

**APPENDIX D**  
**SAES-422**  
**Format for Multistate Research Activity**  
**Accomplishments Report**

*Note: This report is submitted each year of an activity's duration and is due 60 calendar days following the annual meeting. The SAES-422 is submitted electronically by AAs into NIMSS. Annual Reports for MRF projects are available to CRIS and CSREES through NIMSS.*

**Project/Activity Number:** NCCC-308

**Project/Activity Title:** Nutrition and Management of Feedlot Cattle to Optimize Performance, Carcass Value and Environmental Compatibility

**Period Covered:** 10/1/2018—9/30/2019

**Date of This Report:** 7/15/18

**Annual Meeting Date(s):** 5/14/18—5/16/18

**Participants:** DiCostanzo Alfredo (dicos001@umn.edu) – University of Minnesota; Erickson Galen (gerickson4@unl.edu) – University of Nebraska; Hansen Stephanie (slhansen@iastate.edu) – Iowa State University; Henry Darren (darren.henry@ttu.edu) – Texas Tech University; Lawrence John ([jdllaw@iastate.edu](mailto:jdllaw@iastate.edu)) – Iowa State University; DiLorenzo Nicolas (ndilorenzo@ufl.edu) – University of Florida; Loy Dan (dloy@iastate.edu) – Iowa State University; Oltjen Jim (JWOltjen@ucdavis.edu) – University of California; Rusche Warren (warren.rusche@sdstate.edu) – South Dakota State University; Rust Steve (rust@msu.edu) – Michigan State University; Schoonmaker Jon (jschoonm@purdue.edu) – Purdue University; Swanson Kendall (kendall.swanson@ndsu.edu) – North Dakota State University; Relling Alejandro (relling.1@osu.edu) – Ohio State University; McCann Josh (jcmccan2@illinois.edu) – University of Illinois.

**Guests:** Anderson Pete (panderson@mwpm.com) – Midwest PMS; Blom Ethan ([ethan.blom@sdstate.edu](mailto:ethan.blom@sdstate.edu)) – South Dakota State University; Gentry Wesley ([Wesley.Gentry@sdstate.edu](mailto:Wesley.Gentry@sdstate.edu)) – South Dakota State University; Loe Erik (eloe@mwpm.com) – Midwest PMS; VanderPol Kyle ([kvanderpol@mwpm.com](mailto:kvanderpol@mwpm.com)) VanDerWal Allison ([vand0956@umn.edu](mailto:vand0956@umn.edu)) – University of Minnesota; Vermeer Evan (vermeer@mwpm.com) – Midwest PMS; Zeltwanger Joshua (zelt002@umn.edu) – University of Minnesota.

**Brief summary of minutes of annual meeting:** Committee members arrived on May 14. On May 15, there was time for introduction of new members and guests. Steven I Smith, USDA NIFA, updated the group on NIFA budget, competitive programs, and interagency funding opportunities. He also provided contact information for the Division of Animal Systems. John Lawrence, committee advisor, provided an update on committee approval and highlighted importance of reporting on committee member coordinated projects. The committee discussed how to encourage participation by committee members who may not have attended meetings recently. Additionally, the process whereby new members are encouraged to participate was addressed. Discussion on hosting the 2019 meeting collaboratively with researchers at Agriculture and Agri-food Canada at Lethbridge and cattle consultants working for Feedlot Health Management Services in Okotoks ensued. At the time of writing this report, the meeting

is tentatively set for the week of May 12, 2019. Proposed agenda is: tours of feedlots and research facilities (May 14), industry update and beginning station reports (May 15), station reports and adjourn (May 16). Following a group of station reports, a feedlot tour, coordinated by Midwest PMS consultants, was conducted to expose committee members to current issues and concerns regarding facilities, management and nutrition of cattle feedlots in the Upper Midwest. On May 16, Pete Anderson, cattle consultant with Midwest PMS, presented a summary of performance data using company and Elanco Animal Health information to highlight areas of research focus for committee members. In summary, these areas are: improving animal health and retaining marbling in the feedlot. Station reports were made by each attending university representative. Meeting was adjourned at noon.

**General:** In 2018, 12 committee members met to review accomplishments and to determine areas where they could coordinate further research and education efforts to support financial and environmentally sustainable production of feedlot cattle. Written and oral reports were provided by committee members to allow for the integration and reporting of the overall committee's outcomes, outputs, activities, milestones, and impacts. Further, coordination of research and education efforts was supplemented with a tour of commercial feedlot facilities in Northeast South Dakota and Northwest Iowa to maintain committee members informed and exposed to issues arising from production of feedlot cattle in confinement. Also, information on feedlot performance trends highlighting the need to effectively manage health and to retain marbling in the feedlot was presented by an industry representative.

### **Short-term Outcomes:**

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

Modification of ethanol processing technology is resulting in co-products with greater concentration of protein and fiber. Concurrently, incorporation of co-products from the sugar processing industry represent an alternative to corn grain use in times of greater corn grain prices; yet, knowledge of nutrient value of sugar-containing co-products in feedlot nutrition lags. The nutrient value of co-products from modified ethanol plants and those resulting from sugar production plants in high forage or high grain diets was determined. Roughages may play a role in enhancing carbon transformations in a feedlot production system. Efficiency of carbon transformations from roughages such as hay and corn silage in receiving and finishing diets and from corn processed by various methods in finishing diets were studied. Further, utilization of silage preservatives to enhance nutrient value of corn silage was incorporated in these studies. Fine-tuning amino acid and protein requirements of feedlot cattle continues to be a focus of activities.

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

The role of breed and breed crosses, particularly of dairy genotypes, on efficiency of feed conversion to meat protein needs to be elucidated as the dairy industry is relying on beef sires to enhance value of their production. Comparative nutrition approaches were used to determine effects of breed on feed conversion efficiency. A collaborative effort between Pennsylvania State University, University of Minnesota and The Ohio State University is emerging to develop best management practices for producing beef from dairy and dairy crossbred cattle.

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

Cattle feeding operations in the Upper Midwest are diversified. This may result in variable management approaches that may affect cattle health or productivity. Effects of intake fluctuations or feeding time on nutrient utilization were studied. With increasing societal pressure resulting from perception of use of growth-promotion technology, optimizing use of this technology is an issue of priority to the committee. The role of beta-agonists and growth-promoting implants on growth management and on nutrient utilization was studied. Also, the role of emerging genetic marker technologies to enhance efficiency of feedlot cattle production was evaluated. Work on maternal nutrition impact on progeny growth and efficiency continues in collaboration with Brazilian scientists.

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

Novel approaches to reduce reliance on antibiotics are needed. Members participated in efforts to evaluate feed additives based on eubiotics to reduce stress resulting from transport and arrival at cattle feedlots. The role of zinc in nutrient utilization in stressed lambs was studied as a model of zinc nutrition in the bovine. Also, effects of zinc or energy content on diet digestibility and growth rate was studied. Blood metabolite markers are currently evaluated to determine cattle health.

### **Outputs:**

Members of the committee actively participated in various research and education projects leading to 45 presentations where dissemination of results of their research activities occurred. Participants in these meetings were peers, cattle nutritionists and producers. Through peers and other nutritionists this committee ensures multiplication of dissemination efforts to even larger audiences. In addition, these committee members organized at least 13 conferences in which they extended information to end users and other nutritionists. Their combined research effort led to publication of 28 research abstracts and 52 refereed journal manuscripts. These research activities generated 27 proceedings and technical reports and 27 trade publications.

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

Because distillers grains contain 30% protein that is approximately 65% RUP, the excess protein contains more energy than carbohydrate (starch in corn or fiber), and because the protein bypasses rumen fermentation, no losses of carbon occur from ruminal fermentation.

Energy value of sugar co-products in high-forage but not in high-grain diets is lower than that of corn grain.

At the same maturity and crop, oat silage supported greater feed conversion than oat hay in receiving diets. At least some of the observed difference may have been due to diet integrity resulting from mixing a wetter ingredient (silage).

A silage preservative (Silo-Guard II) improved silage stability and recoveries of DM, NDF, S and starch.

Growth performance was improved in cattle fed 906 g/d MP or greater.

Supplemental lysine or arginine may not improve performance of feedlot steers, but

supplemental lysine can increase carcass leanness and arginine improves color stability during retail display and may improve marbling.

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

Breed appears to have little effect on digestion of fiber or starch. Yet, species differences (sheep vs cattle) dictate that use of sheep as a model for fiber digestibility in bovine be used with caution.

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

When managing feed bunks, there is a window of 2 hours where feed delivery may occur without affecting cattle performance.

Feeding behaviors during the finishing phase are highly repeatable and may increase their utility for making management decisions or in cattle selection

Ractopamine hydrochloride enhanced the utilization of N by improving microbial protein synthesis.

Suckling calf implants have positive effects on growth up to weaning age. Beyond weaning age, effects of implanting pre-weaning were not evident thereby permitting selection of implanting strategies appropriate for management conditions post-weaning.

An extended release (Revalor-XS) implant supports greater carcass marbling and quality grade when cattle fed are higher energy diet during the initial release phase (80 mg trenbolone acetate and 16 mg estradiol).

Supplementation of pregnant Nellore cows with protein during the dry season improves calf birth BW, cow BW gain and body condition during gestation, and can help cows recover from calving sooner.

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

Supplementing pre- and probiotic additives during the receiving phase improved gain and feed conversion efficiency.

Similarly, supplementing a pre- and probiotic supplement was observed to have positive implications on early receiving period performance and pre-transit antioxidant concentrations and could therefore be a beneficial addition to receiving cattle diets.

Supplementing diets of stressed lambs with Zn, as a model for bovine, revealed no benefits on retained Zn.

Zinc absorption and retention in feedlot cattle appear to be influenced by diet energy concentration and more positively impacted by low energy diets.

#### **Milestones:**

Committee members are utilizing basic and applied nutrition techniques to further define the energy value of co-products from modified processes to distill ethanol from grains and from sugar processing co-products. This information is made available to other nutritionists and cattle producers so that they may price and incorporate these products at appropriate concentrations.

Similarly, scientists working on coordinated projects in this committee are contributing information on optimized storage, use and processing of forages in receiving and finishing diets. Results are reported as energy values of these feeds and recommendations on appropriate concentration and type of these forages in diets of feedlot cattle.

Management of growth to optimize financial sustainability of feedlots while reducing impacts on the environment is a priority focus of committee members. Through the use of growth-promotion technology and mineral nutrition reductions in N output, optimized feedlot performance and retention of carcass quality are sought.

Committee members have made substantial progress in identifying alternatives to antibiotic use by using pre- and probiotic blends available commercially. Application of these additives is currently during the receiving period; but it may extend to the finishing phase. Utilization of additives in the finishing phase is a likely option but current additive prices make this proposition cost-prohibitive.

### **Impacts:**

Producers and consultants have more confidence in use of co-products and in predicting price changes that should occur as ethanol processes change.

Feeding greater proportions of corn and other silage in receiving and finishing diets in integrated crop-cattle feeding operations should render them more financially and environmentally sustainable.

Some pre- and probiotic preparations currently available commercially hold promise as alternatives to antibiotic use to support gain and feed conversion and health during the receiving phase.

Zinc requirements for growth and maintenance, akin to a net Zn requirement system, are now considered and may be a likely possibility in the near future.

### **Presentations**

1. DiCostanzo, A. Choice of corn crop endpoint and feedlot profitability—Pennsylvania State University Extension, February 2017
2. DiCostanzo, A. Choice of corn crop endpoint and feedlot profitability—Lancaster Cattle Feeding Days and Western PA Cattle Feeders Meeting, Pennsylvania State University Extension, Lancaster and Greensburg, PA, February 2017
3. DiCostanzo, A. Financial opportunities for backgrounding—Minnesota State Cattlemen's Convention, December 2017
4. DiCostanzo, A. Is it possible to precision feed cattle—Osage Cooperative Elevator, Osage IA, September 2017
5. DiCostanzo, A. Minimizing hay waste—Minnesota Cow-Calf Days, presented at Mora, Starbuck, Pipestone, and LeCenter, MN, January 2017
6. DiCostanzo, A. Overview of newly remodeled beef cattle research facilities at the Rosemount Research and Outreach Center—Minnesota Nutrition Conference, Mankato, MN, September 2017
7. DiCostanzo, A. Some observations on backgrounding—Minnesota Cattle Feeders Day, December 2017

8. Felix, T. Alternative Feeds for Feedlot Cattle, Special Programs, Instructor, Extension Program, Berks County PCA, Bernville, PA, 15 participants. Fall (September 27, 2017).
9. Felix, T. Central Dairy Beef Day, Special Programs, Co-Director and Instructor, Extension Program, PA Beef Producers Working Group, Union County, PA, 30 participants. Spring (February 28, 2017). Presented on "2016 Holstein Beef Demo"
10. Felix, T. Eastern Dairy Beef Day, Special Programs, Co-Director and Instructor, Extension Program, PA Beef Producers Working Group, Lancaster, PA, 36 participants. Spring (March 2, 2017). Presented on "2016 Holstein Beef Demo"
11. Felix, T. Feeding Dairy Steers, Conference, Instructor, Lecture, Penn State Extension, Grantville, PA, 80 participants. Fall (November 16, 2017). Part of the Penn State Dairy Nutrition Conference.
12. Felix, T. Feeding the Weaned Calf for Maximum Performance, Special Programs, Instructor, Extension Program, Penn State Extension, York, PA, 35 participants. Fall (September 19, 2017).
13. Felix, T. Grazing Corn Stalks, Special Programs, Instructor, Extension Program, PA Beef Producers Working Group, PA Furnace, PA, 27 participants. Fall (November 9, 2017). Part of the Grazing Interseeded Forages workshop held to showcase the research collaboration of Drs. Jessica Williamson, Greg Roth, and Tara Felix.
14. Felix, T. Northeastern Dairy Beef Day, Special Programs, Co-Director and Instructor, Extension Program, PA Beef Producers Working Group, Susquehanna County, PA, 6 participants. Spring (March 3, 2017). Presented on "2016 Holstein Beef Demo"
15. Felix, T. Nutrition for Growing Cattle, Special Programs, Instructor, Extension Program, Armstrong/Indiana PCA, Elderton, PA, 30 participants. Spring (April 4, 2017).
16. Felix, T. PA Beef Producers Working Group Field Day, Special Programs, Co-Director, Extension Program, PA Beef Producers Working Group, Stoystown, PA, 57 participants. Summer (July 29, 2017). Organized with the farm, took registrations, and introduced speakers.
17. Felix, T. Penn State Beef Cattle Short Course, Director and Instructor, Extension Program, PA Beef Producers Working Group, University Park, PA, 29 participants, Professional. Fall (October 16, 2017 - October 18, 2017). 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 topic "Ration cost analysis".
18. Felix, T. Southeastern Dairy Beef Day, Special Programs, Co-Director and Instructor, Extension Program, PA Beef Producers Working Group, Chambersburg, PA, 25 participants. Fall (September 26, 2017). Presented on "Feedlot nutrition and implants of Holstein steers"
19. Felix, T. Southwestern Dairy Beef Day, Special Programs, Co-Director and Instructor, Extension Program, PA Beef Producers Working Group, Smicksburg, PA, 11 participants. Fall (November 7, 2017). Presented on "Feedlot nutrition and implants of Holstein steers"
20. Felix, T. Statewide Dairy Beef Tour, Farm Tour, Co-Director, Extension Program, PA Beef Producers Working Group, Lancaster, PA, 12 participants, Spring (March 6, 2017).

21. Felix, T. Supplementing growing sheep on pasture, Special Programs, Instructor, Extension Program, Penn State Extension, PA Furnace, PA, 25 participants. Fall (October 28, 2017). Part of the annual Shepherds Symposium.
22. Felix, T. Venango County Ag Day, Special Programs, Instructor, Discussion, Emlenton, PA. Fall (September 9, 2017). Set up a booth to discuss what Penn State Extension Livestock Team can do for farmers in Venango County.
23. Hansen, S. L. 2017. Early Career Award Speaker: Interactions between trace minerals and growth promoting practices in beef cattle. National ASAS Meeting. Baltimore, MD.
24. Hansen, S. L. 2017. Trace mineral nutrition in beef feedlot cattle. Phibro Pre-Symposium. Plains Nutrition Council. San Antonio, Texas.
25. Hansen, S. L. 2017. Trace minerals and growth promoting practices in beef cattle. The XX Feed yard nutrition symposium. Nuevo Leon, Mexico.
26. Hansen, S. L., M. S. Kerley, and J. R. Russell. 2017. Invited: Impact of diet type on repeatability of feed efficiency in beef cattle. Midwest ASAS Meeting. Omaha, NE.
27. Loy D. 2017. Current Topics in Feedlot Nutrition. Interstate Veterinary Conference, South Sioux City, NE
28. Loy D. 2017. Feed Management. Merck Technical Update, Humboldt, IA
29. Loy, D. 2017. Corn Distillers Grains in US Feedlots. VIII Congress on Forage Conservation Quality, INTA, Cordoba, Argentina
30. Loy, D. 2017. Economic Importance of Iowa's Beef Industry. Iowa Cattle Industry Leadership Conference, Ames, IA
31. McCann, J. C. 2018. Alternatives for transitioning cattle to finishing diets and a look at rumen health. Illinois Cattle Feeders Meeting. Dixon, IL.
32. McCann, J. C. 2018. New insights on rumen health for profitable feedlot cattle. Driftless Region Beef Conference. Dubuque, IA.
33. McCann, J. C. 2018. New perspectives on adapting cattle to finishing diets without compromising rumen health. Florida Ruminant Nutrition Conference. Gainesville, FL.
34. Rust, S. R. Feeding distillers grain w/ solubles and sugarbeet products to cattle. Chinese Sugarbeet Delegation, Michigan Department of Agriculture (MDARD), Saginaw, MI, United States.
35. Rust, S. R. Feeding mycotoxin contaminated corn. Presented handout/power point at Industry.
36. Rust, S. R. New NRC nutrient requirements for beef cattle. Presented handout/power point at Great Lakes Professional Cattle Feeding and Marketing Shortcourse, Michigan State University Extension, Bad Axe, MI, United States.
37. Rust, S. R. New NRC nutrient requirements for beef cattle. Presented handout/power point at Great Lakes Professional Cattle Feeding and Marketing Shortcourse, Michigan State University Extension, East Lansing, MI, United States.
38. Rust, S. R. Silage and Grain Quality Considerations. Large Livestock Producer Meeting, Harvey's; Diamond V; and Crop production Services, Mt. Pleasant, MI, United States.
39. Rust, S. R., Black, J. R. New NRC nutrient requirements for beef cattle. Presented handout/power point at Great Lakes Professional Cattle Feeding and Marketing Shortcourse, Michigan State University Extension, Wyoming, Canada.

40. Rust, S. R., Black, J. R. New NRC nutrient requirements for beef cattle. Presented handout/power point at Great Lakes Professional Cattle Feeding and Marketing Shortcourse, Michigan State University Extension, Bowling Green, OH, United States.
41. Rust, S. R., Frey, E., Norby, B., Kulon, K. BCTRC Research Summary. Presented handout/power point at Michigan Cattleman's Field day, Michigan Cattleman's Field Day, East Lansing, MI, United States.
42. Schoonmaker, J. Beef quality and carcass grading. Purdue Workshop for Youth. June, 2017.
43. Schoonmaker, J. Growth and Development. Federal University of Lavras Department of Zootecnia. February 2017.
44. Swanson, K. (2017). World Cattlemen's Cow Efficiency Congress, "Nutritional effects of frame size on efficiency and longevity of beef cows," American Aberdeen Association, Oral Presentation, Dickinson, ND. (Invited).
45. McCann, J. M. 2018. Making Beef Better: From the Feed yard to your plate. IL Farm Bureau Board. February 2018.

## **Publications**

### **2016 Refereed Journal Articles and Book Chapters:**

1. Ahn, J., H, Wua, Y Suh, A. C. Carranza, A. E. Relling, S. Shind, S. S. Lee, and K. Lee. 2017. Comparative sequence analysis and adipose-specific expression of G0S2 and ATGL in sheep. *Small Ruminant Research* 153, 1–4.
2. Antonelo, D.S., N.A. Lancaster, S. Melnichenko, C.R. Muegge, and J.P. Schoonmaker. 2017. Effects of clay on toxin binding capacity, ruminal fermentation, diet digestibility and growth of steers fed high concentrate diets. *J. Anim. Sci.* 95:4658-4667.
3. Bittner, C. J., M. A. Greenquist, D. B. Burken, A. L. Shreck, J. C. MacDonald, T. J. Klopfenstein, W. J. Platter, M. T. Van Koevering, N. A. Pyatt, and G. E. Erickson. 2017. Evaluation of ractopamine hydrochloride (Optaflexx) on growth performance and carcass characteristics of finishing steers across different feeding durations. *J. Anim. Sci.* 95:485-498. doi:10.2527/jas.2016.0806
4. Blank, C. P., D. D. Loy and S. L. Hansen. 2017. Effect of post-ethanol extraction sorghum silage as a forage source in growing and finishing diets on steer performance carcass characteristics, and nutrition digestibility. *J. Anim. Sci.* 95:3206-3213.
5. Blank, C. P., J. Russell, S. M. Lonergan and S. L. Hansen. 2017. Influence of feed efficiency classification and growing and finishing diet type on meat tenderness attributes of beef steers. *J. Anim. Sci.* 95: 2986-2992.
6. Brake, D. W., and K. C. Swanson. 2018. RUMINANT NUTRITION SYMPOSIUM: Effects of postruminal flows of protein and amino acids on small intestinal starch digestion in cattle. *J. Anim. Sci.* 96:739-750.
7. Burken, D. B., B. L. Nuttelman, J. L. Harding, A. L. McGee, K. M. Sudbeck, S. E. Gardine, T. C. Hoegemeyer, T. J. Klopfenstein, and G. E. Erickson. 2017. Effects of agronomic factors on yield and quality of whole corn plants and the impact of feeding



- high concentrations of corn silage in diets containing distillers grains to finishing cattle. *Transl. Anim. Sci.* 1:367-381 doi:10.2527/tas.2017.0045
8. Burken, D. B., B. L. Nuttelman, M. J. Jolly-Briethaupt, J. L. Harding, S. E. Gardine, T. J. Klopfenstein, J. C. MacDonald, and G. E. Erickson. 2017. Digestibility and performance of steers fed varying inclusions of corn silage and modified distillers grains with solubles to partially replace corn in finishing diets. *Transl. Anim. Sci.* 1:382-396. doi:10.2527/tas2017.0046
  9. Camacho, E., K. C. Swanson, Dorsam, S., and K. A. Vonnahme. 2017. Effects of maternal nutrient restriction followed by realimentation during early and mid-gestation in beef cows. II. Placental development, umbilical blood flow, and uterine blood flow responses to diet alterations. *Theriogenology*. (accepted)
  10. Carvalho, P. H., Schroeder, A. R., Meteer, W. T., DiCostanzo, A., & Felix, T.L. (2017). Effects of feeding corn plant residues during the growing phase on steer growth performance and feedlot economics. *Prof. Anim. Sci.*, 33, 668-679.
  11. Condrón, K.N., J.N. Waddell, M.C. Claeys, R.P. Lemenager, and J.P. Schoonmaker. 2017. Effect of supplemental  $\beta$ -carotene compared to retinyl palmitate on fatty acid profile and expression of mRNA from genes involved in vitamin A metabolism in beef feedlot cattle. *Anim. Sci. J.* 88:1380-1387.
  12. Crane, A. R., R. R. Redden, K. C. Swanson, B. M. Howard, T. J. Frick, K. R. Maddock-Carlin, and C. S. Schauer. 2017. Effects of distiller's grains and lasalocid inclusion on feedlot lamb growth, carcass traits, nutrient digestibility, ruminal fluid volatile fatty acid concentrations, and ruminal hydrogen sulfide concentration. *J. Anim. Sci.* 95:3198-3205.
  13. Crane, A. R., R. R. Redden, M. S. Crouse, J. D. Kirsch, P. P. Borowicz, J. E. Held, K. C. Swanson, and C. S. Schauer. 2018. Influence of distiller's dried grains with solubles on ram lamb growth and reproductive traits. *J. Anim. Sci.* doi: 10.1093/jas/sky031
  14. DiCostanzo, A. 2017. Cow-calf management. In: *Blackwell's Five-Minute Veterinary Consult: Ruminant, Second Edition*. C. Chase, K. Lutz, E. McKenzie, and A. Tibary, Editors). Wiley E-book.
  15. DiCostanzo, A. 2017. Feeding by-products to the beef cow herd. 2017. In: *Blackwell's Five-Minute Veterinary Consult: Ruminant, Second Edition*. C. Chase, K. Lutz, E. McKenzie, and A. Tibary, Editors). Wiley E-book.
  16. Fink, R.C., J.M. Popowski, J.E. Anderson, J.L. Tran, S. Kalyanikutty, G.I. Crawford, A.DiCostanzo, R.B. Cox and F. Diez-Gonzalez. 2017. Impact of distillers grain solids (DGS) and seasonality on the prevalence of *Escherichia coli* O157 at an abattoir in the U. S. Upper Midwest. *J. App. Anim. Res.* 46:237-241.
  17. Fluharty F.L., H.N. Zerby, G.D. Lowe, D. D. Clevenger and A.E. Relling. 2017. Effects of feeding corn silage, pelleted, ensiled, or pelleted and ensiled alfalfa on growth and carcass characteristics of lamb. *SASAS* 47: 704-711.
  18. Freitas T. B., A. E. Relling, M. S. Pedreira, W. J. B. Rocha, A. R. Schroeder, and T. L.Felix. 2017 Effects of increasing inclusion of sodium hydroxide treatment on growth performance, carcass characteristics, and feeding behavior of steers fed 50% DDGS. *J. Anim. Sci.* 95:371-378.

19. Freitas, T. B., Felix, T.L., Pedreira, M. S., Silva, R. R., Silva, F. F., Silva, H. G. O., Moreira, B. S. (2017). Effects of increasing palm kernel cake inclusion in supplements fed to grazing lambs on growth performance, carcass characteristics, and fatty acid profile. *Anim. Feed Sci Tech.*, 226, 71-80.
20. Freitas, T. B., Felix, T.L., Pedreira, M. S., Silva, R. R., Silva, F. F., Silva, H. G. O., Tigre, J. S. (2017). Replacement of soybean meal with treated castor bean meal in supplements for grazing lambs. *Revista Brasileira de Saúde e Produção Animal*, 18, 465-478.
21. Freitas, T. B., Relling, A. E., Pedreira, M. S., Rocha, W. J., Schroeder, A. R., & Felix, T. (2017). Effects of increasing inclusion of sodium hydroxide treatment on growth performance, carcass characteristics, and feeding behavior of steers fed 50% DDGS. *J. Anim. Sci.*, 95, 371-378.
22. Grooms, D. L., Bolin, S. R., Durst, P. T., Rust, S. R., Allen, M., Buskirk, D. D., Hattry, J. E., Lim, A., & Smith, R. W. (in press). Survival of *Mycobacterium bovis* during forage ensiling. *Amer. J. Vet. Res.*
23. Gunn, P.J., G.A. Bridges, R.P. Lemenager, and J.P. Schoonmaker. 2017. Feeding corn distillers grains as an energy source to gestating and lactating beef heifers: Impact of excess protein on feedlot performance, glucose tolerance, carcass characteristics and Longissimus muscle fatty acid profile of steer progeny. *Anim. Sci. J.* 88:1364-1371.
24. Hartman, S. J., O. N. Genter-Schroeder, and S. L. Hansen. 2017. Effect of trace mineral source on mineral status and performance of beef steers fed low- or high-sulfur diets. *J. Anim. Sci.* 95:4139-4149.
25. Hristov, A., Degaetano, A. T., Rotz, C. A., Hoberg, E., Skinner, R. H., Felix, T. (Co-Author; 5% contribution), Li, H., Patterson, P. H., Roth, G., Hall, M., Ott, T. L., Baumgard, L. H., Staniar, W., Hulet, R. M., Dell, C. J., Brito, A. F., Hollinger, D. Y. (2017). Climate change effects on livestock in the Northeast U.S. and strategies for adaptation. *Climate Change.* 146, 33-45.
26. Keomanivong, F. E., L. E. Camacho, C. O. Lemley, E. A. Kuemper, R. D. Yunusova, P. P. Borowicz, J. D. Kirsch, K. A. Vonnahme, J. S. Caton, and K. C. Swanson. 2017. Effects of realimentation after nutrient restriction during mid- to late-gestation on pancreatic digestive enzymes, serum insulin and glucose levels, and insulin-containing cell cluster morphology. *J. Anim. Physiol. Nutr.* 101:589-604.
27. Keomanivong, F. E., M. C. Ruch, J.-H. Liu, J. D. Kirsch, M. L. Bauer, C. R. Dahlen, M. Kapphahn, M. S. Borhan, S. Rahman, and K. C. Swanson. 2017. Influence of dry-rolled corn processing and distiller's grain inclusion rate on ruminal pH, ammonia and volatile fatty acid concentration, in vitro methane production and enzyme activity. *Anim. Feed Sci. Tech.* 228:132-139.
28. Kholif, A. E., O.H. Matloup, T. A. Morsy, M. M. Abdo, A. A. Abu Elalla, U.Y. Anele, and K. C. Swanson. 2017. Rosemary and lemongrass herbs as phytogenic feed additives to improve efficient feed utilization, manipulate rumen fermentation and elevate milk production of Damascus goats. *Livest. Sci.* 204:39-46.
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### **Proceedings and Technical Reports:**

#### **Experiment Station Publications:**

1. Bondurant, R. G., M. N. Streeter, G. E. Erickson, J. C. MacDonald, and M. K. Luebbe. 2018. Evaluation of Revalor-XH for beef heifers fed different days on feed. *Neb Beef Cattle Rep.* MP105:113-115.
2. Burhoop, J. E., C. J. Bittner, F. H. Hilscher, M. K. Luebbe, J. C. MacDonald, and G. E. Erickson. 2018. Impact of corn oil removal from modified distillers grains plus solubles

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3. Burhoop, J. E., M. L. Jolly-Breithaupt, J. L. Gramkow, M. K. Luebke, J. C. MacDonald, and G. E. Erickson. 2018. Impact of feeding distillers grains with or without oil removal as well as supplemental corn oil on nutrient digestibility by finishing cattle. *Neb Beef Cattle Rep.* MP105:105-108.
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7. Deters, E. R. Stokes O. Genther-Schroeder, S. L. Hansen. 2017. Effects of Original XPC on Newly Weaned Beef Steer Growth Performance and Antioxidant Defense. Iowa State University Animal Industry Report.
8. Deters, E. R. Stokes O. Genther-Schroeder, S. L. Hansen. 2017. Effects of Original XPC on Newly Weaned Beef Steer Nutrient Digestibility and Response to a Vaccination Challenge. Iowa State University Animal Industry Report.
9. DiCostanzo, A. Harvest endpoint decisions for corn acres—In: *Proc. Driftless Region Beef Conference*, Dubuque, IA, January 2017
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11. Hartman, S., O. Genther-Schroeder, S. L. Hansen. 2017. Comparison of trace mineral repletion strategies in beef cattle to overcome a high antagonist diet. Iowa State University Animal Industry Report.
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14. Hilscher, F. H., M. L. Jolly-Breithaupt, J. L. Gramkow, H. C. Wilson, M. M. Norman, J. N. Anderson, and G. E. Erickson. 2018. Nutrient digestibility and fermentation of brown midrib corn fed to growing beef steers. *Neb Beef Cattle Rep.* MP105:49-51.
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26. Underdahl, S. R., A. B. P. Fontoura, L. L. Hulsman Hanna, K. A. Vonnahme, K. C. Swanson, K. A. Ringwall, T. C. Gilbery, and C. R. Dahlen. 2017. The effects of day of estrus on dry-matter intake and feeding behavior in beef heifers. *North Dakota Beef Report.* pp 36-38.

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**Abstracts:**

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2. Carmicheal, R., O. N. Genther-Schroeder, C. P. Blank, E. L. Deters, S. J. Hartman, E. K. Niedermayer and S.L. Hansen. 2017. The influence of supplemental zinc and ractopamine hydrochloride on mineral and nitrogen retention of beef steers. *J. Anim. Sci. (Suppl. 4)* Abstract 638.
3. Carvalho, P. H., Pinto, A. C., & Felix, T. (2018). Effects of Grain or Forage-based Diets on Digestibility and Ruminant pH in Angus or Holstein Steers. *Sect. Mtg. Abstracts. J. Anim. Sci. (97 (E-Suppl. 2))*.
4. Carvalho, P. H., Pinto, A. C., Kirk, M., & Felix, T. (2018). In Situ Ruminant Disappearance Among Corn Grains in Holstein and Angus Steers. *Sect. Mtg. Abstracts. J. Anim. Sci. (97 (E-Suppl. 2))*.
5. Chishti, G. A., Carvalho, P. H., & Felix, T. (2018). Comparison of Forage and Concentrate Digestibility in Sheep and Cattle. *Sect. Mtg. Abstracts. J. Anim. Sci. (97 (E-Suppl. 2))*.
6. Crawford, D. M. and J. C. McCann. 2018. Utilization of coproducts as an alternative to forage in adapting feedlot cattle to finishing diets. *J. Anim. Sci.* 96 (Suppl. 2).
7. Deters, E.L., R. S. Stokes, O. N. Genther-Schroeder, and S.L. Hansen. 2017. Effect of original XPC in receiving diets on newly weaned beef steer performance and response to a *Mannheimia haemolytica* vaccination challenge. *J. Anim. Sci. (Suppl. 4)* Abstract 559.
8. Fontoura, A. B. P., E. Knutson, F. E. Keomanivong, A. K. Ward, and K. C. Swanson. 2017. On the association between linear measurements, feeding behavior traits, and feed efficiency measures in finishing steers. *J. Anim. Sci.* 95(Suppl. 5):54.
9. Genther-Schroeder, O. N. and S. L. Hansen. 2017. The effect of dietary grain inclusion and Zn concentration on rumen epithelial structure and Zn transporter expression in sheep. *J. Anim. Sci. (Suppl. 4)* Abstract 636.
10. Harsh, B. N., B. J. Klatt, M. J. Volk, A. C. Dilger, D. D. Boler, and J. C. McCann. 2018. Effects of ractopamine hydrochloride (Actogain) on nutrient digestibility and nitrogen excretion of finishing steers. *J. Anim. Sci.* 96 (Suppl. 2).
11. Harsh, B. N., J. C. McCann, A. C. Dilger, and D. D. Boler. 2018. Young scholar presentation: technology in livestock production: use of production technologies to improve the sustainability of meat production. *J. Anim. Sci.* 96 (Suppl. 2).
12. Johnson, H. and A. DiCostanzo. 2017. A meta-analysis on the effects of backgrounding strategy on feedlot and carcass performance. *J. Anim. Sci.* 95(Suppl. 2): 22
13. Kelany, K., M. A. Vasquez, M. L. Bauer, K. Swanson, S. Dorsam, V. Valkov, A. Reyaz, A. T. Grazul-Bilska, and K. A. Vonnahme. 2018. The effect of in vivo estrogen treatment

- on uterine cell proliferation in ovariectomized Romanov ewes. *J. Anim. Sci.* 96(Suppl. 2):205-206.
14. Keomanivong, F. E., P. P. Borowicz, J. S. Caton, K. A. Vonnahme, A. Grazul-Bilska, D. A. Redmer, and K. C. Swanson. 2017. Young Scholar Presentation: The impact of nutrition and reproductive stage on maternal and fetal pancreatic exocrine and endocrine function in ruminants. *J. Anim. Sci.* 96(Suppl. 5):169.
  15. Klatt, B. J., B. N. Harsh, and J. C. McCann. 2018. Determining rumen degradable protein requirements in growing beef cattle. *J. Anim. Sci.* 96 (Suppl. 2).
  16. Knutson, E. E., A. B. P. Fontoura, J. J. Gaspers, P. P. Borowicz, K. C. Swanson, M. L. Bauer, J. A. Clapper, and A. K. Ward. 2017. The effects of a low vitamin A diet on the mechanism of intramuscular fat development. *J. Anim. Sci.* 95(Suppl. 4):36.
  17. Lourenço, J. M., T. J. Kieran, J. C. McCann, T. C. Glenn, and L. Stewart. 2018. Analysis of the gastrointestinal tract-associated microbiome of calves supplemented during the suckling phase. *J. Anim. Sci.* 96 (Suppl. 1).
  18. Lundy, E. L., O. N. Genther-Schroeder, M. E. Branine and S. L. Hansen. 2017. Effect of dietary zinc amino-acid complex supplementation on cattle performance, biomarkers of inflammation and metabolism, and liver abscess formation on steers receiving a mild acidosis challenge. *J. Anim. Sci.* (Suppl. 4) Abstract 640.
  19. McCann, J. C., L. M. Shoup, M. D. Miller, G. E. Carstens, and D. W. Shike. 2017. Relationships between DMI fluctuation and feeding behavior at the beginning and end of the finishing phase in feedlot cattle. ASAS Annual Meeting, July 8-12, Baltimore, MD. Poster presentation
  20. McCann, J. C., T. B. Wilson, L. L. Guan, D. W. Shike, and J. J. Loo. 2017. Maternal plane of nutrition during mid-gestation affects the skeletal muscle transcriptome in beef cattle progeny. ASAS Annual Meeting, July 8-12, Baltimore, MD. Oral presentation
  21. Niedermayer, E. K., E. M. McDonald, O. N. Genther-Schroeder, D. D. Loy and S.L. Hansen. 2017. Effect of trace mineral supplementation with or without hormone implants on growth and carcass characteristics of steers. *J. Anim. Sci.* (Suppl. 4) Abstract 639.
  22. Nunez, A.J.C. and J.P. Schoonmaker. 2017. Effect of increasing protein and fat inclusion in the diet of beef cows during gestation and lactation on feedlot performance and carcass characteristics of progeny. *J. Anim. Sci.* (Suppl. 4):309.
  23. Pukrop, J.R., B.T. Campbell, and J.P. Schoonmaker. 2017. Effect of essential oils or Tylosin on performance, liver abscesses, carcass characteristics and meat quality in feedlot steers. *J. Anim. Sci.* 95 (Suppl. 5):42.
  24. Pukrop, J.R., K.M. Brennan, B.J. Funnell, and J.P. Schoonmaker. 2017. Effect of Select-TC on performance and health status of receiving cattle. *J. Anim. Sci.* (Suppl. 4):275.
  25. Rodrigues, L.M., J. P. Schoonmaker, F. D. Resende, G. R. Siqueira, O. R. Machado Neto, T. R. Gionbelli, and M. M. Ladeira. 2017. Effect of maternal nutrition on performance of Nellore cows and pre-weaning growth of their progeny. *J. Anim. Sci.* 95 (Suppl. 5):172.
  26. Silva, F. A., & Felix, T., et al. (2018). Effect of Duration of Limit Feeding on Nitrogen and Phosphorus Metabolism, Growth Performance, and Carcass Characteristics of HolsteinxZebu Finishing Steers. Sect. Mtg. Abstracts. *J. Anim. Sci.* (97 (E-Suppl. 2)).



27. Sitorski, L. G., A. B. P. Fontoura, F. E. Keomanivong, M. L. Bauer, T. C. Gilbery, S. R. Underdahl, C. R. Dahlen, and K. C. Swanson. 2018. The effect of protein concentration in finishing diets on growth performance and carcass characteristics of steers. *J. Anim. Sci.* 96(Suppl. 2):229-230.
28. Underdahl, S. R., A. B. P. Fontoura, L. L. Hulsman Hanna, K. A. Vonnahme, K. C. Swanson, K. A. Ringwall, T. C. Gilbery, and C. R. Dahlen. 2018. The effects of estrus on dry matter intake and feeding behavior in beef heifers. *J. Anim. Sci.* 96(Suppl. 2):200-201.

**Publications including Trade Publications and Newsletters:**

1. DiCostanzo, A. Cattle numbers, beef production and prospects for profitability—Minnesota Farm Guide, March 2017
2. DiCostanzo, A. Don't blame the calves—New Mexico Stockman, August 2017
3. DiCostanzo, A. Focusing on herd profitability—Minnesota Farm Guide, November 2017
4. DiCostanzo, A. Principles of backgrounding cattle—Minnesota Farm Guide, November 2017
5. DiCostanzo, A. What do we expect on cattle markets and profitability—Minnesota Farm Guide, December 2017
6. Felix, T. (2017). "2017 Dairy Beef Wrap-up: Implant Demonstration." Penn State Extension. <http://extension.psu.edu/2017-dairy-beef-wrap-up-implant-demonstration>.
7. Felix, T. (2017). "Are our cattle too good?" Penn State Extension News.
8. Felix, T. (2017). "Implants used in beef cattle are safe and efficacious. Penn State Extension." Penn State Extension. Pub EE0183.
9. Felix, T. (2017). "Ionophores: A technology to improve cattle production efficiency. Penn State Extension." Penn State Extension. Pub EE0189.
10. Felix, T. (2017). "Survey Conducted to Guide Programmatic Efforts." Penn State Extension News.
11. Gould, K. S., & Rust, S. R. (2017, August). Converting Older Dairy Facilities to Beef Feeding Operations. *The Michigan Cattleman*, 32(4), pp. 20-21.
12. Loy, D., P. Gunn, D. Anderson, J. Russell, S. Shouse and E. Lundy 2017. Water Quality and Beef Sustainability. A literature review prepared for the National Cattlemen's Beef Association, May 2017.
13. Loy, Dan. 2017 Traceability. August 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter
14. Loy, Dan. 2017. "Systems Thinking" for Iowa Beef Cow Systems. November 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter
15. Loy, Dan. 2017. Adding Value to the Calf Crop. February 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter.
16. Loy, Dan. 2017. Assuring a Wholesome Beef Supply. May 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter
17. Loy, Dan. 2017. Beef Production Research at ISU. March 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter

18. Loy, Dan. 2017. Changing Feedlot Demographics. April 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter.
19. Loy, Dan. 2017. Cover Crops and Stocker Cattle. July 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter
20. Loy, Dan. 2017. Iowa Beef Center- 2017 in Review. December 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter
21. Loy, Dan. 2017. Resilience and Compassion. October 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter
22. Loy, Dan. 2017. The Haves and the Have Nots. September 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter.
23. Loy, Dan. 2017. Tools for You. June 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter
24. Loy, Dan. 2017. We're Listening. January 2017 Iowa Cattleman and Iowa Beef Center Growing Beef Newsletter.
25. National Consortium for the Genetic Improvement of Feed Efficiency in Beef Cattle. 2017. Final Report on National Program for Genetic Improvement of Feed Efficiency in Beef Cattle. IBC-118E, <https://store.extension.iastate.edu/Product/14906>.
26. Rust, S. R. (2017, December). Where is the Prime? The Michigan Cattlemen's Magazine. 32(4), pp. 20-21.
27. Schwehofer, J. P., & Rust, S. R. (2017). Why should I be concerned about the antibiotic resistance issue? The Michigan Cattleman, 31(2), pp. 22-23.

**Courses or Conferences Organized (includes multi-state efforts):**

Northwest Iowa Feedlot Forum, January 17, Sioux Center, IA  
 Driftless Region Beef Conference. January 26-27, Dubuque, IA  
 UNL Feedlot Roundtable live web link to 3 Iowa sites, February 9  
 BRaNDS Workshop, Wichita, KS, March 29  
 BRaNDS Workshop, Lafayette, IN, July 18-19  
 BRaNDS Workshop, Ames, IA, August 1  
 ISU Feedlot Short course, August 8-10, Ames, IA  
 Eastern Iowa Feedlot Conference, Welton, IA  
 Great Lakes Professional Cattle Feeding and Marketing Shortcourse held in East Lansing, MI, Bowling Green, OH, Bad Axe, MI, and Wyoming, ON.  
 Minnesota Cow-Calf Days, Staples, Bagley, Lancaster, Roseau, Baudette, Grand Rapids, Mora,

Pipestone, Rochester, LeCenter, February 2017

Minnesota Cattle Feeder Days, Rochester and Luverne, December 2017

Nebraska Beef Feedlot Roundtable

Nebraska Corn Husker Nutrition Conference