

Minutes from the NCERA 219 Committee on Swine Management
Agenda for Annual Meeting
October 26-28, 2016 Brookings, SD
SDSU Swine Unit

Wednesday, October 26th

Those present at the meeting included: Benny Mote, Lee Johnston, Merlin Lindemann, Brian Richert, Garth Ruff (Ohio State Grad Student), Steve Moeller, Bob Thaler (Chair), and Dale Rozeboom (Secretary). The meeting was called to order at 12:30 PM, with a welcome from Bob Thaler and a review of the agenda he had prepared for the meeting.

At 1:00 PM, Bob Thaler provided the attendees a tour of the two buildings near campus which are part of the new SDSU Swine facilities. Attendees participated in discussion of the layout, mechanical features, environmental management approaches, and research capabilities provided for in the new 150-sow unit and four-room 1200-head wean-finish-barn. These units are not physically connected and pigs will be moved at weaning from one building to the other. We learned that a significant collaboration among groups, agencies, private farms, individuals and government made possible the acquisition of \$7.4 million to build the new facilities. Attendees agreed that SDSU will be able to conduct swine research for many years related to multiple-disciplines, including the studies designed and proposed by the NCERA-219 Committee. The new facilities at SDSU positions them and younger faculty for a long and healthy run into the future.

At 2:30 PM we met in the classroom and began giving station reports (if written station reports were provided, they are attached to these minutes below). During the report from Kentucky, Merlin Lindemann asked each station to describe the genotype of the sows being used for reproduction. This led to an impromptu discussion of differences and how they contribute to the 'station effect' described statistically in the collaborative research we conduct together. Benny Mote described a videography capability used at Nebraska that may serve the NCERA-219 committee in the future as it records specific activities, without human assessment.

At 5:00 PM we adjourned and went to check-in at our hotels. At about 5:20 PM we all jumped into a SDSU van and Bob Thaler drove us to the new Offsite Contract Wean-to-Finish Barn; the third building that is part of the new swine facilities at SDSU. We rode about 8 miles southeast of Brookings to tour the contract barn built by SDSU for research, using pigs that will be provided by local producers. The barn is a wide barn, with two rooms of 50 pens each, a pen scale, Feed Logic™ feed distribution

system, and the ability to randomly provide one of four different water treatments. The facility cost about \$1.7 million (of the \$7.4 million mentioned above).

At 6:00 PM, we drove to Flandreau, SD for supper at Mad Mary's. The food was excellent and discussions regarding changes being made in departments at our respective universities, extension programming, and the history of the NCERA-219 committee and past members of the NCERA-219 Committee.

Thursday, October 27th

At about 7:20 AM we boarded the SDSU van for Sioux Falls, where we were going to tour the John Morrel's/Smithfield harvest plant. We arrived at about 8:15 AM. Mr. Spencer Jacobson, Assistant Procurement Director, gave us an extremely detailed tour of the entire plant. "We saw portions of the plant that most tour groups do not see. We walked 3.5 miles and were there over 3 hours. The plant harvest 19,000 per day, using 2 shifts, and six days per week. Ninety semi-trailer loads of products leave each day. About 3500 people are employed there. At 11:30 AM we departed Sioux Falls for Brookings, where we ate lunch at the Backyard BBQ. During lunch we visited about the role of John Morrel's/Smithfield in the Midwest U.S. and how our work with the management and well-being of heavy weight hogs did relate to the desired market weights being sought by that harvest facility. After lunch, Steve Moeller requested that we tour the new cow-calf facilities at SDSU, and so we did.

At 2:00 PM, we gathered again in the classroom of the swine unit and continued giving station reports.

At 4:00 PM we connected by phone with our Administrative Advisor, Ernie Minton, KSU. We provided him an updated list of committee members, including our most recent addition, Dr. Benny Mote, from the University of Nebraska. It was noted that Rich Gates has never attended a meeting, and is not considered 'active.' Dr. Minton stated that only the University of Illinois can remove him. The committee expressed that we would like to have someone from U of Illinois who would be active on this committee. It was acknowledged that the Department of Animal Science at Illinois is presently engaged in a search for a new extension swine person. It was mentioned that Dr. Rob Knox is another person we could invite. Dr. Minton suggested that someone on the current committee reach-out to Rob Knox and see if he is interested. If so, then we could ask the University of Illinois to remove Rich Gates from Appendix E, and consider adding Dr. Rob Knox. If a committee member would contact Rob, then Dr. Minton is willing to contact the Experiment Station at Illinois and ask them to make the change. Bob Thaler volunteered to contact Dr. Knox. It was mentioned that Bob Goodband, Jay Harmon, Ken Stalder do attend and are active, but not in attendance this year; as do Marcia Carlson and Gary Apgar who were not on Dr. Minton's list. He agreed to add them, but noted that they must complete the Appendix E at their respective universities. Dr. Minton agreed to check on if David Newman (now

at Arkansas State and collaborating with Arkansas) can be officially a member of this committee. Dr. Minton apologized for not coming. Health prohibited him from coming last year. He stated that our current project is approved through 2021. He asked that we be aware that on NIMMS, the old expired project in September 2016 had all 5 annual reports. But the close-out or wrap of the old project went up at the end of the old project. The last report in there included all of this past year. So this year, he suggested that we report on 10.1.15 to 9.30.16. Then, in 2017 we should report the federal year; 10.1.16 to 9.30.17. Lee Johnston asked if in our renewal process was there any issues about our project that directors mentioned. Dr. Minton said, “No, none that I recall.”

Following our phone conversation with Dr. Minton, the committee briefly discussed and advised the secretary to submit this year’s minutes in this year’s report, not next year’s as suggested by Dr. Minton.

At 4:25 PM, the committee selected Benny Mote as Secretary elect by unanimous vote. The 2017 meeting date and location was discussed and Bob Thaler agreed to ask Bob Goodband if KSU will host. Plan B was discussed and would be Ohio, with Steve Moeller hosting. The proposed date will be October 18-20, 2017.

At 4:30 PM, we finished station reports. Lee Johnston announced that Minnesota Extension has Swine Educator position currently open – Worthington or Marshall, MN.

At 5:15 PM we were joined by Dr. Crystal Levesque, SDSU Swine Nutrition Researcher, as our guest. She briefly described her position at SDSU.

At 5:38 PM, Merlin Lindemann shared that he would be departing Brookings at this time and would not be here on Friday. So then Bob Thaler proposed that we take time now to discuss the “Space for 300 Pound Pigs” study. Lee Johnston presented raw data from this study. Discussion ensued. Experiment 1 had 5 stations participated. We had different durations of feeding. Lee Johnston asked questions of participating stations, regarding raw data. He will send email to all participants to seek another review of raw data. Cortisol data is pending. KSU may or may not complete Experiment 2. Missouri will not be completing Experiment 2.

At 6:22 PM, we discussed the NPB call for proposals focused on ‘heavy pig’ performance, food safety, well-being, nutrition, and pork quality. Two of the five must be the focus of each proposal. Lee Johnston stated that it was coming from a subcommittee that was formed across several of the main committees and proposed the availability of some \$200,000.

At 6:39 PM we adjourned for supper at Whiskey Creek, Brookings.

Friday, October 28th

The meeting reconvened at the swine unit at 7:50 AM. Members paid Bob Thaler \$20 registration fee for meeting. He agreed to have receipts sent to all of us.

At 8:00 AM we were joined by and given an official welcome to SDSU by ANR College and Animal Science Department leadership. Dr. Joe Cassady, ANS Department

Head, shared that about 38% of students from MN, 36% from SD in ANS. He expressed optimism that more from IA will come here when IA is granted 'in-state' tuition at SDSU. He stated that not many students come from Nebraska. He noted that 85% of students take the 'production track' and only 15% take 'pre-vet' track. The focus at SDSU in ANS is to get young people to go back into production agriculture. The department is working to improve research output; federal grants. Dr. Daniel Scholl, presently Interim Dean (has been Director of the Agricultural Experiment Station) spoke of being a 'regional university'. He gave an example that SDSU is exploring veterinary education collaboration with the University of Minnesota Veterinary School. Dr. Bill Gibbons, Interim Director of Agriculture Experiment Station, was also a guest and he complimented the SDSU ANS Department on the excellent recent changes. All spoke about the 'team' effort to relate to donors and potential donors that provide funding for facilities and other educational developments at SDSU. Dr. Scholl said "It's about relationship management; using those in the right balance; shifting and adjusting that balance as we go."

At 8:30 AM, members giving leadership to various NCERA-219 research projects gave updates. Regarding 'Ingredient Switch Finishing', Brian Richert and Dale Rozeboom will draft potential journal article in upcoming year. Regarding 'Peripartum Sow Feeding', Dale Rozeboom remains responsible and will draft potential journal article in upcoming year.

At 9:30 AM, we discussed new research project ideas and possible grant development. It was noted that we presently do not have any protocols in development at any stage. The committee reviewed the NPB call for proposals. Brian Richert mentioned that under welfare there may be opportunities for our committee. The following is a list of ideas that came from our discussion:

1. Castration with meloxicam – Steve Moeller.
2. Feeder space for heavy hogs; linear inches – Brian Richert.
3. Are cup waters big enough for heavy hogs? – Brian Richert.
4. Heavy (275-400 lbs.) meat quality – Brian Richert/Steve Moeller.
5. Weaned pig transport – time factors, intervention strategies (water treatment of newly received pigs), energy substrate.
6. Creep form – Steve Moeller.
7. Creep of pigs weaned at 24 d of age – Brian Richert.
8. Stall design for larger litters and larger sows; how do you use the existing space; put creep at the front; shoulder ulcers – Brian Richert.
9. Creep space – Brian Richert. Lee Johnston mentioned that the Danish have done imaging work on creep area for older pigs at weaning; assessing pig size and litter size.
10. Individual sow farrowing pens – Lee Johnston.

11. Enrichment at farrowing – Brian Richert, Lee Johnston state that we could consider using a rope and recycled paper mat (e.g. Compostamat.com). Benny Mote contacted this company immediately and learned that they have not used their mat for such a purpose to-date, but would be interested in learning more about our idea. Steve Moeller volunteered to take lead on writing a NPB grant in next week, about this idea. The groups talked about having each station contribute a minimum of two reps, one in each season (warm and cold) and a minimum of eight total observations per treatment.

At 10:30 AM, Dale Rozeboom noted in these minutes that all in attendance expressed sincere appreciation to Bob Thaler for hosting an excellent meeting at SDSU. The meeting concluded.

Respectfully submitted, Dale Rozeboom

University of Kentucky
Swine Nutrition Research
NCERA-219 – SDSU, Brookings SD
October 26-28, 2016

~~Personnel~~

Research:

Nutrition: Merlin Lindemann, Sunday A. Adedokun, Gary Cromwell (retired)

Digestive Physiology: Jamie Matthews

Meats: Gregg Rentfrow

Microbiology: Melissa Newman

Research Specialist: Jim Monegue

Extension: open position

Graduate Students in Swine Nutrition: *Post-doc:* Dr. Youngdal Jang (Seoul National University, Korea),
PhD: Ning Lu (CAU, PR China), Ding Wang (CAU, PR China), Kun Dong (CAU, PR China),
MS: Brian Bryson (Morehead State University, KY), *Visiting Professor:* Dr. Beob Gyun Kim (Konkuk University, Seoul, South Korea).

~~Research Facilities~~

The UK Swine Research Unit is at the C. O. Little Agricultural Research Center located between Versailles and Frankfort, approximately 15 miles west of Lexington. The three-site production facility (Headquarters-Breeding-Gestation-Farrowing; Nursery; Grow-Finish) will accommodate 120 sows as part of the production herd, utilize all AI (Yorkshire-Landrace sows x purchased boar semen), and 3-week weaning. At full capacity, we can finish about one-half of the pigs that are farrowed.

Research space for nursery pigs, grow-finish pigs, metabolism crates, and battery cages are available on campus in the W. P. Garrigus Building.

~~Research Activity in Swine Nutrition~~

~~Weanling Pig Research~~

- **Peptide protein source for young pigs.** We have done several studies with a controlled digest of cottonseed meal to evaluate its feeding value (dose titration studies) as well as its palatability in nursery pigs. While there were feed intake preferences demonstrated, the growth performance effects were inconclusive.
- **Copper source comparison.** A detailed study was conducted to examine Mintrex Cu (a Novus product) to copper sulfate with respect to various measures of tissue antioxidant status, digestibility, and cecal microbiome. Another set of studies compared copper chloride (TBCC, a Micronutrients product) to copper sulfate for some of the same response measures plus immunological measures that are assessed in an LPS challenge.

~~Growing-Finishing Pig Research~~

- **Effect of exogenous enzymes on ileal and total tract digestibility of fiber, nitrogen, and amino acids (ileal only) in grower pigs.** An ongoing study is evaluating the effects of enzyme supplementation (singly or in combination) on ileal and total tract fiber, nitrogen, and amino acid (ileal only) digestibility in cannulated pigs.
- **Exogenous enzymes for grow-finish pigs.** A series of studies over the past 3 years have examined enzymes singly and in combination for potential total tract P and energy release in diets with and

without DDGS and/or other fibrous feedstuffs. The studies have been primarily with phytase and a xylanase (from several companies) and have examined both enzyme level and enzyme combinations. Studies have been with both nursery pigs and grow-finish pigs. A recently completed NPB-funded project on potential phytase * xylanase interactions demonstrated some xylanase benefit in a diet already supplemented with phytase; when the best xylanase level was supplemented with multiple doses of phytase in a P-adequate diet, the xylanase effect was not seen but there was a quadratic response to phytase levels on growth and carcass measures. One method of evaluation is in our individual grower pens where we scale feed pigs to metabolic BW to remove the potential impact of feed intake differences in pigs when we are examining effects of enzymes where feed efficiency is a/the primary response measure.

- **Fat source and vitamin E supplementation to heavy weight market pigs.** A NPB project has been funded where we will take pigs to a market weight of 150 kg. Fat source and various aspects of vitamin E supplementation will be evaluated on growth performance, immunology, antioxidant status, and pork quality. This project also has funding from the Fats and Protein Research Foundation and industry.

~~Sow Research~~

- **Supplemental Cu for sows.** Participation in this S-1061 project objective is almost complete. This project evaluating multiple levels of Cu from copper chloride (TBCC) has finished the animal phase. Lab work will commence in a variety of areas and 2 other universities remain to complete the animal and sample collection phase.
- **Essential oils for sows.** This project is also part of the S-1061 project. Currently an essential oil (trade name “Absorbezz”) is being evaluated relative to its effects on constipation. Several universities are using the evaluation as an undergraduate student research project.
- **Superdose phytase for sows.** An NPB project has been developed for submission related to the concept of superdosing. This follows the very successful NPB project with superdosing in grow-finish pigs.

University of Nebraska-Lincoln

Swine Research

NCERA-219 – SDSU, Brookings, SD

October 26-28, 2016

Personnel

Nutrition – Philip Miller, Thomas Burkey

Reproductive Physiology – Brett White

Meats – Gary Sullivan, Ty Schmidt, Dennis Burson

Genetics – Daniel Ciobanu, Benny Mote (60% extension, 40% research)

Graduate Research Tech: Melanie Trenhaile

Graduate Students: 3 Genetic, 4 Nutrition

Research Facilities

The ARDC swine facility is 45 minutes north of campus. It is a wean to finish facility that has 24 boar stalls, 368 sow gestation stalls, breeding pens, 96 farrowing crates, and 21 day weaning age. Nursery capacity is roughly 800 head and finishing capacity of 1200 head. All matings are now via AI with some being in house collected with new collection area and semen analysis equipment. Lines at the farm include Nebraska Index Line (NIL), Full sized piglet line, and “longevity” reps consisting of DNA Landrace sires X NIL females.

On campus facilities include gestation, 12 farrowing crates, nursery, metabolism crates, and small pen grow finish.

Research Activities

Sow Longevity – Currently are farrowing the 14th repetition of ~100 females. Rep 15’s are bred for P1 litters and Rep 16’s are on the ground. Females are developed from 120 days to 240 days of age on different planes of nutrition. Most recent reps are on an ad libitum feed with either standard energy or restricted energy. Gilts are heat checked starting at 130 days of age to capture age at puberty. Feet and leg structure traits are now being recorded using GoPro cameras from front, side, rear and close ups of toes/feet in both gilt development and gestation. Rep 14 gilts were gestated in either stalls or pens for the duration of gestation. There was no difference in litter size, but there was a significant effect for lameness.

1200 head commercial nursery facility

Finalizing the agreements for nutrition/water trials at a commercial antibiotic free flow an hour from campus. 24 pens holding 50 pigs can be fed either of two diets and two water treatments.

Water Intake

Working to develop a water meter to measure/capture water intake on an individual pig basis in group pens. Initial goal is to better understand behavior in relation to producing full market value pigs. Working towards the connection of water intake and feed intake from a genetic standpoint.

Kinect Monitoring

Developing technology to automatically track individual pigs in group pens for welfare, behavior, locomotion, water tendencies and feed tendencies.

Nutrition

Nursery probiotics trials with nothing of great significance. Trials designed to get pigs through health challenges with most recent work with PCV2 challenged pigs.

Michigan State University Station Report
2016 NCERA-219 Meeting
South Dakota State University
Brookings, South Dakota

- People
 - Work related to swine
 - Janice Siegford
 - Nathalie Trottier
 - Gretchen Hill
 - Madonna Gemus-Benjamin
 - Julie Funk
 - Jim Hilker
 - Steve Safferman
 - Steve Miller
 - John Mann
 - Tim Harrigan
 - Janice Swanson
 - Adam Moeser
 - Beth Ferry
 - Melissa Millerick-May
 - Martha Mulks
 - Sarah Ison
 - Shelby Bollwahn
 - Jason Hofman
 - Roger Betz
 - Lois Wolfson
 - Joan Rose
 - James Tiedje
 - Retirements
 - John Shelle
 - Richard Balander
 - Camie Heleski
 - Jerry May
 - Departures
 - Darrin and Liz Karcher – to Purdue University
 - Wendy Powers – to the University of California
 - Tom Guthrie – switch to 100% Equine
 - Loss
 - Dan Kiesling
 - Open Positions
 - Swine Educator Southcentral Michigan – currently
 - Aerosol Dispersion Educator – in development
- Research
 - Siegford, Bates and others
 - Genetics of sow mixing aggression
 - Trottier and others
 - Lactating sow heat stress and dietary synthetic amino acids
 - Hill and others
 - Vitamin A, D, E in drinking water of nursery pigs
 - Rozeboom
 - Whey-fed pork
 - Miller, Rozeboom, Mann, Safferman
 - Economic assessment of factors related to winter manure application
 - Safferman, Smith, Rozeboom
 - Manure nutrient movement through partially frozen soils
 - Mulks and others
 - Stabilized E. Coli, Tonsil microbiome
 - Funkhouser, Bates, Ernst and Steibel
 - Using genomic marker information to assess breed purity
- Extension
 - Benjamin and others
 - Animal well-being audits
 - Rozeboom, Ross, Ferry, Schmidt
 - Preparedness of Michigan Pork Producers for Highly-Contagious Disease
 - HPAI Response – Planning and Implementation

NCERA219

The Ohio State University

Submitted by Steven J. Moeller

10/28/16

Ohio State Swine Research Faculty and Staff:

- Dr. Steve Moeller (production management, genetics), Dr. Monique Pairis-Garcia (animal welfare), Dr. Sheila Jacobi (swine nutrition, gut health), Dr. Eric England (muscle biology, pork quality, genetics).

Swine Research Activities:

- Steve Moeller - Space Study within NCERA – Two replications completed as of August, 2016 for the MN Pork Board grant via University of Minnesota. Garth Ruff, M.S. candidate will use the OSU portion of the study for a portion of his M.S. thesis. Expected graduation in May 2017.
- Monique Paris-Garcia – Completed NPB funded research on placement of sow mats in farrowing for lame sows. Manuscript submitted. Garth Ruff as co-author. Briefly, no impact on improvement of lameness. Sows with mats in the crate weaned fewer pigs.
- Sheila Jacobi – Nursery Nutrition research, alternatives to antibiotics. 1) Chris Hanson Company: Efficacy of a new probiotic product (EB15) containing 2 strains of *Bacillus subtilis* in nursery pigs. No effect compared with no-antibiotic control. 2) Evaluation of Supplemental Dietary Organic Acid and Plant Extract on Piglet Weaning Stress. No effect when compared with antibiotic control.
- Eric England. Studying a genetic mutation in the area of the Napole Gene, influence on meat quality. Packer study on pork shelf-life for enhanced pork loins.

Swine Extension Programming:

- Ohio Swine Symposium
- Tri-state Sow Housing Conference (OSU, MSU, Purdue)
- Ohio Health Symposium
- Pork- and SowBridge participation – Multi-state collaboration
- Ventilation Trailer Training Programs
- PQA Plus, TQA, and Youth PQA Plus – Advisor Training and Certification of producers/youth
- PAACO – Common Swine Industry Audit, Auditor Training and On-farm programs
- Junior Swine Day

University of Minnesota Station Report
NCERA-219 Committee Meeting
University of Minnesota
10/26/16

Swine Management Projects

Do old floor space allowances apply to modern finishing pigs marketed at 300 lb?

PI's: Johnston, Moeller, Goodband, Rozeboom, Shannon, Schieck

This cooperative project is nearing completion under the same protocol at five university research farms. Current floor space allowances were determined in research studies conducted 10 to 20 years ago using pigs that were marketed at a body weight of no more than 250 pounds. Currently, pork producers are regularly marketing pigs that weigh over 280 pounds and often weigh 300 pounds. The overall objective of this project is to determine the proper floor space allowance for growing-finishing pigs that are marketed at 300 pounds live weight. *Specific objective 1:* In Study 1, we will determine the effects of floor space allowance on growth performance and welfare of pigs throughout the growing-finishing period when marketed at an average pen live weight of 300 pounds. *Specific objective 2:* In Study 2, we will determine the effects of floor space allowance on growth performance of pigs weighing 300 pounds. Cooperating institutions are wrapping up the last studies and data from each cooperator is being collated into one dataset for analysis. The final report is due to the MN Pork Board on February 1, 2017.

Funding: MN Pork Board

Determining the minimal floor space allowance for gestating sows kept in pens with electronic sow feeders.

PI's: Li, Johnston, Baidoo

The objective of this project is to determine the minimal floor space allowance that will ensure acceptable performance and welfare of gestating sows kept in large pens with electronic sow feeders (ESF). By investigating effects of floor space allowance on reproductive performance, behavior, health, and stress of gestating sows under near-production conditions, we will be able to define the minimal space allowance scientifically. About 960 sows are involved in this study conducted at the University of Minnesota's Southern Research and Outreach Center in Waseca. Sows were assigned to gestation housing treatments that provide: 22, 20, 18 or 16 ft² per sow from day 35 of gestation until farrowing. A fifth treatment will provide 22 ft² per sow for the first week after mixing then sows will be allowed 16 ft² per sow. The data collection portion of this experiment is complete. We are currently preparing the data for statistical analysis. We expect to complete this experiment August 1, 2017.

Funding: National Pork Board

Tail-biting in growing-finishing pigs

PI's: Li, Johnston, Jacobson, and Martin

Consumers and activists are raising concerns about the un-relieved pain associated with tail-docking young pigs. In the absence of drugs or practices to mitigate the pain associated with tail-docking, some have asked if the industry still needs to dock tails on young pigs. This project is designed to provide answers to that question. The overall objective of this project is to identify an effective and animal welfare-friendly measure to prevent tail biting in pigs. First, we evaluated the efficacy of the current preventative measure, tail docking. We quantified the impact of tail docking on tail biting behavior and growth performance of pigs. Half the pigs were tail-docked at birth and the remaining pigs had their tails left intact. Tail biting did occur throughout the study. Tail biting first presented when pigs were in the nursery. Tail biting was rampant in some pens. Pigs that were victims of tail biting displayed a transient reduction in ADG; however, overall growth rate of victimized pigs was not different than pigs that suffered no tail biting. However, 21% of pigs with intact tails vs. 5% of docked pigs were removed due to tail damage. As a consequence of carcass trim loss, carcass contamination and mortality, 90% of pigs with undocked tails vs. 97% of docked pigs were harvested for full value. We are in the process of using video recordings of pigs to investigate the development of tail biting behavior with an aim of predicting tail biters (pigs that bite other pigs' tails). This will allow us to explore an alternative measure of prevention by managing tail biters. We collected blood samples to determine the effect of tail biting on pain, stress, and weight gain of victimized pigs (pigs with damaged tails) and tail biters. This will help us not only quantify the negative impact, but understand the underlying mechanism of tail biting. This project was conducted at the West Central Research and Outreach Center during the summer of 2015. Video recordings and blood parameters are being analyzed currently. The following publications have resulted from this project:

Li, Y.Z., S. Q. Cui, J. Anderson, A. Holten, A. M. Hilbrands, and L. J. Johnston. 2016. Docking the tail or not: Effect on tail damage, skin lesions and growth performance of growing-finishing pigs. Abstract Session 2.6. Precision Livestock Farming, Animal Production, Health, and Welfare, CIGR-AgEng. Conf., Aarhus, Denmark, June 26-29, http://conferences.au.dk/cigr-2016/sessions-and-participants/#/programme?_k=k3rc9k

Li, Y., J. Anderson, A. Holten, J. Holen, A. M. Hilbrands, and L. J. Johnston. 2016. Understanding tail biters and victimized pigs during outbreaks of tail biting. J. Anim. Sci. (Supple. 2):8 Abstr. #018.

Li, Y. Z. and L. J. Johnston. 2016. Effect of tail docking on welfare and performance of pigs during nursery and growing-finishing periods. Submitted for presentation at 2017 Midwest ASAS meeting. Omaha, NE.

Funding: National Pork Board

Understanding social structures related to tailbiting

PI's: Li, Johnston, Martin

Tail biting among growing-finishing pigs continues to be a problem in a wide array of pig production systems. This project seeks to understand the social connections among pigs that might precipitate outbreaks of tail biting. Through the use of Social Network Analysis (SNA), we are attempting to characterize the social relationships among growing pigs housed in groups. One performance study including video recording of pigs has been completed in the summer of 2016. We are currently analyzing the data to gain experience in use of SNA and to understand social relations among pigs. The following publications have resulted from this project:

Li, Y. Z., H. Zhang, L. J. Johnston, and W. Martin. 2016. Do pigs form social structures: An application of social network analysis. Submitted for presentation at 2017 Midwest ASAS meeting. Omaha, NE.

Funding: Rapid Agricultural Response Fund, MN Agricultural Experiment Station.

Greening of Agriculture

PI's: M. Reese, Heins, C. Reese, Johnston, Jacobson, Tallaksen, Buchanan, and others

Agricultural production systems in Minnesota use immense amounts of energy for the production of grain, feed, milk, and meat. In many cases, the energy systems used in livestock production are antiquated and inefficient. Large energy losses have become the industry standard. Inefficient as the energy systems may be, producers have grown confident with their operation and reliability. Increasingly however, margins are becoming smaller for livestock producers and consumers are demanding low-energy, low-footprint food. Producers may be willing to adopt new, energy-efficient systems but need to know their reliability and effectiveness. This project has many different facets. In one portion of this project, we are monitoring use of fossil fuel energy in 6 commercial swine units over a period of 18 months. The monitored swine units include sow, nursery, and growing-finishing barns. During 2015, heat lamp operation accounted for about 70% of the electricity used in sow units. In finishing units, ventilation fans accounted for about 80% of electricity use. With this baseline energy consumption data, we will calculate a carbon footprint of each phase of pork production and identify areas for significant energy savings. We have also completed a modeling exercise to evaluate the potential energy and cost savings of several different energy conservation approaches.

In another facet of this project, we installed a 27 kW solar photovoltaic panel on the roof of the swine finishing barn at the West Central Research and Outreach Center. This panel was installed in June, 2015. Through August 2016, electricity generated by the solar panels on the roof was greater than the total electricity used in the power-ventilated barn which houses 432 pigs.

Funding: Minnesota State Legislative Citizen Commission on Minnesota Resources

Solar energy utilization for Minnesota swine farms – Phase II

PI's: Johnston, Reese, Jacobson, Janni, Buchanan

Market chains are pushing agricultural producers to improve the environmental sustainability of their production systems and reduce their carbon footprint. One way to do that is to reduce the use of fossil fuels in production. In this project, we will install solar PV panels on the roof of the WCROC farrowing barn which will generate electricity to drive chillers. The chillers will cool liquid that will be circulated under sows in farrowing stalls to cool sows during summer. In addition, the chillers will cool water supplied to drinkers for lactating sows. The hope is that cooling sows in this manner will reduce the use of fossil fuel-generated electricity for ventilation to cool sows and will improve performance of heat-stressed sows. Consequently, the carbon footprint is reduced due to less fossil fuel use and improved productivity of sows. Funding has been secured and the system is currently being designed with installation expected in early spring, 2017.

Funding: Minnesota State Legislative Citizen Commission on Minnesota Resources

Performance response of growing-finishing pigs to an air-cooled environment during simulated heat stress.

PI's: Jacobson and Johnston

This project was designed to determine the pig performance benefits of maintaining thermal neutral conditions (avoiding heat stress) in a group of grow-finish pigs compared to allowing the room environments to exceed the pig's thermal neutral zone (heat stress). This project was conducted from December, 2014 through March, 2015 at the West Central Research and Outreach Center. Heat-stressed pigs exhibited a 13% reduction in feed intake, a 5% reduction in daily gain and were 5 pounds lighter at marketing than pigs housed in the thermo-neutral environment. Carcass composition was not affected by temperature treatments. This project sets the stage for a subsequent project on use of solar-powered heat pumps to cool finishing pigs. The following publications resulted from this project:

Johnston, L. J., L. D. Jacobson, B. P. Hetchler, C. D. Reese, and A. M. Hilbrands. 2016. Performance response of grow-finish pigs to simulated heat stress under commercial-like conditions. 16th International Conf. on Production Animal Diseases in Farm Animals, Wageningen Academic Publishers. Pg. 81(Abstr.).

Jacobson, L., L. Johnston, B. Hetchler, C. Reese, and A. Hilbrands. 2016. Research room design using ambient winter cooling to implement pig heat stress studies. CIGR-AgEng. Conf., Aarhus Denmark, June 26-29,
http://conferences.au.dk/uploads/tx_powermail/2016_cigr_ageng_full___final___pdf_version_of_paper_cooling_pigs_using_ambient_winter_air_without_instructions__may__2016_.pdf

Funding: Minnesota Pork Board

Influence of storage bin design and feed characteristics on flowability of pig diets

PI's: Johnston, Rosentrater, Hilbrands, Shurson

Swine diets very high in DDGS are notorious for poor flowability in commercial feed handling systems. One factor that may influence this characteristic is feed bin design. In this project, we evaluated feed storage bins of three designs: Steel with 60° cone, Steel with 67° cone, and Poly with 60° cone. We filled each bin with a corn-soybean meal-DDGS (40%) diet and measured flow rate out of the bin at 3, 7, and 21 days after feed delivery. We conducted this study during cool (spring-fall) and hot (summer) seasons. In a second experiment, we installed a passive feed flow agitator in one bin of each design. Feed flowed fastest out of the Poly bin with a 60° cone. Installing the passive agitator improved feed flow in the Poly bin but had no effect in the two Steel bins. The following publications have resulted from this project:

Hilbrands, A. M., K. A. Rosentrater, G. C. Shurson, and L. J. Johnston. 2014. Influence of storage bin design on flowability of DDGS-based pig diets. *J. Anim. Sci.* 92(Suppl. 2):125 (Abstr.).

Hilbrands, A. M., K. A. Rosentrater, G. C. Shurson, and L. J. Johnston. 2016. Influence of storage bin design and feed characteristics on flowability of pig diets containing maize distillers dried grains with solubles. *Appl. Eng. Agric.* 32:273-280.

Funding: MN Pork Board

Use of a liquid feeding system for grow-finish pigs

PI: Baidoo

A Big Dutchman liquid feeding system has been installed at the Southern Research and Outreach Center in Waseca, MN. Studies are underway to evaluate the use of this feeding system with a variety of feedstuffs, especially co-products of the biofuels industries. Current projects are designed to evaluate effects of liquid feeding condensed corn distillers solubles and distillers whole stillage on growth performance, carcass characteristics, and sensory qualities of growing-finishing pigs.

Funding: MN Pork Board

Minimizing hunger in gestating sows

PI: Baidoo

Understanding the physiological basis for and nutritional approaches to mitigate the negative welfare effects of hunger in gestating sows is the focus of this project. Multiparous sows (n = 156) were fed four different feeding levels (0.5, 1.0, 1.5, or 2.0 times maintenance energy requirements) during three different periods of gestation (27-34 d, 55-62 d, and 83-90 d). A subset of sows was implanted with chronic venous catheters for blood sampling of energy metabolites to evaluate relationship between these metabolites and hunger in sows. This project is nearing completion and results are being summarized in final reports and journal manuscripts.

Jin Soo K., X. Yang and S.K. Baidoo. 2016. Relationship between body weight of primiparous sows during late gestation and subsequent reproductive efficiency over six parities. *Asian Australas. J. Anim. Sci.* 29:6:768-774.

Ren, P., X. Yang, J. Kim, D. Menon, D. P. Pangen, H. Manu, A. Tekeste and S. K. Baidoo. 2015. Effect of different feeding level during three periods of gestation on sow and litter performance. *J. Anim. Sci.* 93(E-Suppl. 2): 385(Abstr.).

Kim, J., S. K. Baidoo, and X. Yang. 2014. Relationship between backfat thickness of sows at d 109 of gestation and performance of sows and suckling pigs. *J. Anim. Sci.* 92(E-Suppl. 2): 349 (Abstr.).

Ren, P., R. Railton, J. Jendza and S. K. Baidoo. 2014. Interactive effects of different energy intake during periods of gestation and housing system on sow performance. *J. Anim. Sci.* 92(E-Suppl. 2): 350 (Abstr.).

Funding: USDA NIFA

Effects of age at first breeding and dietary energy levels during the rearing period of replacement gilts on reproductive performance

PI's: Baidoo, Kim, and Yang

The objectives of this study are to investigate the influence of age at first breeding and diet energy levels during the rearing period of replacement gilts on farrowing rate, body weight, backfat change, wean-to-breed interval, litter weight and piglet survivability at birth and at weaning and also on gilt endocrine status. This information will be used to guide nutritional management of gilts with the aim to increase sow economic returns. Proper gilt development is essential to maximize the lifetime productivity of sows. Our study will provide new information for optimizing the age at first mating for gilts.

Funding: MN Pork Board

Waste Not project

PI's:: Shurson and others

The goal of Waste Not is to learn how urban organic wastes (sewage biosolids, food waste, and urban vegetation) are generated; how they flow through coupled city-farm systems, and how these flows can be re-engineered – technically, economically, and politically – to improve sustainability. In phase 1, the sources of organic wastes were analyzed for nutrient and energy content. In addition, the social and political landscapes related to re-routing these wastes were studied. In subsequent phases, the research team will evaluate the feasibility of using these wastes for swine feed, conduct a life-cycle analysis and economic analysis of using these wastes for swine feed and analyze the political and social drivers that influence use of urban wastes for swine feed.

Funding: MN Drive funds (U of M internal initiative)

Education/Demonstration Projects

SowBridge

PI's: Schieck, Johnston, et al.

Short monthly programs (30 min + Q&A) are delivered over the noon period via CD and a phone-bridge. The program has grown to include ten collaborating institutions: MN, IA, SD, NE, OH, IN, IL, KS, NC, and MI. The program for the 2017 series is being developed. The 2017 series will be the ninth edition of SowBridge.

PorkBridge

PI's: Schieck, Johnston, et al.

Bi-monthly programs (60 min + Q&A) are delivered over the noon period via CD and a phone-bridge. Same states involved as SowBridge.

PQAPlus and TQA Producer Training

PI's: Schieck, Baidoo, Johnston, DeWitte, and Resler

Our group of advisors in cooperation with the MN Pork Board provides monthly training sessions to certify producers in the Pork Quality Assurance Plus and Transport Quality Assurance programs that are administrated by the National Pork Board. We also provide services for Site Assessments in the PQA+ program.

Common Swine Industry Audit workshops

PI: Schieck

These workshops are modeled after a very successful workshop developed by the Extension staff at Iowa State University. The goal is to familiarize producers with the audit tool, audit procedures, and goals of the audit. Producers leave the workshop prepared for an audit of their swine operation.