentration. Ohio Dairy research funds. $5225. 80%

9. Other relevant accomplishments and activities.
N/A

Station Report (2021-2022)
Texas A&M AgriLife Research – Department of Animal Science, Texas A&M University

Submitted by: Vinícius Gouvêa, Assistant Professor, Texas A&M AgriLife Research, Department of Animal Science

NC Project Station Report Content

1. Impact Nuggets:

Our research portfolio is focused on optimizing nutrient utilization and mitigating greenhouse gas emissions of finishing feedlot cattle and decreasing morbidity and mortality from bovine respiratory disease (BRD) through different nutritional and management practices.

2. New Facilities and Equipment:

We built 8 new pens at our research feedlot facility at Bushland – TX. These new pens are equipped with portable, self-contained feeding units (SmartFeed; C-Lock Inc., Rapid City, SD) that will allow individual intake evaluation. Each pen can house 16-20 head. We expect to equip these pens with SmartScales and GreenFeed units (C-Lock Inc., Rapid City, SD) to fully automate the collection of individual data on growth performance and greenhouse gas emissions of feedlot cattle.

3. Unique Project Related Findings. N/A

4. Accomplishment Summaries.

Our research group conducted projects on receiving and finishing feedlot cattle. The results from these projects align with our objective of optimizing nutrient utilization and mitigating greenhouse gas emissions of finishing feedlot, and also decreasing morbidity and mortality from bovine respiratory disease (BRD) during the receiving feedlot phase.

5. Impact Statements

- **Productive and physiological responses of feedlot cattle receiving different sources of Ca salts of fatty acids in the finishing diets.**

  Lay Summary: Supplemental fat has been provided to feedlot cattle to increase the energy density of their diets and may yield nutraceutical advantages if includes polyunsaturated fatty acids (FA). Alternatively, carcass quality can be improved when the fat supplement is based on saturated and monounsaturated FA. Hence, this experiment evaluated a blend of saturated, monounsaturated, and polyunsaturated FA to improve both performance and carcass merit in feedlot cattle. Steers received a finishing diet that included this blend (CSMIX), a source of saturated and monounsaturated FA (CSPALM), or no supplemental fat (CON). Growth rate and gain efficiency were improved in steers that received CSMIX compared with CSPALM and CON, and these traits did not differ between the latter treatments. The inclusion of CSMIX increased FA concentrations in the circulation of steers throughout the 147-day study and in Longissimus muscle (LM) samples collected after slaughter. This increase in FA concentrations was associated with a greater accumulation of polyunsaturated and ω-6 FA, suggesting that CSMIX resulted in LM with FA profile deemed more beneficial for human consumption. Collectively, supplementing CSMIX to feedlot steers improved gain efficiency and FA composition in the LM, and these advantages may be associated with the increased supply of polyunsaturated ω-6 FA to the finishing diet.

- **Roughage level and supplemental fat for newly received finishing calves: effects on growth performance, health, and physiological responses**

  Lay Summary: The low intake of feed that beef calves exhibit during the first weeks after feedlot arrival results in inadequate nutrient intake, especially energy, which leads to low rates of gain and decreased immune function and likely increases the risks for respiratory diseases. Increasing the energy density of receiving diets (Mcal/kg of dry matter) could result in increased energy intake of newly received finishing cattle. In this experiment, we evaluated the effects of two roughage levels (wheat hay at 30% [R30] or 60% [R60]; dry matter [DM] basis) combined with two levels of supplemental fat (yellow grease at 0% [−FAT; no supplemental fat] or 3.5% [+FAT]; DM basis). Calves-fed R30 tended to have greater average daily gain and final body weight than calves-fed R60. Gain efficiency (gain:feed ratio; G:F) was greater for calves-fed R30 than calves-fed R60. Feeding +FAT tended to increase average daily gain compared to −FAT diet, and G:F was greater for calves-fed +FAT than −FAT. In summary, feeding 30% roughage diets or adding 3.5% of yellow grease increased G:F during the feedlot receiving period, with minimal impact on morbidity rate from respiratory disease

- **Supplementing a blend of magnesium oxide to feedlot cattle: effects on ruminal, physiological, and productive responses**

  Lay Summary: Acidosis is a common digestive disorder in feedlot cattle consuming high-grain diets, resulting in excessive accumulation of organic acids and pH reduction in the rumen. Sub-acute acidosis is the most prevalent form of acidosis in feedlot cattle, and it is difficult to diagnose due to limited clinical signs, but directly impairs cattle health and productivity. This study evaluated the inclusion of a blend of magnesium oxide (MG) into feedlot diets, a novel neutralizing agent to control rumen pH and mitigate sub-acute acidosis. More specifically, cattle received a corn-based diet with the inclusion of MG at different levels (0%, 0.25%, 0.50%, or 0.75% of the diet). Ruminal pH increased as dietary MG inclusion increased, particularly as cattle consumed feed toward the end of the day. Concentrations of plasma haptoglobin and cortisol in the tail-switch hair decreased as dietary MG inclusion increased, indicating that MG supplementation reduced inflammatory and chronic stress from sub-acute acidosis. However, no benefits from MG were noted for cattle productive traits, including growth rate, feed efficiency, and carcass merit traits. Therefore, supplemental MG appears to be effective in controlling rumen pH in cattle receiving a corn-based finishing diet, but without improvements in feedlot performance and carcass quality.

- **Novel Strategies to Increase Sustainability of Beef Production Systems in the Western United States.**

  Lay Summary: The project is investigating the viability and trade-offs of three novel strategies: heritage genetics, precision ranching, and range-finishing in the Southwest U.S.. Core field research will take place at feedyards in the Ogallala region and five participating ranches that together represent beef production systems with different combinations of novel strategies. The long-term goal of the proposed project has three parts: 1) Increase profitability and total factor productivity (TFP) on ranches of the Southwest; 2) Reduce cattle production losses due to weather and climate impacts on ranches; 3) Improve water and nutrient use efficiency in the Southwest U.S.-Ogallala Beef Production Area.

- **Effect of live yeast supplementation on energy partitioning and ruminal fermentation characteristics of steers fed a grower-type diet in heat-stress conditions**

Lay Summary: About 70% of global beef production is located in tropical and sub-tropical regions. With elevated temperatures and significant humidity, these regions impose heat stress on beef animals. Heat stress is the main antagonist to ruminant production as it decreases dry matter intake and digestion and increases energy expenditure due to the animal's need for thermoregulation. Supplementation of live yeast products has proven efficacious at improving ruminal fermentation dynamics. This study sets out to determine if live yeast supplementation to animals in heat stress conditions can positively affect energy partitioning, nitrogen metabolism, and ruminal parameters. Additionally, this study models the ruminal performance after exposure to heat stress or live yeast supplementation. This study identified several interesting in vitro dynamics of previously stressed- or supplemented rumen fluid. Although there was a lack of effects for live yeast supplementation on energy partitioning, nitrogen metabolism, and some ruminal parameters during heat stress, further research should be completed in order to understand if live yeast supplementation is a plausible mitigation technique to enhance the performance of beef animals reared in tropical and sub-tropical regions of the world.

- **Evaluation of sampling methods for methane concentration from in vitro fermentation**

Lay Summary: Greenhouse gas emissions (GHG) from ruminant production equate to 81% of total global livestock supply chain emissions, with 51% originating from beef cattle production. Traditional in vivo estimation methods of methane (CH_4), a highly scrutinized greenhouse gas, are timely and costly. In vitro gas production (IVGP) methods can accurately describe CH_4 emission patterns from the rumen but tend to overestimate quantities. Additionally, in vivo estimation methods present CH_4 on a dry-gas basis, whereas in vitro does not. In vitro methods utilize a gas chromatography machine to estimate CH_4. Laboratory constraints can impose deviations to a strict IVGP protocol. This multi-objective study evaluates three treatment methods of IVGP bottles to understand whether discrepancies exist in CH_4 estimation when deviating from the published protocol. To estimate CH_4 from IVGP more accurately and provide a more comparable number to in vivo methods, this study also evaluates environmental conditions within an IVGP bottle to formulate a system of equations to calculate CH_4 on a dry-gas basis. This study found that the treatment method of the IVGP bottle had an impact on CH_4 estimation, and the developed equations should be utilized to produce more comparable estimates.

- **Quantification of methane emitted by ruminants: a review of methods**

Lay Summary: There is a need to accurately and precisely quantify greenhouse gas (GHG) emissions, specifically methane (CH_4), to ensure correct reporting of GHG inventories and, perhaps more importantly, determine how to best mitigate CH_4 emissions. The objective of this study was to review existing methods and methodologies to quantify and estimate CH_4 emissions from ruminants. Historically, most techniques were developed for specific purposes that may limit their widespread use on commercial farms and for inventory purposes and typically required frequent calibration and equipment maintenance. Whole animal and head respiration chambers, spot sampling techniques, and tracer gas methods can be used to measure enteric CH_4 from individual animals, but each technique has its own inherent limitations. The measurement of CH_4 emissions from manure depends on the type of storage, animal housing, CH_4 concentration inside and outside the boundaries of the area of interest, and ventilation rate, which is likely the most complex variable creating many uncertainties. For large-scale areas, aircraft, drones, and satellites have been used in association with the tracer flux method, inverse modeling, imagery, and LiDAR (Light Detection and Ranging), but research is lagging in validating these methods. Bottom-up approaches to estimating CH_4 emissions rely on empirical or mechanistic modeling to quantify the contribution of individual sources. Top-down approaches estimate the amount of CH_4 in the atmosphere using

spatial and temporal models to account for transportation from an emitter to an observation point.

6. Published Works

Refereed Journal Articles

Colombo, E. A., Cooke, R. F., Araújo, A. C. R., Harvey, K. M., Pohler, K. G., & Brandão, A. P. (2022). Supplementing a blend of magnesium oxide to feedlot cattle: effects on ruminal, physiological, and productive responses. Journal of Animal Science, 100(1). https://doi.org/10.1093/jas/skab375

Cooke, R. F., Colombo, E. A., Mackey, S. J., Pickett, A. T., Batista, L. F. D., Pohler, K. G., de Souza, O. A., Cappellozza, B. I., & Brandão, A. P. (2023). Productive and physiological responses of feedlot cattle receiving different sources of Ca salts of fatty acids in the finishing diet. Journal of Animal Science, 101. https://doi.org/10.1093/jas/skac404

D'Souza, G. M., Dias Batista, L. F., Norris, A. B., & Tedeschi, L. O. (2022). Effect of live yeast supplementation on energy partitioning and ruminal fermentation characteristics of steers fed a grower-Type diet in heat-stress conditions. Journal of Animal Science, 100(11). https://doi.org/10.1093/jas/skac320

D'Souza, G. M., Norris, A. B., & Tedeschi, L. O. (2022). Technical note: Evaluation of sampling methods for methane concentration from in vitro fermentation. Journal of Animal Science, 100(9). https://doi.org/10.1093/jas/skac259

Goulart, R. S., Tedeschi, L. O., Silva, S. L., Leme, P. R., De Alencar, M. M., & Lanna, D. P. D. (2022). The energy requirement for maintenance of Nellore crossbreds in tropical conditions during the finishing period. Journal of Animal Science, 100(5). https://doi.org/10.1093/jas/skac125

Gouvêa, V. N., Oliveira, M. O., Giacomelli, H. J. M., Colombo, E. A., Batistel, F., Santos, F. A. P., Duff, G. C., Marques, R. S., & Cooke, R. F. (2023). Roughage level and supplemental fat for newly received finishing calves: effects on growth performance, health, and physiological responses. Journal of Animal Science, 101. https://doi.org/10.1093/jas/skac322

Jacobs, M., Remus, A., Gaillard, C., Menendez, H. M., Tedeschi, L. O., Neethirajan, S., & Ellis, J. L. (2022). ASAS-NANP symposium: Mathematical modeling in animal nutrition: Limitations and potential next steps for modeling and modelers in the animal sciences. Journal of Animal Science, 100(6). https://doi.org/10.1093/jas/skac132

Menendez, H. M., Brennan, J. R., Gaillard, C., Ehlert, K., Quintana, J., Neethirajan, S., Remus, A., Jacobs, M., Teixeira, I. A. M. A., Turner, B. L., & Tedeschi, L. O. (2022). ASAS-NANP Symposium: Mathematical Modeling in Animal Nutrition: Opportunities and challenges of confined and extensive precision livestock production. Journal of Animal Science, 100(6). https://doi.org/10.1093/jas/skac160

Tedeschi, L. O., Abdalla, A. L., Álvarez, C., Anuga, S. W., Arango, J., Beauchemin, K. A., Becquet, P., Berndt, A., Burns, R., De Camillis, C., Chará, J., Echazarreta, J. M., Hassouna, Mc. D. sign©lynda, Kenny, D., Mathot, M., Mauricio, R. M., Mcclelland, S. C., Niu, M., Onyango, A. A., … Kebreab, E. (2022). Quantification of methane emitted by ruminants: a review of methods. Journal of Animal Science, 100(7). https://doi.org/10.1093/jas/skac197

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

- Novel Strategies to Increase Sustainability of Beef Production Systems in the Western United States.

8. Other relevant accomplishments and activities. None

2022 NCCC-308 Project Station Report – California - DREC

1. **Impact Nugget:**

Calf-fed Angus x Holstein steers had an increase in GF ratio, final BW, HCW, LMA, and dressing percentage when compared to calf-fed Holstein steers when cattle were fed a steam-flaked corn-based diet for 328 days.

2. **New Facilities and Equipment.**

NA.

3. **Unique Project Related Findings.**

Regardless of cattle breed calf-fed Holsteins and Angus x Holsteins cross had liver abscess incidence of less than 5%.

4. **Accomplishment Summaries.**

Supplementing of calf-fed Holstein steers with monensin or blend of essential oil plu 25-hydroxyvitamin- D3 (HYD EO+HYD) increased overall efficiency of dietary net energy utilization for maintenance and gain (3 and 4%, respectively) without major effects on carcass characteristics or liver abscess incidence when fed to calf-fed Holstein steers for over 285 days. Moreover, cattle supplemented with EO+HYD decreased mean reticulorumen temperature when experiencing extremely high ambient temperature.

Supplementing calf-fed Holstein steers with nutragen (NTG) increased the live weight of steers during the initial 56 days on feed. Moreover, calf-fed Holstein steers supplemented with NTG had a greater percentage of KPH fat and LM area. However, treatment effects were not appreciable on overall cattle growth performance, and had no major effect on diet digestibility and ruminal temperature.

Supplementing calf-fed Holstein steers fed a steam-flaked corn-based diet with flavomycin at 6.6 or 13.2 mg/kg or 30 mg/kg of monensin had similar effects on cattle growth performance, carcass characteristics, diet digestibility, and ruminal fermentation characteristics.

The NEm and NEg values for DDGS in SFC-based growing-finishing diets were consistent with current tabular standards (2.18 and 1.50 Mcal/kg, respectively). The first 111-d growth performance was not enhanced with increasing DDGS substitution for SFC. Moreover, methionine and Histidine were the first co-limiting amino acids, averaging 91.5 and 81.78% of theoretical requirements. Whereas increasing DDGS concentration in the diet increased metabolizable protein supply to the small intestine, it did not appreciably increase metabolizable lysine.

5. **Impact Statements**.

The utilization of beef semen in the dairy herd has the potential to increase production and efficiency of dairy bull calves.

6. **Published Written Works**.

Montano, M. F., **P. H. V. Carvalho**, B. C. Latack, Ferraz Junior, M.V.D.C, 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

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

Latack, B. C., **P. H. V. Carvalho,** and R. A. Zinn. 2022. The interaction of feeding an eubiotic blend of essential oils plus 25-hydroxy-vit-D3 on performance, carcass characteristics, and dietary energetics of calf-fed Holstein steers. Frontiers in Veterinary Science. https://doi.org/10.3389/fvets.2022.1032532

Ferraz Junior, M. V. C. and **P. H. V. Carvalho.** Use of feed additives to improve feed efficiency and growth of feedlot cattle. Latin American Archives of Animal Production, 30: 27-35. https://doi.org/10.53588/alpa.300503

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

Managing Dairy Steers for Beef Production, Invited Speaker, Midwest Section – American Society of Animal Science - Omaha. NE, 03/16/2022.

Beef Production from the Dairy Herd, Invited Speaker, Golden State Dairy Conference - Modesto, CA, 03/23/2022

Beef Production from the Dairy Herd, Invited Speaker, EMBRAPA - Brazil (online), 05/25/2022.

Beef Production from the Dairy Herd, Invited Speaker, Sao Gotardo - Brazil, 07/08/2022.

Beef Production From the Dairy Herd in the United States, Invited Speaker, Beef and Dairy Day - Futura - Brazil, 07/09/2022.

Research and Extension, Invited Speaker, University of Arizona/USDA Summer STEAM Academy - El Centro, CA, 08/08/2022.

Sustainable Beef Production, Invited Speaker, Symposium in Sustainability – UABC Mexico (online), 08/26/2022.

Beef Production in the United States, Invited Speaker, Federal University of Mato Grosso do Sul - Brazil (online), 08/29/2022.

Sustainability of Beef and Dairy Production, Invited Speaker, Feedlot Symposium - UNAL - Monterrey, Mexico, 10/05/2022.

Beef Production from the Dairy Herd, Invited Speaker, China (online), 11/21/2022.

Sustainable Beef Symposium, Invited Speaker, Lattech Symposium - Puerto Vallarta, MX, 12/06/2022.

8. **Fund leveraging**,
Grant

California Department of Food and Agriculture: Effects of extended colostrum feeding to calf-fed Holstein steers on health, performance, fecal resistome, and carcass characteristics

Adisseo: Interaction of supplemental lysine and methionine and supplemental ractopamine on feedlot growth performance and carcass characteristics of calf-fed dairy steers

Private funding
DSM: “The interaction of a eubiotic blend of essential oils plus 25-hydroxy-vit-D3 on performance, carcass characteristics, and diet digestibility of calf-fed Holstein steers”

SilvaTeam: “Effect of breed, Holstein or Holstein x Angus cross, and supplemental condensed tannins on cattle feedlot growth performance, carcass characteristics, and ruminal temperature of calf-fed dairy steers”

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

2023NCCC308 Project Station Report – Michigan State University

1) **Impact Nugget:**
   a) The breakeven feeder (400#) feeder calf price for Beef × Holstein steers was $0.65/lb greater than compared with straightbred Holstein steers.
   b) Beef × Holstein steers with a severe liver abscess score (A+) had a reduced average daily gain of 0.18 lb/d compared with less severe liver abscess scores (0 or A-).

2) **Facilities and Equipment Update:** The feedlot removed the rubber from the slats and replaced slats as needed in the slatted floor barn.

3) **Unique Project Related Findings:**
   a) Beef × Holstein steers tended to have a greater rate of gain, were more feed efficient, and required fewer days to reach a similar empty body fat percentage compared with straightbred Holstein steers. Beef × Holstein steers had a greater dressing percentage, ribeye area, and backfat thickness compared with straightbred Holstein steers. Beef × Holstein steers had a more desirable cost of gain due to fewer days on feed and lesser feed and non-feed operating costs compared with straightbred Holstein steers.

4) **Accomplishment Summary:** As a result of the study comparing Beef × Holstein steers with straightbred Holstein steers, Extension presentations have been created and delivered to producers and industry stakeholders at Michigan State University Extension programs, at the Michigan Cattlemen's Association annual meeting, and collaborated Ohio State University Extension programs. Furthermore, the study has produced one abstract presented at the 2023 ASAS Midwest meeting and a manuscript that is being prepared for submission. Results highlight the positive benefits of producing and raising Beef × Holstein steers compared with straightbred Holstein steers and offer discussion on future research needs regarding the management of Beef × Holstein steers for improved performance and efficiency.

5) **Impact Statements:** Raising Beef × Holstein steers compared with straightbred Holstein steers resulted in a more desirable cost of gain. The lesser cost of gain for Beef × Holstein steers was due to a slightly greater rate of weight gain and greater feed efficiency, which resulted in fewer days on feed and total feed consumed. Cheaper cost of production for Beef × Holstein steers would have allowed cattle feeders to purchase Beef × Holstein steers calves at a $0.65/lb premium compared with straightbred Holstein steers calves at 400 pounds. Carcass data indicates greater muscle deposition for Beef × Holstein steers compared with straightbred Holstein steers, but future research is needed to confirm the anticipated improvement in carcass red meat yield.

6) **Published Written Works:**

Scientific Journal Articles and Abstracts:

Jaborek, J. R., Fluharty, F. L, Lee, K., Zerby, H. N., Relling, A. E. 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. 101: skac371. doi.org/10.1093/jas/skac371

Jaborek, J. R., Fluharty, F. L, Zerby, H. N., Relling, A. E. 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. J. Anim. Sci. 101: skac343. doi.org/10.1093/jas/skac343

Jaborek, J. R., Carvalho, P. H. V., Felix, T. L. 2023. Post-weaning management of modern dairy cattle genetics for beef production: a review. J. Anim. Sci. 101: skac345. doi.org/10.1093/jas/skac345

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. 2023. Feedlot performance, carcass traits, and feeder calf value of beef × Holstein and Holstein steers. Proceedings of the ASAS Midwest Section Meeting. Madison, Wisconsin, USA. March 12-15. Abstract.

Carvalho, Pedro H. V., T. L Felix, and **J. R. Jaborek**. 2022. Feeding and Managing Dairy Cattle Genetics for Beef. Proceedings of the ASAS Midwest Section Meeting. Omaha, Nebraska, USA. March 14-16. Abstract.

Extension Articles:

Jaborek, J. R. 2023. Young calves fed starter benefit from supplemental forage. Michigan State University Extension News.

Jaborek, J. R. 2023. Industry concerns with liver abscesses in finishing cattle. Michigan Cattleman Magazine.

Jaborek, J. R. and K. Gould. 2022. Beef calf weaning management to prepare your calves for future success. Michigan Cattleman Magazine.

Jaborek, J. R. 2022. FDA CVM attempting to clarify ear implant labels for reimplant use. Michigan Cattleman Magazine.

Jaborek, J. R. 2022. Truth or fallacy: cattle cannot digest whole shelled corn? Michigan State University Extension News.

Jaborek, J. R. and J. P. Schweihofer. 2022. How will PFAS impact the Michigan cattle industry? Michigan Cattleman Magazine.

Jaborek, J. R. 2022. What we know about buller steer syndrome in feedlot steers. Michigan State University Extension News.

Jaborek, J. R. 2023. Newly received feedlot calves may need more protein due to a lesser feed intake. Michigan Cattleman Magazine.

Jaborek, J. R. 2023. Not all protein sources are the same. Michigan State University Extension News.

Jaborek, J. R. and K. Gould. 2023. MSU Beef Team enhances beef cattle ultrasound services to support industry needs. Michigan Cattleman Magazine.

7) **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. 2023. Feedlot performance, carcass traits, and feeder calf value of beef × Holstein and Holstein steers. Proceedings of the ASAS Midwest Section Meeting. Madison, Wisconsin, USA. March 12-15.

Carvalho, Pedro H. V., T. L Felix, and **J. R. Jaborek**. 2022. Feeding and Managing Dairy Cattle Genetics for Beef. Proceedings of the ASAS Midwest Section Meeting. Omaha, Nebraska, USA. March 14-16.

Extension Presentations:

Michigan Cattleman's Association Annual Meeting. Advanced Technologies that Lead to the Increased use of Beef on Dairy Breeding. Invited Speaker (**J. R. Jaborek**, S. Eaglen). March 31, 2023. 15 participants.

MSU Feedlot Health and Management Program (Sturgis, MI). Instructor, Speaker (**J. R. Jaborek**, J. Gordon, K. Gould, P. Durst). March 29, 2023. 7 participants.

MSU Feedlot Health and Management Program (Ithaca, MI). Instructor, Speaker (**J. R. Jaborek**, J. Gordon, K. Gould, P. Durst). March 28, 2023. 31 participants.

MSU Feedlot Health and Management Program (Kingston, MI). Instructor, Speaker (**J. R. Jaborek**, J. Gordon, K. Gould, P. Durst). March 23, 2023. 32 participants.

MSU Feedlot Educational Series - Discussion on Beef Carcass Composition. Instructor (**J. R. Jaborek**), Speaker (J. Leininger). March 8, 2023. 28 participants - in-person/virtual hybrid.

MSU Feedlot Educational Series - Growth Promoting Technologies. Instructor (**J. R. Jaborek**), Speaker (C. Daily). February 8, 2023. 24 participants - in-person/virtual hybrid.

MSU Feedlot Educational Series - The Role of Plant health in Corn Silage Quality & Yield. Instructor (**J. R. Jaborek**), Speaker (D. Bolinger). January 11, 2023. 14 participants – in-person/virtual hybrid.

MSU Thumb Ag Day - Beef x Holstein Research Phase I Update. Speaker (**J. R. Jaborek**). December 14, 2022. 30 participants.

Thumb Cattleman's Summer Picnic: Meat Left on the Table. Instructor (C. Daily, **J. R. Jaborek,** J. VanLoon), Speaker (N. Pyatt, T. Schunk). September 1, 2022. ? participants.

8) **Fund Acquisition:**

Jaborek, J. R, Bradford, B. J., Okkema, C. 2023. Effect of Colostrum Administration with or without Aspirin Supplementation on Immunoglobulin G Absorption in Newborn Calves. $46,755. Michigan Alliance for Animal Agriculture.

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.

Kim, J., Gondro, C., DeDecker, J., **Jaborek, J. R**. 2022. Improving beef cattle production with guanidinoacetic acid (GAA) supplement. $149,676. 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. $456,478. Holstein Association USA and JBS USA.

9) **Other Accomplishments:** Multiple Extension programs have been conducted to educate producers about beef × dairy crossbreeding with collaborative efforts made between Michigan State University, the Ohio State University, and the University of Wisconsin.

June 2022 – May 2023 Penn State NCCC308 Station Report

Impact Nugget

Pennsylvania State University is collaborating with the University of Connecticut to determine the impacts of beef x dairy in the northeast through survey outreach.

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 third year of a 4-year feedlot trial investigating the optimal genetics of beef-sired steers born to Holstein dams (beef × Holstein).

New Facilities and Equipment

None added.

Unique Project Related Findings.

Wagyu × Holstein steers resulted in the greatest economic losses due to their inferior ADG and DMI on the feedlot, greater days on feed, and reduced carcass weights in comparison with steers of other sire breeds. Angus x Holstein and Charolais x Holstein steers had the greatest ADG and DMI and Angus x Holstein steers were on feed for the fewest days when compared with steers sired by other beef breeds.

Accomplishment Summaries

Penn State has completed the third year of a 4-year feedlot trial investigating the optimal genetics of beef-sired steers born to Holstein dams (beef × Holstein). The prevalence of beef × dairy matings continues to grow beyond what was reported along beef x Holstein feedlot data in 2020 and 2021. In 2021, 8.7 million units of beef semen were sold domestically, up another 20% from the previous year. To provide beef sire selection recommendations to dairy producers, Penn State researchers have continued evaluating beef × Holstein steers in 2022. The results of these efforts are detailed below.

Research efforts are supported by the USDA Critical Agricultural Research and Extension (CARE) with additional support from JBS and Premier Select Sires. Research animals were finished at the Pennsylvania Department of Agriculture's Livestock Evaluation Center (LEC) feedlot in Pennsylvania Furnace. Beef × Holstein bull calves sired by Angus, Charolais, SimAngus, and Wagyu bulls and born on PA dairy farms from May to August 2021 were transported to one of two commercial calf growing facilities within 1 week of birth. Calves were fed milk replacer and free choice starter grain until weaning at 7 ± 2 weeks of age. Following weaning, calves were consolidated to one facility and fed a growing ration (~56 Mcal NEg). Calves were implanted with Synovex-C in November and implanted with Synovex-S in February.

Following the initial grow out, 19 Angus × Holstein, 79 Charolais × Holstein, 16 SimAngus × Holstein, and 10 Wagyu × Holstein steers were brought to the LEC. Steers were fed a common corn and corn silage-based diet (~63 Mcal NEg) and slaughtered after 90, 118, or 153

days on feed at the LEC. Groups were selected for slaughter based on a combination of visual appraisal and body weight. Daily feed intake of individual steers was recorded using the GrowSafe Feed Intake Monitoring System. Initial and final weights are reported as a 2-day average body weight at the beginning and end of the LEC feeding period, respectively. Average daily gain was calculated as the difference between initial and final average body weight divided by the total days on feed.

Angus-sired steers were heaviest at feedlot entry (966 lbs) and were fed at the LEC for the fewest (112) days. SimAngus and Wagyu-sired steers were the lightest at feedlot entry (783 and 738 lbs, respectively) and on feed for the most days (144 and 161 days, respectively). Charolais-sired steers outperformed the Wagyu and SimAngus-sired steers but were still inferior to Angus. Angus × Holsten steers were heavier at slaughter than SimAngus and Wagyu-sired steers. The disadvantage Wagyu-sired steers had in feedlot growth performance was due in part to their reduced dry matter intake (DMI) and average daily gain (ADG) when compared to progeny of other sire breeds. Because the cattle that consumed less feed grew slower, no breed differences existed in feed conversion to gain (~8 lbs of feed were required for 1 lb of gain). Additionally, there were no differences between sire breeds in hip height at harvest. Yearling height is included in the $AxH index. While the Angus sires used in this project were not specifically selected using the $AxH index, height has been of interest to ensure that beef x dairy crossbreds are not too large for meatpackers to accommodate.

Despite the growing popularity of Wagyu genetics in the United States, carcasses from Wagyu × Holstein steers were the lightest and had the least amount of backfat of any sire breed used. Dressing percentage tended to be least in carcasses from Charolais × Holstein steers (60.5%) and greatest in carcasses from SimAngus × Holstein steers (61.7%); carcasses from Angus and Wagyu-sired steers were intermediate and not different. About 84% of carcasses from Angus × Holstein steers graded Choice while only 31% of carcasses from SimAngus × Holstein steers graded Choice. However, there were no differences in marbling scores between sire breeds. The majority of carcasses from beef x Holstein steers were Yield Grade 2.

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.

Published Written Works

Scientific works relevant to the committee

1. Felix, T.L., Emenheiser, J., Govoni, K., Zinn, S., & Reed, S. Survey of the use of beef semen in dairy herds from the Northeastern United States. Translational Animal Science. Doi: 10.1093/tas/txad038
2. Jaborek, J. R., P. H. V. Carvalho, and T. L. Felix. 2023a. Feeding and managing dairy cattle genetics for beef production: A review. J. Anim. Sci. 101:skac345. doi: 10.1093/jas/skac345.

Extension works relevant to the committee

1. Felix, T.L. 2023. Dairy producer attitudes about beef-on-dairy. Progressive Cattle. https://www.agproud.com/articles/57438-dairy-producer-attitudes-about-beef-on-dairy.
2. Basiel, B.L. and T.L. Felix. 2023. 2022 Beef-sired progeny from dairy cows. Lancaster Farming.

3. Felix, T.L. 2022. Penn State Beef Cattle Short Course Celebrates 7 years of Quality Producer Education. Keystone Cattlemens Magazine.

4. Felix, T.L. 2022. Does the growing beef x dairy trend work for the feeders. Keystone Cattlemens Magazine.

5. Felix, T.L. and D.W. Hartman. 2022. Being Part of Something Bigger. Lancaster Farming.

<u>Scientific and Outreach Oral Presentations</u>

Scientific meetings

1. Bemisderfer, M. B.L. Basiel, T.L. Felix. 2023. Assessing the success of passive transfer in beef x dairy calves and its lasting impacts on feedlot growth and carcass characteristics. Gamma Sigma Delta Research Symposium. March 30.
2. Basiel, B.L., T.L. Felix, and C.D. Dechow. 2023. Early-lactation health event frequency of cows that carried beef or Holstein-sired calves. Penn State Gamma Sigma Delta Research Expo. University Park, PA.
3. Basiel, B.L., T.L. Felix, and C.D. Dechow. 2023. Early-lactation health event frequency of cows that carried beef or Holstein-sired calves. ADSA Annual Meeting invited presentation. Ottawa, Ontario, Canada.
4. Basiel, B.L. and T.L. Felix. 2023. Growth performance and carcass characteristics of beef-sired steers born to Holstein dams. ASAS Midwest Section Annual Meeting. Madison, WI. March 13-15
5. Basiel, B. L., T. L. Felix, and C. D. Dechow. 2022. Gestation length and dystocia of Holsteins mated to Holstein and beef breed service sires. ADSA Annual Meeting.

Invited presentations

1. Felix, T.L. Dust off your crystal ball: a discussion of futures markets, R&J Consulting, East Earl, PA, External to Penn State. Spring (March 1, 2023).

2. Felix, T.L. What every beef producer should know about beef x dairy, Minnesota Extension, Carver County, MN, External to Penn State. Spring (February 20, 2023).

3. Felix, T.L. What every dairy producer should know about beef x dairy, Minnesota

Extension, Carver County, MN, External to Penn State. Spring (February 20, 2023).

4. Felix, T.L. Feeding beef cattle for meat quality, PA Cattlemens Summer Field day, Nottingham, PA, 30 participant(s), External to Penn State, Professional. Summer 2 (July 23, 2022).

5. Felix, T.L. Simplifying beef cattle diets, Cargill, Dallas, TX, 60 participant(s), External to Penn State, Professional. Spring (May 2, 2022 - May 3, 2022).

6. Felix, T.L. Feeding Beef x Dairy Crossbred Cattle, 24th Annual Mid-Atlantic Consortium Extension In-Service, Wilkes-Barre, PA, 25 participant(s), Both, Professional. Summer 1 (May 26, 2022).

7. Felix, T.L. Feeding and managing dairy genetics for beef, Mid-Atlantic Conference for Bovine Practitioners, Hagerstown, MD, 100 participant(s), External to Penn State, Professional. (April 1, 2022).

8. Felix, T.L. Successful transition of the beef calf from weaning through backgrounding, Mid-Atlantic Conference for Bovine Practitioners, Hagerstown, MD, 100 participant(s), External to Penn State, Professional. (April 1, 2022).

Outreach (Extension talks presented by Tara Felix around PA)

1. Felix, T.L. Implications of beef x dairy systems, Stevens Feed Mill, Inc, Lewisburg, PA, External to Penn State. Spring (March 16, 2023).

2. Felix, T.L. Modifying your Infrastrucuture for Beef Cattle - Space Requirements, Penn State Extension, Wellsboro, PA, 32 participant(s), External to Penn State, Professional. Spring (February 28, 2023).

3. Felix, T.L. Modifying your Infrastrucuture for Beef Cattle - Space Requirements, Penn State Extension, Chambersburg, PA, 56 participant(s), External to Penn State, Professional. Spring (February 16, 2023).

4. Felix, T.L. Modifying your Infrastrucuture for Beef Cattle - Space Requirements, Penn State Extension, New Holland, PA, 56 participant(s), External to Penn State, Professional. Fall (February 14, 2023).

5. Felix, T.L. Changes to antibiotics and implants, Penn State Extension, Lancaster, PA, External to Penn State. Spring (January 24, 2023).

6. Felix, T.L. Modifying your Infrastrucuture for Beef Cattle - Space Requirements, Penn State Extension, Mercer, PA, 48 participant(s), External to Penn State, Professional. Fall (December 8, 2022).

7. Felix, T.L. Modifying your Infrastrucuture for Beef Cattle - Space Requirements, Penn State Extension, Belle Vernon, PA, 28 participant(s), External to Penn State, Professional. Fall (December 6, 2022).

8. Felix, T.L. Using beef semen to crossbreed dairy cows, Penn State Dairy Nutrition Conference, Hershey, PA, 6 participant(s), External to Penn State, Professional. Fall (November 3, 2022).

9. Felix, T.L. Sixth Annual Penn State Beef Cattle Short Course, PA Beef Producers Working Group, State College, PA, 48 participant(s), External to Penn State, Professional. Fall (October 11, 2022 - October 12, 2022).
   This short course was developed for advanced beef producers to gain better understanding of the beef business from start to finish. I set up the short course and organized all the details (speakers, venues, etc.). I also presented on the topics, 1) Cattle Feeding: Thinking Beyond your Fence Rows and 2) Economic impacts of yield and grade.

10. Felix, T.L. Handling and Housing for Beef Cattle, Penn State Extension, State College, PA, 14 participant(s), External to Penn State, Professional. Summer 1 (June 15, 2022).

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. December 15, 2021 - December 14, 2024.

Felix, T. (Principal Investigator; Project Correspondent), Dechow, C. D., and Harvatine, K. J. “Enhancing the value of beef sired progeny from dairy cattle,” USDA National Institute of Food and Agriculture. Total requested: $299,566.00. (Funded: April 1, 2020 - March 31, 2023).

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. March 1, 2021 - February 28, 2023

Other Relevant Accomplishments

None to report.

Iowa State University Station Report

****For impacts and accomplishments, try to emphasize collaborative, multistate efforts whenever available.**

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 Zn and Mn nutrition, especially in cattle given anabolic implants. Implanting cattle maintained insulin sensitivity longer in the feeding period, likely contributing to increased feed efficiency. Examinations of how ethanol co-products, and also Zn and vitamin A affect bovine immunity suggest there are ways to improve cattle resilience to disease through strategic nutrient supplementation.

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 cattle a high protein ethanol co-product resulted in poorer DMI early in the feeding period, but a rebound in intakes and a robust performance response during the beta agonist feeding period.

Intranasal vitamin A increased plasma vitamin A concentrations and improve some markers of lung health during a disease challenge.

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.
None at this time.

Objective 2. To enhance the environmental sustainability of the feedlot industry through conservation and nutrient management.
None at this time.

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

Studies examined the impact of Zn, high protein coproducts, vitamin A on cattle immunity, and improvements in immune cell markers suggest nutrient supplementation at the right time during or prior to disease challenge may positively affect cattle health and thus overall beef production.

5. Impact

Work at Iowa State University has continued to move towards more strategic trace mineral supplementation to feedlot cattle utilizing growth promoting technology. Looking specifically at periods of high growth rates, increasing supplemental Mn during the terminal implant period improved performance of steers during the first half, with minimal overall effects.

Examination of novel feedstuffs, such as high protein ethanol co-products indicates beta agonist supplementation induces different responses to these coproducts, perhaps suggesting implications of the yeast content, the branch chain amino acid content, or the rumen undegradable protein content of the product for how cattle grow when fed a beta agonist.

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

1. Rients, E., A. VanDerWal, D. Loy, M. Reynolds, **S. Hansen**. 2022. Survey of feedlot nutritionists gives insight on information-seeking behavior. Trans. Anim. Sci. 6(4):txac114.
2. Heiderscheit, K. J., **S. L. Hansen**. 2022. Effect of increasing zinc supplementation on post-transit performance, behavior, blood and muscle metabolites, and gene expression in growing beef feedlot steers. J. Anim. Sci. 100(9):skac246.
3. Hochmuth, K., Schulte, M., Messersmith, E., Huff-Lonergan, and **S. Hansen**. 2022. The influence of supplemental zinc and ractopamine hydrochloride on the performance and longissimus proteome of finishing beef steers. Meat and Muscle Biology. 6(1):14456, 1–17.
4. Rients, E., E. Deters, C. Belknap, J. McGill and **S. Hansen**. 2022. Effects of feeding *Saccharomyces cerevisiae* fermentation product and ractopamine hydrochloride to finishing beef steers on growth performance, immune system and muscle gene expression. J. Anim. Sci. 101:skac311.
5. Dornbach, C. W., A. Beenken-Babb, D. W. Shike, **S. L. Hansen** and J. C. McCann. 2022. Effects of injectable vitamin E before or after transit on receiving phase growth performance, health, and blood parameters of beef steers. J. Anim. Sci. 101:skac333.
6. Beenken-Babb, A., C. W. Dornbach, E. L. Deters, D. W. Shike, **S. L Hansen**, and J. C. McCann. 2022. Effects of injectable vitamin C at weaning and prior to transit on growth performance of early-weaned beef steers. J. Anim. Sci. 101:skac307.
7. Smerchek, D. T., M. E. Branine, J. L. McGill, and **S. L. Hansen**. Effects of supplemental Zn concentration and trace mineral source on immune function and associated

biomarkers of immune status in weaned beef calves received into a feedlot. J. Anim. Sci. Accepted.

Abstracts
Deters, E. L., E. L. Rients, R. Carmichael, O. N. Genther-Schroeder, and S. L. Hansen. 2022. Dietary zinc and ractopamine elicit changes in gene expression of zinc transporters in the muscle of finishing beef steers. J. Anim. Sci. 100(Suppl. 3): 166.

Franco, C. E., F. E. Diaz, E. Rients, D. T. Smerchek, S. L. Hansen and J. L. McGill. 2022. The effects of dietary zinc supplement on intracellular zinc concentration in bovine immune cells. J of Immun. 208(Suppl 1): 124.16.

Diaz, F. E., E. Rients, C. E. Franco, D. T. Smerchek, S. L. Hansen, J. L. McGill. 2022. Dietary zinc supplementation impact on relative frequency and innate function of peripheral bovine immune cells. J. of Immun. 208(Suppl 1): 124.18.

Hansen, S. L., E. M. Messersmith, and E. L. Deters. 2022. State of the art: zinc and copper nutrition for feedlot cattle. Invited. J. of Anim. Sci. 100 (Suppl. 2):111.

Messersmith, E.M., D. Smerchek, and S. L. Hansen. 2022. Awardee talk: What we know now: strategic zinc supplementation for cattle utilizing growth promoting technologies. J. Anim. Sci. 100 (Suppl 2):108.

Deters, E. L. and S. L. Hansen. 2022. Proteomic analysis reveals differential tissue responses to road transportation in beef steers. J. Anim. Sci. 100 (Suppl 2): 109.

Franco, C., F. Diaz, E. Rients, D. Smerchek, S. Hansen and J. McGill. 2023. Dietary zinc and BRD effects on intracellular zinc concentration and transporter expression in bovine immune cells. Conference of Research Workers in Animal Disease. Chicago.

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.
ISU Beef Short Course. August 2022. Ames, IA.

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

Iowa State and Illinois collaborated to study the effects of vitamin E injection on early weaned calf response to shipping, this work in addition to our vitamin C work was published in the NCCC-308 special topics JAS edition.

9. Other relevant accomplishments and activities.

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 and carcass outcomes. Our research suggests that increasing the proportion of roughage in finishing cattle diets improves dry matter intake (DMI) without negatively impacting performance; whereas, removing roughage and increasing the proportion of fibrous byproducts decreases DMI and improves feed efficiency.

Accomplishments

Effects of Starch Dilution with Roughage or Wet Distillers Grains with Solubles on Growth Performance, Carcass Characteristics, and Rumen Buffering of Feedlot Steers. This study evaluated performance and carcass characteristics of beef cattle fed diets diets that included varying concentrations of corn stalks and/or wet distillers grains with solubles. Cattle were fed 1 of 4 dietary treatments consisting of steam-flaked corn-based diets containing: 1) **CON**; 7.50 % corn stalks on a DM basis fed for the entire feeding period, 2) **CS;** 14.75% corn stalks on a DM basis fed from terminal implant to slaughter, 3) **WD**; 9.50% wet distillers grains with solubles, and 7.50% corn stalks on a DM basis fed from terminal implant to slaughter, and 4) **NR**; 19.00% wet distillers grains with solubles, and 0.0% corn stalks on a DM basis fed from terminal implant to slaughter. Results suggest increasing the proportion of corn stalks in the diet post-terminal implant administration increases DMI and metabolizable energy intake with no impact on feed efficiency. In contrast, removing corn stalks from the diet and increasing the proportion of wet distillers grains with solubles to provide an equivalent starch concentration reduced DMI and improved feed efficiency.

Impact Statements

Historically, feedlot cattle diets contain high concentrations of processed grains and low amounts of traditional roughage sources to improve cost of gain and maximize feed efficiency. However, these diets typically provide high amounts of readily available starch to the animal, which can increase the risk for metabolic disorders. Decreasing the dietary concentration of starch may be beneficial for cattle gut health, but does not always result in improved performance, particularly when traditional roughage sources are used. However, increasing the energy concentration of the diet via added fat may provide a way to improve performance of cattle fed diets with greater proportions of roughage. In contrast, the results observed for cattle fed diets containing no roughage and greater proportions of wet distillers grains with solubles indicate there may be potential to remove roughage from the diet without greatly impacting rumen health parameters. This research is important to feedlot cattle producers as it suggests perhaps physically effective roughage sources are not needed to maintain rumen health, but do influence cattle DMI.

Selected Written Works

Spowart, P. R., J. T. Richeson, D. M. Crawford, and K. L.Samuelson. 2022. Impacts of including Sweet Bran and wet distillers grains with solubles alone or in combination in finishing cattle diets on physically effective fiber concentrations and ruminal buffering characteristics of feedlot cattle. Transl. Anim. Sci. 6:1–13.

Spowart, P. R., J. T. Richeson, D. M. Crawford, and K. L. Samuelson. 2022. Finishing diets including Sweet Bran and wet distillers grains with solubles alone or in combination improve performance and carcass characteristics of feedlot steers. Appl. Anim. Sci. 38: 118–128.

Crawford, D. M., J. T. Richeson, T. L. Perkins, and K. L. Samuelson. 2022. Feeding a high energy diet upon arrival to high-risk feedlot calves: effects on health, performance, ruminal pH, rumination, serum metabolites, and carcass traits. J. Anim. Sci. 100:1–12.

Crawford, D. M., K. E. Hales, T. M. Smock, N. A. Cole, and K. L. Samuelson. 2022. The impact of modern diets and growth technologies on animal growth performance and the carbon footprint of cattle feeding. Appl. Anim. Sci. 38:47–61.

Nickodem, C., A. N. Arnold, K. B. Gehring, J. J. Gill, J. T. Richeson, K. L. Samuelson, H. M. Scott, J. K. Smith, T. M. Taylor, J. Vinasco, and K. N. Norman. 2023. A longitudinal study on the dynamics of Salmonella enterica prevalence and serovar composition in beef cattle feces and lymph nodes and potential contributing sources from the feedlot environment. Appl. Environ. Microbiol. 89.

Samuelson, K. L., M. E. Hubbert, E. R. Oosthuysen, and C. A. Löest. 2023. Effects of dietary protein concentration and degradability on performance, carcass characteristics, net energy utilization, and metabolizable protein balance of finishing beef heifers receiving 0 or 400 mg of ractopamine hydrochloride. Appl. Anim. Sci. 39:56-68.

NC Project Station Report Template

1. Impact Nugget:

Our research portfolio is focused on optimizing the use of byproducts, optimizing other diet ingredients that are economical for the feedyard sector, and mitigating greenhouse gas emissions via feed additives, feeding management strategies, and feedstuffs.

2. New Facilities and Equipment

We are constructing a new Feedlot Innovation Center with 36 pens, housing 60 head per pen in 4 different housing systems. We are also constructing a new 240 head individual feeding facility. The processing center will house two different handling systems to compare worker experience and cattle behavior in those two different systems.

For PHREEC (Pandhandle Research, Education and Extension Center), the handling facility was updated by purchasing a new Arrowquip snake that will allow us to work cattle that are of larger 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.

□ 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. As the industry feeds less distillers grains or supply is variable, gains will decrease and will usually negative impact feed efficiency compared to feeding higher inclusions. Other ingredients included in diets with byproducts such as how corn processed or roughage sources also impact performance, with corn silage being an economical roughage source that is also resulting in best performance.

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

Evaluating total system greenhouse gas fluxes is a major priority and measuring carbon uptake in grazing systems will be critical to the future sustainability of the beef industry. During optimal grazing, uptake of carbon during summer pasture can offset all GHG emissions from birth to slaughter.

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 4 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.**

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.

** 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. The limit-feeding management strategy may make checking for and identifying sick cattle easier for the animal health crew at the feedlot.

6. Published Written Works.

Refereed Journal Articles

Carlson, Z. E., L. J. McPhillips, R. R. Stowell, G. E. Erickson, M. Drewnoski, and J. C. MacDonald. 2023. Evaluation of growth performance, carcass characteristics, and methane and CO_2 emissions of growing and finishing cattle raised in extensive or partial-intensive cow-calf production systems. J. Anim. Sci. 101:1-10. https://doi.org/10.1093/jas/skac368

Coulson, C. A., B. M. Boyd, B. C. Troyer, L. J. McPhillips, M. M. Norman, N. M. Woita, H. C. Wilson, K. M. Butterfield, T. J. Spore, and G. E. Erickson. 2023. Impact of different corn milling methods for high-moisture and dry corn on finishing cattle performance, carcass characteristics, and nutrient digestion. J. Anim. Sci. 101:1-10 https://doi.org/10.1093/jas/skac385

Troyer, B. C., E. J. Dennis, A. DiConstanzo, and G. E. Erickson. 2023. Pooled analysis on the effects of inclusion, moisture, and oil removal from distillers grains on cattle performance and economic returns in diets with different corn processing. J. Anim. Sci. 101:1-11 https://doi.org/10.1093/jas/skac358

Wilson, H. C., L. J. McPhillips, B. M. Boyd, A. K. Watson, J. C. MacDonald, and G. E. Erickson. 2023. Effect of increasing corn silage inclusion in finishing diets with or without tylosin on performance and liver abscesses. J. Anim. Sci. 101:1-12 https://doi.org/10.1093/jas/skac380

Winders, T. M., B. A. Melton, B. M. Boyd, C. N. Macken, A. K. Watson, J. C. MacDonald, and G. E. Erickson. 2023. Impact of shade in beef feedyards on performance, ear temperature, and heat stress measures. J. Anim. Sci. 101:1-10 https://doi.org/10.1093/jas/skad004

Hilscher, F. H., C. J. Bittner, J. L. Gramkow, M. L. Jolly-Breithaupt, M. M. Norman, H. C. Wilson, A. K. Watson, J. C. MacDonald, J. N. Anderson, and **G. E. Erickson**. 2022. The effect of corn silage hybrid and inclusion on performance of finishing steers and silage hybrid effects on digestibility and performance of growing steers. Transl. Anim. Sci. 6:1-10 https://doi.org/10.1093/tas/txac147

Sperber, J. L., B. C. Troyer, **G. E. Erickson**, and A. K. Watson. 2022. Evaluation of the effects of pine-sourced biochar on cattle performance and methane and carbon dioxide production from growing and finishing steers. Transl. Anim. Sci. 6:1-7 https://doi.org/10.1093/tas/txac152

Sperber, J. L., **G. E. Erickson**, and A. K. Watson. 2022. Evaluation of the effects of wood-sourced biochar as a feedlot pen surface amendment on manure nutrient capture. Transl. Anim. Sci. 6:1-10 https://doi.org/10.1093/tas/txac127

Experiment Station Reports

Colin, R. L., K. K. Buse, A. K. Watson, G. E. Erickson, and P. J. Kononoff. 2023. Effect of Alga Bio 1.0 on reducing enteric methane emissions from cattle. Neb. Beef Cattle Rep. MP117:73-74.

Funk, R. A., B. C. Troyer, M. M. Norman, L. J. McPhillips, and G. E. Erickson. 2023. Effect of ad libitum vs. limit feeding program at receiving on morbidity and performance of feedlot calves. Neb. Beef Cattle Rep. MP117:37-39.

Heil, H. A., B. C. Troyer, L. J. McPhillips, J. L. Sperber, M. M. Norman, G. E. Erickson, and A. K. Watson. 2023. Impact of pistachio shell biochar in finishing beef cattle diets. Neb. Beef Cattle Rep. MP117:75-77.

Heil, H. A., B. C. Troyer, M. M. Norman, G. E. Erickson, and A. K. Watson. 2023. Ponderosa pine wood biochar used as an emissions reduction strategy in a finishing beef cattle diet. Neb. Beef Cattle Rep. MP117:78-80.

McPhillips, L. J., Z. E. Carlson, A. Suyker, J. MacDonald, T. Awada, J. Okalebo, S. R. S. Dangal, R. R. Stowell, A. K. Watson, and G. E. Erickson. 2023. Greenhouse gas emissions from two beef systems from birth to slaughter in Eastern Nebraska. Neb. Beef Cattle Rep. MP117:81-86.

Miller, J. L., B. C. Troyer, L. J. McPhillips, M. M. Norman, J. C. MacDonald, and G. E. Erickson. 2023. Effect of corn processing on steer performance and fecal starch content. Neb. Beef Cattle Rep. MP117:62-63.
Miller, J. L., K. H. Wilke, G. E. Erickson, and P. L. Loza. 2023. Effect of enogen feed corn inclusion in conventional and natural finishing cattle diets. Neb. Beef Cattle Rep. MP117:64-66.
Miller, J. L., N. R. Meier, K. H. Wilke, G. E. Erickson, and P. L. Loza. 2023. Effects of corn processing and silage inclusion in feedlot diets on steer performance. Neb. Beef Cattle Rep. MP117:67-69.
Sjostrand, R. L., R. Prachumchai, M. Youngers, R. A. Stock, J. C. MacDonald, and G. E. Erickson. 2023. Effects of individual Sweet Bran components in beef finishing diets on nutrient digestion. Neb. Beef Cattle Rep. MP117:48-50.
Suarez-Lorences, S., B. C. Troyer, M. M. Norman, J. C. MacDonald, and G. E. Erickson. 2023. Impact of constant inclusion or decreasing inclusion of distillers grains with high-quality or low-quality roughage on finishing cattle performance. Neb. Beef Cattle Rep. MP117:55-56.
Suarez-Lorences, S., B. C. Troyer, M. M. Norman, P. L. Loza, R. Stock, J. C. MacDonald, and G. E. Erickson. 2023. Impact of removing 20% distillers grains after one-third or two-thirds of the feeding period on performance of finishing yearlings. Neb. Beef Cattle Rep. MP117:57-58.
Troyer, B. C., E. J. Dennis, A. DiCostanzo, and G. E. Erickson. 2023. Evaluate the effect of corn processing, drying distillers grains, oil removal from distillers grains, and distillers inclusion on cattle performance. Neb. Beef Cattle Rep. MP117:51-54.

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, G. .E Erickson, P. L. Loza. Plains Nutrition Conference, San Antonio, TX. April 6 and 7th , 2023.

Oral Presentations, Beef Feedlot Roundtable Series at Bridgeport, North Platte, and West Point February 7-9, 2023. Research Update, Site Specific Research.

McPhillips, L, A. Suyker, Y. Xiong, A. Watson, and G. Erickson. 2022. Impacts of Cow System on Greenhouse Gas Emissions of Beef Production. 8th Int. Greenhouse Gas and Animal Agriculture Conference, Orlando, FL.
Heil, H. A., B. Troyer, L. J. McPhillips, J. l. Sperber, A. K. Watson, and G. E. Erickson. 2022. Effects of Feeding Biochar to Finishing Beef Cattle on Enteric Methane Production. 8th Int. Greenhouse Gas and Animal Agriculture Conference, Orlando, FL.
Heil, H. A., B. Troyer, L. J. McPhillips, J. L. Sperber, A. K. Watson, and G. E. Erickson. 2022. 209 Effects of biochar in finishing beef cattle diets on greenhouse gas emissions. J. Anim. Sci. 100 (Suppl. 2):98-99. https://doi.org/10.1093/jas/skac064.164

McPhillips, L. J., Z. Carlson, J. C. MacDonald, A. Suyker, T. Awada, A. K. Watson, J. Okalebo, Y. Xiong, S. Dangal, H. A. Heil, R. Stowell, and G. E. Erickson. 2022. 211 Greenhouse gas emissions from two beef systems from birth to slaughter in Eastern Nebraska. J. Anim. Sci. 100 (Suppl. 2):102. https://doi.org/10.1093/jas/skac064.170

Meier, N. R., K. Wilke, G. E. Erickson, and P. Loza. 2022. 198 Effects of corn processing and silage inclusion levels in feedlot diets on steer performance. J. Anim. Sci. 100(Suppl. 2):96. https://doi.org/10.1093/jas/skac064.159

Sjostrand, R., B. Troyer, L. J. McPhillips, M. Youngers, R. Stock, J. C. MacDonald, and G. E. Erickson. 2022. 196 Interaction of corn processing method and sweet bran inclusion in finishing diets. J. Anim. Sci. 100(Suppl. 2):94-95. https://doi.org/10.1093/jas/skac064.156

Sperber, J. L., B. Troyer, M. Norman, L. J. McPhillips, A. K. Watson, and G. E. Erickson. 2022. 210 Evaluation of the effects of wood-sourced biochar as a feedlot pen surface amendment on manure nutrient capture. J. Anim. Sci. 100 (Suppl. 2):98 https://doi.org/10.1093/jas/skac064.163

Suarez-Lorences, S., B. C. Troyer, M. M. Norman, P. L. Loza, R. A. Stock, J. C. MacDonald, and G. E. Erickson. 2022. 344 Impact of removing 20% distillers grains after one-third or two-thirds of the feeding period on performance of finishing yearlings. J. Anim. Sci. 100(Suppl. 3):169-170. https://doi.org/10.1093/jas/skac247.314

Troyer, B., M. Norman, L. J. McPhillips, A. K. Watson, J. C. MacDonald, and G. E. Erickson. 2022. 200 Evaluating performance of calf-fed steers fed steam-flaked corn based finishing diets with varying levels of distillers grains. J. Anim. Sci. 100 (Suppl. 2):95. https://doi.org/10.1093/jas/skac064.157

Troyer, B., Z. Carlson, L. J. McPhillips, A. K. Watson, J. C. MacDonald, and G. E. Erickson. 2022. 202 Evaluating finishing performance of cattle fed high-moisture corn:steam-flaked corn blends with modified distillers grains. J. Anim. Sci. 100(Suppl. 2):92-93. https://doi.org/10.1093/jas/skac064.152

Xiong, J., C. Suntara, R. Sjostrand, T. Spore, M. Youngers, R. Stock, G. E. Erickson, and J. C. MacDonald. 2022. 199 Characterizing digestion traits of corn bran products from corn wet milling. J. Anim. Sci. 100(Suppl. 2):95-96. https://doi.org/10.1093/jas/skac064.158

2023 Purdue University NCCC 308 Station Report
Jon Schoonmaker

Impact Nugget

Addition of an exogenous glucoamylase enzyme to feedlot diets containing greater than 42% corn silage (DM basis) improves gain and efficiency late in the feeding period. Dietary inclusion of Tylosin, Monensin, or Chlortetracylcine (CTC) improve intestinal integrity and decrease leaky gut.

Accomplishments

Addition of an exogenous glucoamylase enzyme to feedlot diets containing greater than 42% corn silage (DM basis) may increase feed efficiency. Increasing corn silage content in feedlot cattle diets from 15 to 42 to 69% (DM basis) did not affect DM intake, but did decrease average daily gain (ADG) and gain:feed. Addition of a glucoamylase enzyme increased ADG and gain:feed late in the feeding period in feedlot cattle fed 42% corn silage (DM basis) but not in cattle fed 15 or 69% corn silage.

Dietary non-therapeutic antibiotics improve intestinal integrity and decrease leaky gut. Compared to no dietary antibiotics, Tylosin, Monensin, and Chlortetracycline decreased chromium EDTA leakage into urine and appearance of inflammatory markers in serum (lipopolysaccharide binding protein; LBP) in cattle fed 93% concentrate diets suggesting that non-therapeutic dietary antibiotics improve intestinal integrity. Tylosin + Monensin increased jejunal villus height:crypt depth ratio in grain-fed cattle, but CTC did not compared with cattle not fed non-therapeutic antibiotics.

Impact Statements

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

N/A

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

N/A

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

Addition of an exogenous glucoamylase enzyme to feedlot diets containing greater than 42% corn silage (DM basis) improves gain and efficiency late in the feeding period.

Objective 4. To enhance management strategies that improves animal health and well-being.

Dietary inclusion of Tylosin, Monensin, or Chlortetracylcine (CTC) improve intestinal integrity and decrease leaky gut.

Published Works

Refereed journal articles (for 2022)

Bitsie, B., A.M. Osorio, D.D. Henry, B.C. Silva, L.A Godoi, C. Supapong, T. Brand, and J.P. **Schoonmaker**. 2022. Enteric methane emissions, growth, and carcass characteristics of feedlot steers fed a garlic and citrus based feed additive and three different forage concentration. J. Anim. Sci. 100:skac139. https://doi.org/10.1093/jas/skac139

Ceja, G., J.P. Boerman, R.C. Neves, N.S. Johnson, J.P. **Schoonmaker**, M.W. Jorgensen, and J.S. Johnson. 2022. A procedure for urine collection in 1-week and 6-week-old preweaned heifer calves for evaluation of in vivo intestinal permeability. J. Anim. Sci. 100:skac213. https://doi.org/10.1093/jas/skac213

Centeno-Martinez, R.E., N. Glidden, S. Mohan[G], J.L. Davidson, E. Fernandez-Juricic, J.P. Boerman, J**. Schoonmaker**, D. Pillai, J. Koziol, A. Ault, M.S. Verma, and T.A. Johnson. 2022. Identifying bovine respiratory disease through the nasal microbiome. Anim. Microbiome 4:15. https://doi.org/10.1186/s42523-022-00167-y

Ramirez-Zamudio, G.D., W.F.G da Cruz, J.P. **Schoonmaker**, F.D de Resende, G.R. Siqueira, O.R. Machado-Neto, T.R.S. Gionbelli, P.D. Teixeira, L.M. Rodriques, M.P. Gionbelli, M.M. Ladeira. 2022. Effect of rumen-protected fat on performance, carcass characteristics and beef quality of the progeny from Nellore cows fed by different planes of nutrition. Liv. Sci. 104851. https://doi.org/10.1016/j.livsci.2022.104851

Teixeira, P.D., J.P. **Schoonmaker**, J.R.R Carvalho, C.V.R. Oliveira, A.C. Rodrigues, L.R. Santos and M.M. Ladeira. 2022. Fatty acid profile and beef quality of Nellore and Angus bulls fed whole shelled corn. Sci. Agric. 79:e20200273 https://doi.org/10.1590/1678-992X-2020-0273

Extension Publications

Boerman, J., J. **Schoonmaker**, M. Kepler, C. Croney, J. Koziol. 2022. Use of Technology to detect bovine respiratory disease in cattle. Purdue University Extension Publication AS-688-W. https://www.extension.purdue.edu/extmedia/AS/AS-688-W.pdf

Symposium Proceedings

None

Poster Presentations

None

Scientific and Outreach Oral Presentations

Use of Technology to Improve the Health of Beef Cattle. Lowe's Pellets and Grain producer meeting. February 16, 2022

Ceja, G., J.P. Boerman†, R.C. Neves†, J.P. **Schoonmaker**†, M.W. Jorgensen, and J.S. Johnson*. 2022. The influence of L-glutamine supplementation on measures of intestinal permeability, immune function, and physiological stress in Holstein heifer calves. J. Anim. Sci. 100 (Suppl 2):15. https://doi.org/10.1093/jas/skac064.025 Oral presentation and the Midwest American Society of Animal Science meetings. Omaha, NE, March 14-16, 2022

Interrelationships between the microbiome, gut health, and animal growth. (co-presentation with Dr. Josh McCann, University of Illinois). Midwestern Section ASAS Regional Meeting. Omaha, NE. March 15, 2022

Beef carcass quality and yield grading. Indiana Market Reporting Service, Indiana State Department of Agriculture producer meeting. August 19, 2022.

Detecting BRD and antibiotic susceptibility through the nasal microbiome: what we have learned from producers and veterinarians. (co-presentation with Dr. Jacquelyn Boerman). Purdue Veterinary Conference. West Lafayette, IN. September 21, 2022

CA Project Station Report NCCC-308
James W. Oltjen

1. Impact Nugget
Sorting incoming feedlot cattle on model predicted days on feed to a carcass endpoint increases profit, and bunk management can affect apparent maintenance energy requirements of beef cattle.

2. New Facilities and Equipment
We have now installed and used the Insentec RIC system.

3. Unique Project Related Findings. List anything noteworthy and unique learned this year.
Extending our work on beef finishing systems, we determined maintenance of individual and pen fed steers. Also we measured feeding behavior of the two groups. Further, sorting cattle on expected days to a given carcass endpoint is more profitable and decreases carcass variation compared to sorting on initial body weight.

4. Accomplishment Summaries
We fed a set of cattle in both traditional pens, and in individual Insentec feeders, and measured intake, growth, carcass composition, and calculated apparent maintenance requirements. Further, we sorted the pen fed cattle into groups based on either their initial weight or expected days on feed to the choice grade. We determined maintenance of individual and pen fed steers. Also we measured feeding behavior of the two groups. Further, sorting cattle on expected days to a given carcass endpoint is more profitable and decreases carcass variation compared to sorting on initial body weight

5. Impact Statements
Our work showed that apparent maintenance requirements depend on feed availability in feedlot systems, and that time of eating between steers is not correlated to feed intake, but is within a steer Also sorting cattle by expected days on feed increases profit.

6. Published Written Works
None this period.

7. Scientific and Outreach Oral Presentations
Harrison, M.A., P. Demochkina, and J.W. Oltjen. 2022**.** Individual animal feed intake estimation using bunk cameras and feeding algorithms. Proc. European Conf. on Precision Livestock Farming Annual. Aug. 29–Sept. 01. Vienna, Austria.

Harrison, M.A., and J.W. Oltjen. 2022**.** Parameter updates in the Davis Growth Model for growth, intake, and composition of modern Angus cross cattle. Proc. International Symposium on Energy and Protein Metabolism and Nutrition. Sept. 12–15. Granada, Spain.

Harrison, M.A., P. H. V. Carvalho, S. E. Meija Turcios, and J.W. Oltjen. 2022. Application of feeding behavior as a method to predict individual steer feed intake**.** Proc. Modelling Nut. Dig. and Utiliz. In Farm Anim. Sept. 18-21. Alghero, Sardinia. Italy

Harrison, M.A., and J.W. Oltjen. 2021. Effect of a reduction in linear bunk space on feedlot steer performance and body composition. Trans. Anim. Sci. 5(Supplement_S1):S34–S37. doi: 10.1093/tas/txab174

8. Fund leveraging, specifically, collaborative grants between stations and members.
None this period.

9. Other relevant accomplishments and activities.
Graduating PhD students are now working at JBS and C-Lock.

Examples of Station Report Content (Courtesy of Dr. Marc van Iersel - for your consideration, from another Multi-State Research project)

Impact Nugget Examples:
Michigan State University has developed and distributed software to bedding plant growers that can potentially reduce their energy consumption by up to 30% by optimizing temperature and light.

University of Georgia has developed recommendations for using automated irrigation controllers that may reduce water use by 40% to 70%.

Examples of Accomplishments:
Purdue University grew five day-neutral or everbearing cultivars of strawberry plants with three different day/night temperature regimes in growth chambers or in a greenhouse. Chamber plants were hand pollinated, while greenhouse plants were pollinated by hand or by vibrating wand. The coolest temperatures (18 C days/10 C nights) produced more berries with better flavor. No effect of pollination method was found, possibly due to heavier insect loads on plants pollinated more intensively.

Rutgers University quantified the impact of a manually operated energy curtain on the recorded inside soil and air temperatures and daily light integrals during early season high tunnel production of tomato. Data collected from late March through mid-May for two New Jersey locations and two growing seasons revealed that the use of an energy curtain inside a high tunnel increased the inside nighttime air temperature on average by 1.4 °C (or 13%) compared to a tunnel without a curtain. The use of an energy curtain inside a high tunnel increased the inside nighttime soil temperature on average by 0.5°C (or 4%) compared to a tunnel without a curtain but also decreased the accumulated inside light by approximately 5%.

Examples of Impact Statements:
Lighting and temperature studies at Michigan State University have quantified the effects of growing bedding plants under different greenhouse conditions. As a result, flowering time and plant quality can be more accurately predicted by commercial greenhouse growers to meet their scheduled market dates. This information can be incorporated with energy consumption models to predict the amount of energy consumed when crops are grown at different temperatures. Growers who optimize temperature and light can potentially reduce their energy consumption by up to 30%.

The availability of water for agricultural use is under pressure, and more efficient use of the available water is increasingly important. Research at the University of Georgia has shown that efficiency can be increased by applying water based on the actual needs of the crops. This can be done using automated irrigation controllers that maintain substrate water content at a grower-determined level. Research

indicates that a substrate water content of 15% (v/v) is adequate for most crops. Using automated controllers to maintain this substrate water level may reduce water use by 40% to 70%.

Format for Published Works (arrange alphabetically):

Books

Hartmann, H.T., D.E. Kester, F.T. Davies, Jr. and R.L. Geneve. 2002. Hartmann and Kester's Plant Propagation: Principles and Practices. Seventh Edition. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Book Chapters

Gent, M.P.N. and R.J. McAvoy. 2000. Plant growth retardants in ornamental horticulture. In: Plant Growth Regulators in Agriculture and Horticulture: Their Role and Commercial Uses. A.S. Basra, (ed.) Good Products Press, NY. pp. 89-146.

Refereed Journal Articles

Shimizu, H., E.S. Runkle, and R.D. Heins. 2004. A steady-state model for prediction of poinsettia plant shoot-tip temperature. J. Amer. Soc. Hort. Sci. 129:303-312.

Symposium Proceedings

Fleisher, D.H., H. Baruh and K.C. Ting. 2001. Model-based predictive control for biomass production in advanced life support. Proceedings of the 2nd IFAC-CIGR Workshop on Intelligent Control for Agricultural Applications, Bali, Indonesia. August 22-24. pp. 198-203.

Poster Presentations

Padhye, S., E.S. Runkle, and A.C. Cameron. 2005. Quantifying the vernalization response of Dianthus gratianopolitanus 'Bath's Pink'. HortScience 40:1013 (poster presentation).

Popular Articles

Albright, L.D., R.S. Gates, K.G. Arvanitis and A. E. Drysdale. 2001. Control strategies for plant shoot and root environments on Earth and in space. IEEE Control Systems Magazine: Agriculture and the Environment 21(5):28-47.

Fausey, B., E. Runkle, A.C. Cameron, R.D. Heins, W.H. Carlson. 2001. Herbaceous perennials: Heuchera. Greenhouse Grower 19(6):50-62.

Other Creative Works

Donnell, M. and T.H. Short. 2001. An interactive economic analysis and business plan for hydroponic lettuce production. Program was developed on an OSUE hydroponics homepage site.

Prenger J. and P.P. Ling. 2001. Greenhouse condensation control – understanding and using vapor pressure deficit (VPD). Ohio State University Extension Fact Sheet, AEX-804-2001. The Ohio State University, Columbus, OH 43210.

Format for Scientific and Outreach Presentations (arrange alphabetically)

Lopez, R.G. and E.S. Runkle. 2006. Quantifying the thermal tolerance of non-rooted Impatiens hawkeri cuttings and their subsequent performance. XXVII International Horticultural Congress, Seoul, Korea.

Runkle, E.S. 2005. Controlling plant growth and development with environment. International Plug & Cutting Conference, Dearborn, MI.

University of Illinois Station Report **NCCC308 2023**
Josh McCann

Impact Nuggets:

University of Illinois determined that a compensatory gain feeding protocol can be used in feedlot program without any negative impact on steer behavior at the bunk or growth performance.

University of Illinois determined that adapting beef cattle to lactic acid may positively influence ruminal fermentation and help mitigate acidosis in feedlot cattle.

Accomplishment Summaries:

Evaluating the effects of programmed compensatory gain on feedlot steers growth performance and behavior
Z.T. Buessing, J.J. Schwager, M.R. Murphy, B.M. Hannon, D.W. Shike, J.C. McCann
.
The objective was to determine the effects of programmed compensatory gain on feedlot steer growth performance and behavior. Simmental × Angus steers (n = 159; BW = 278 ± 49 kg) were blocked by weight, stratified by sire, and allotted to 10 pens. Each pen contained a 3.0 m-long bunk to allow 19 cm of linear bunk space per steer. Pens were randomly assigned to one of two treatments on d 0: control (CON) or programmed compensatory gain (PCG). To achieve programmed compensatory gain, the amount of feed offered to animals previously being fed ad libitum was reduced by 3.29% daily for 10 consecutive d. Thus, on d 54, PCG steers were consuming 72% of the original DMI and subsequently returned to ad libitum intake to facilitate a period of compensatory gain. Feed intake for CON pens was managed using a clean bunk strategy for the entire experiment. Steers were fed a common diet and fed twice daily at 0800 h and 1200 h. Programmed compensatory gain steers did have a greater ($P = 0.03$) ADG than CON steers from d 39-63. Control steers tended ($P = 0.07$) to have a greater ADG than PCG steers from d 63-92. From d 39-63, PCG steers had a greater ($P < 0.01$) G:F when compared with CON steers. However, from d 63-92, CON steers had greater ($P = 0.05$) G:F than PCG steers. The treatment did not affect ($P \geq 0.15$) overall BW, ADG, DMI, and G:F. No treatment effect was observed ($P \geq 0.14$) for any carcass characteristics. A treatment × day interaction was observed for the proportion of steers at the bunk in the morning ($P = 0.02$); more PCG steers were at the bunk on d 47, 49, 51, 54, and 58. No treatment × day interaction was observed ($P \geq 0.14$) for the proportion of steers at the bunk in the afternoon, the proportion of steers waiting behind the bunk, the proportion of steers standing, or the occurrence of pushing. A greater ($P \leq 0.01$) proportion of PCG steers waited behind the bunk during both feeding times. A greater ($P < 0.01$) proportion of PCG steers stood in the morning. During both feeding times, a greater ($P = 0.01$) occurrence of pushing occurred by PCG steers. Overall, the programmed compensatory gain feeding protocol had minimal effects on steer growth performance and behavior.

Programmed compensatory gain feeding protocols should be further evaluated to determine the optimal length and severity of feed restriction.

Evaluating the effects of lactic acid adaptation in beef cattle prior to an acidosis challenge
Z. T. Buessing, B.A. Gaffney, H. F. Linder, S. M. Tondini, J. C. McCann

The objective was to determine if a seven-day lactic acid adaptation in cannulated steers affected ruminal fermentation during an acidosis challenge. In the in vivo experiment, 18 steers (790 ± 68 kg) were assigned to one of two treatments: control (**CON**) 500 mL of H_2O or 1 mM DL-Lactic acid solution per kg steer BW (**LAC**). Treatments did not affect ($P \geq 0.65$) dry matter intake (**DMI**) before or after the acidosis challenge. A treatment × time interaction was not observed ($P = 0.83$) for ruminal pH, but pH was affected ($P < 0.01$) by time and remained between 5.6 and 5.0 for about 14 h during the challenge. A companion experiment was conducted to determine if lactic acid adaptation in cannulated steers affected fermentation characteristics in an ex vivo model utilizing the previously described steers. Rumen fluid was collected prior to treatments being administered on d 7 of adaptation and added to 3 flasks containing corn, DDG, and corn silage. A treatment × hour effect ($P < 0.01$) was observed for pH; LAC had a greater pH at h 12. A treatment × hour interaction was not observed ($P \geq 0.15$) for lactic acid and NH_3 Overall, a 7-day lactic acid adaptation period impacted ex vivo fermentation but had minor effects in cannulated steers during an acidosis challenge. Further research is warranted to refine the lactic acid adaption period to help mitigate acidosis in feedlot cattle.

Published Works:

Journal Articles

Beenken-Bobb, A. M., C. W. Dornbach, E. L. Deters, D. W. Shike, S. L. Hansen, and J. C. McCann. 2023. Effects of injectable vitamin C at weaning and prior to transit on growth performance of early-weaned beef steers. J. Anim. Sci. 101:1-7. doi: 10.1093/jas/skac307

Dornbach, C. W., A. M. Beenken-Bobb, D. W. Shike, S. L. Hansen, and J. C. McCann. 2023. Effects of injectable vitamin E before or after transit on receiving phase growth performance, health, and blood parameters of beef steers. J. Anim. Sci. 101:1-10. doi: 10.1093/jas/skac333

Shao, T, J. C. McCann, and D. W. Shike. 2023. Effects of late gestation supplements differing in fatty acid amount and profile to beef cows on cow performance, steer progeny growth performance through weaning, and relative mRNA expression of genes associated with muscle and adipose tissue development. Animals. 13:437. doi: 10.3390/ani13030437

Tondini, S. M., R. I. Mackie, and J. C. McCann. 2023. Polyclonal antibodies inhibit growth of key cellulolytic rumen bacterial species. Front. Microbiol. 14:119649. doi: 10.3389/fmicb.2023.1196492

Meeting Abstracts

Buessing, Z., B. Gaffney, J. McNelis, H. Linder, S. M. Tondini, and J. C. McCann. 2022. Evaluating the Effects of lactic acid adaptation in beef cattle prior to an acidosis challenge. ASAS-CSAS Annual Meeting. June 26-30. Oral presentation.

Junior, J. O., E. Domingues, T. Bernardes, M. P. Gionbelli, D. R. Casagrande, P. Teizeria, T. Gionbelli, J. C. McCann, and M. M. Ladeira. 2022. Intramuscular fat and expression of genes involved in lipid metabolism and gluconeogenesis in Nellore bulls fed snaplage. ASAS-CSAS Annual Meeting. June 26-30. Poster presentation.

Dornbach, C. W. and J. C. McCann. 2022. Effects of dietary forage inclusion during finishing on growth performance, feeding behavior, and ruminal fermentation in steers at risk for acidosis. ASAS-CSAS Annual Meeting. June 26-30. Poster presentation.
Junior, J. O., E. Kwon, and J. C. McCann. 2022. Lysophospholipids supplementation increases growth performance and hot carcass weight in finishing beef steers. ASAS-CSAS Annual Meeting. June 26-30. Poster presentation.

Linder, H. F., J. Li, L. L. Berger, A. R. Green-Miller, and J. C. McCann. 2022. Impact of ruminal acidosis on cattle energy metabolism. ASAS-CSAS Annual Meeting. June 26-30. Poster presentation.

Pugh, L. M., W. P. Chapple, W. T. Meteer, J. C. McCann, and D. W. Shike. 2023. Effects of creep feed duration in a drylot system on cow performance and reproduction as well as calf performance through receiving. Midwest ASAS Meeting. March 13-15. Oral presentation.

Buessing, Z. T., J. Schwager, M. Murphy, B. Hannon, D. W. Shike, and J. C. McCann. 2023. Effects of programmed compensatory gain on feedlot steer performance. Midwest ASAS Meeting. March 13-15. Oral presentation.

Linder, H., A. Fritz, and J. C. McCann. 2023. Effects of forage or coproduct-based transition diets on the rumen microbiome and ruminal fermentation ex vivo in feedlot steers. Midwest ASAS Meeting. March 13-15. Poster presentation.

Schwager, J., Z. T. Buessing, B. Hannon, M. Murphy, D. W. Shike, and J. C. McCann. 2023. Effects of programmed compensatory gain on feedlot steer behavior. Midwest ASAS Meeting. March 13-15. Oral presentation.

Jensen, V., H. F. Linder, M. Cecava, J. C. McCann. 2023. The effects of a novel brewer's yeast product on ruminal fiber fermentation in vitro. Midwest ASAS Meeting. March 13-15. Poster presentation.

<u>Oral Presentations:</u>

"Avenues for protein feeding to drive sustainability in the feedlot" presented at the Minnesota Nutrition Conference, September 21, 2022 in Mankato, MN

"Success on Slats: Cattle Mobility and Conformation" presented at the Driftless Region Beef Conference, January 27, 2023 in Dubuque, IA

NC Project Station Report Template

****For impacts and accomplishments, try to emphasize collaborative, multistate efforts whenever available.**

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 nutrient balance experiment to evaluate the effects of feeding hempseed cake (HEMP) or dried corn distillers grains plus solubles [DDGS; each included at 20% of diet dry matter (DM) in respective treatments] in comparison to a dry-rolled corn-based control treatment (CON) on organic matter (OM) intake, ruminal fermentation parameters, nutrient digestibility, nutrient flow and nitrogen (N) balance in crossbred steers. Results suggested that, although ruminal digestibility of all nutrients is greater in steers fed the HEMP diet, the greater ADF concentration in hempseed cake negatively influences total tract apparent OM digestibility when fed to finishing steers. However, N digestion and retention was improved in steers fed hempseed cake suggesting that it could be a viable alternative feed for use as a protein supplement in finishing 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 plasma metabolites and cytokines 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. Plasma concentrations of some proinflammatory and anti-inflammatory cytokines were decreased and increased, respectively in lambs receiving VIP. Also, plasma concentrations of urea nitrogen and blood glucose increased and decreased, respectively, in lambs receiving VIP. These results suggest that VIP may have anti-inflammatory effects and alter nutrient partitioning in lambs fed a high-grain diet. More research is needed to further study potential effects on tissue inflammatory responses and on hormonal signaling related to nutrient use and partitioning better describe the regulatory mechanism mediating VIP's effects on inflammation, nutrient partitioning, and growth.

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.

A special collection of manuscripts was published in the Journal of Animal Sciences highlighting the current research and the collaborative research conducted by members of the NCCC308 coordinating committee.

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, 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. (accepted)

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

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.

Hawley, E., K. Mia, M. Yusuf, K. C. Swanson, C. Doetkott, and G. P. Dorsam. 2022. Messenger RNA gene expression screening of VIP and PACAP neuropeptides and their endogenous receptors in ruminants. 11:1512.

Chakrabarty, S., E. M. Serum, T. M. Winders, B. Neville, M. D. Kleinhenz, G. Magnin, J. F. Coetzee, C. R. Dahlen, K. C. Swanson, and D. J. Smith. 2022. Rapid quantification of cannabinoids in beef tissues and bodily fluids using direct-delivery electrospray ionization mass spectrometry. Food Addit. Contam. Part A Chem. Anal. Control Expo. Risk Assess. doi:10.1080/19440049.2022.2107711

Yusuf, **M., K. C. Swanson,** L. L. Hulsman Hanna, R. Degges, and M. L Bauer. 2022. Solar radiation and temperature as predictor variables for dry matter intake in beef steers. Front. Anim. Sci. 3:975093.

Neville, B. W. W. J. Pickinpaugh, L. J. Mittleider, R. L. Moore, K. C. Swanson, and J. S. Caton. 2022. Interaction of replacing corn silage with soyhulls as a roughage source with or without 3% added wheat straw in the diet: impacts on intake, digestibility and ruminal fermentation in steers fed high-concentrate diets. Transl. Anim. Sci. 6:txac061.

Winders, T. M., E. M. Serum, D. J. Smith, B. W. Neville, G. K. Mia, S. Amat, C. R Dahlen, and K. C. Swanson. 2022. Influence of hempseed cake inclusion on growth performance, carcass characteristics, feeding behavior and blood parameters in finishing heifers. J. Anim. Sci. 100:skac159.

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

9. Other relevant accomplishments and activities.