

Minutes

Projects: NCCC42 Committee on Swine Nutrition
S-1081 Nutritional Systems for Swine to Increase Reproductive Efficiency
Meeting Date: January 3 - 4, 2019
Date of Report February 14, 2019
Meeting Location: Rosen Plaza Hotel, 9700 International Drive, Orlando, FL 32819

Meeting Agenda and Minutes

Morning Session: Thursday, January 3, 2019 Joint Session (NCCC42 & S-1081)

NCCC42 Members in Attendance: Tayo Adedokun (University of Kentucky), Layi Adeola (Purdue University), Michael Azain (University of Georgia), Scott Carter (Oklahoma State University), Thomas Crenshaw (University of Wisconsin), Ryan Dilger (University of Illinois), Rajesh Jha (University of Hawaii at Manoa), Sung Woo Kim (North Carolina State University), Shengfa Liao (Mississippi State University), Yanhong Liu (University of California, Davis), Phillip Miller (University of Nebraska), Anoosh Rakhshandeh (Texas Tech University), Tofuko Woyengo (South Dakota State University)

S-1081 Members in Attendance: Joel Brendemuhl (University of Florida), Lee Chiba (Auburn University), Mark Estienne (Virginia Tech-Tidewater AREC), Merlin Lindemann (University of Kentucky), Crystal Levesque (South Dakota State University) Charles Maxwell (University of Arkansas), Eric van Heugten (North Carolina State University)

Committee Officers:

S-1081: Merlin Lindemann, Chair; Charles Maxwell, Vice Chair; Mark Estienne, Secretary
NCCC42: Ryan N. Dilger, Chair; Shengfa Liao, Vice Chair; Tayo Adedokun, Secretary

Administrative Advisors: Dr. Don Beitz (Iowa State University; NCCC42) and Dr. Bob Godfrey (University of Virgin Islands; S-1081)

Guests: Dean Boyd, Hanor Company (called in); Chris Hostetler (National Pork Board), and Chad Risley (Berg+Schmidt America LLC)

Day 1 (Jan 3rd; AM meeting)

The meeting was declared open at 8:00 AM by Merlin Lindemann, and he immediately introduced the new (two) administrative advisors, committee officers of both committees, and the guest speakers. An overview of the agenda was presented and changes noted. Each member that was present had an opportunity to introduce him or herself. Nutritional Systems for Swine to Increase Reproductive Efficiency formerly known as S-1061 is now S-1081. Merlin Lindemann introduced and welcomed the new administrators to the meeting. Ryan Dilger introduced and welcomed one new member, Anoosh Rakhshandeh (Texas Tech University) into the group. The new proposal for NCCC42 has been submitted

for review. Layi Adeola and Phil Miller worked extensively on this with some assistance from Ryan Dilger.

Merlin Lindemann stated that there is a possibility that NIFA will move out of Washington, D.C. and this was discussed. Approximately 131 cities and universities have made proposals for relocating NIFA to their location. Many people (e.g., land grant universities) are opposed to a potential move and many USDA employees have begun to look for jobs elsewhere. Possible benefits of a move out of USDA include a location that is closer to stakeholders and decreased operating costs (rent will soon be due to be renegotiated).

NCCC42: The ongoing government shutdown prevented Brian Kerr (USDA-ARS, Ames) from attending this year's meeting. In addition to this, Marcia Shannon (University of Missouri), Hans H. Stein (University of Illinois), Jim Nelssen (Kansas State University), and Gretchen Hill (Michigan State University) were absent at this year's meeting.

Comments from administrative advisors

Don Beitz (Iowa State University: NCCC42) stated that a new project proposal was submitted by NCCC42 last fall and is currently under review. Dr. Bob Godfrey (University of Virginia: S-1081) announced that the new project proposal for S-1081 was approved and noted that the entire submission process had progressed in a smooth fashion. Bob Godfrey also noted that reports of the annual meeting were due within 60 days of the meeting.

Guest presentations:

Merlin Lindemann announced that one of the invited speakers (Charlotte Kirk-Baer) was unable to make it to the meeting due to the ongoing Government shutdown.

Prior to Dean Boyd's presentation, Merlin Lindemann introduced Dean Boyd to the group and gave some background information regarding his training and profession. Boyd is a University of Nebraska graduate with over 38 years of experience in academic and industry research. He was a faculty member at Cornell University for 14 years before leaving for PIC with the goal of expediting application of research findings into industry. Dean Boyd (Hanor Company) was unable to attend the meeting and give his presentation in person but was able to call in to give his presentation. The theme of his talk was on perspectives about nutrition research in the future. He stressed a strong interpersonal relationship between academia and the industry among other things.

Boyd summarized how pig nutrition research has changed: 1) New scientists are highly trained and work at a very high level, 2) funding for research has decreased, 3) multidisciplinary research has increased (e.g., feed efficiency group), 4) Some research groups have developed small "armies" of people, 5) By today's standards, university swine facilities are generally small so industry units must be utilized, and 6) Pace of research is high and must increase. In response to a question from Lindemann, Boyd stated that Industry-University collaboration is not a saturated market. Industry looks primarily at personal relationships that are mutually beneficial. Universities bring to the table: 1) Good minds, 2) Hands to do work, and 3) ability to iron out details. Examples of companies with university research ties: Prestage,

Iowa Select, Smithfield, Seaboard and Christensen Farms. New Fashion Pork has worked with Kansas State University.

Chris Hostetler (National Pork Board, NPB) thanked members of both committees for their timely response and submission of research proposals for funding consideration. In addition, he expressed his gratitude to members that have been reviewing proposals for NPB. He spent most of the time that was allocated to him to provide in-depth information regarding new updates at NPB as well as information on likely priority areas for future research funding. He also stressed on the importance of collaboration when putting together research proposals for funding consideration.

Finally, Chad Risley (Berg+Schmidt America LLC) provided us with information about the inside workings of AFIA and AFIA non-ruminant nutrition updates. He also shared with the committee information on IFEEEDER updates and projects.

Joel Brendemuhl requested members to suggest potential dates for the 2020 meeting. The two options that were discussed were Jan 6-7 or 7-8. It was agreed that Joe Brendemuhl would check with the hotel staff about availability after which a final decision would be made (the following day).

Following administrative updates, **oral reports from participating stations** were presented. For these station reports, a digital copy of 14 reports compiled from 14 stations were distributed to the meeting attendants ahead of the oral reports.

The joint morning session concluded at 9:45 AM.

Break-out Sessions

S-1081

The S-1081 session was called to order at 10:20 a.m. by chair Lindemann. Those present were Drs. Lindemann, Maxwell, Estienne, Brendemuhl, Crystal Levesque from South Dakota State University, Eric van Heugten from North Carolina State University, and Lee Chiba from Auburn University. Also attending was Dr. Bob Godfrey, new S-1081 administrative advisor, and Dr. Chad Risley from Berg+Schmidt.

Lindemann reviewed the approval process for the most recently submitted project proposal (S-1081). Lindemann thanked Godfrey for his assistance during the project review and also for his willingness to attend the meeting. For Godfrey's benefit each committee member briefly described facilities at the home institution. *Lindemann*. The University of Kentucky swine facility near Versailles, KY opened in 2001 and is in good shape. Capacity is 80 – 100 sows and Lindemann noted that the facility supplies the University of Tennessee with pigs. *Estienne*. The Virginia Tech- Tidewater Agricultural Research and Extension Center in Suffolk, has older swine facilities, most of which were constructed in the 1960's. Capacity is 96 sows, but the unit currently batch farrows 40 – 50 sows and supplies the Virginia-Maryland College of Veterinary Medicine with pigs on occasion. The Suffolk facility is approximately 275 miles from the Virginia Tech campus in Blacksburg. A new swine facility to replace the existing swine center on campus has been approved and will be located off-site at the Kentland farm. *Levesque*. South Dakota State University has a 2-year old swine facility the bill for which was recently paid in full. The main unit is spaced for 150 sows and 10 miles south of town is a 1,200-head wean-to-finish unit. *Van Heugten*. North

Carolina State University has a 200-sow farrow-to-finish facility that was constructed in 1987. Thirty-two to 40 sows farrow monthly. A 200-sow, farrow-to-finish research facility is also located in Plymouth, NC that batch farrows under the supervision of Dr. Mark Knauer. There are 5 hoop barns at a research facility in Rocky Mount, NC that maintains the antibiotic-free sow herd originally housed at the University of Kentucky. Finally, the former Swine Evaluation Station in Clayton, NC, can accommodate grow-finish trials with 99 pens (6 pigs/pen). Research facilities are serviced by a recently constructed feed mill. The University Animal Science Department has 5 nutritionists, 1 reproductive physiologist, and 1 geneticist working in the swine area. *Maxwell*. The University of Arkansas swine facility has 150 PIC sows with 30 to 35 farrowing every seven weeks (6 to 7 farrowing groups per year). Maxwell noted that research is facilitated by an outside statistician that returns analyzed data in just a few days. *Chiba*. Originally with 5 units, Auburn University now has one swine facility. The unit has 18 farrowing crates and 18 nursery pens and maintains 20 sows, including Mangalitsa genetics. *Brendemuhl*. The University of Florida once had three swine units and 6 to 7 faculty conducting swine research. Today there is only one unit with no active swine research program. A handful of sows farrow every 5 to 6 weeks and are used primarily for teaching.

Objectives contained in the new S-1081 project were briefly discussed. The three objectives are to determine reproductive effects of feeding sows boron (objective 1; Maxwell or Lindemann to serve as coordinator) or phytogenic additives (objective 2; Chiba or Lindemann to serve as coordinator). Objective 3 is to determine reproductive effects of phase feeding gestating sows and the coordinator is Levesque. Levesque stated that Objective 3 is underway at South Dakota State University and sows are receiving a constant 12 g lysine/day throughout gestation; 12 g lysine/day until increased to 17 g/day in late gestation; or 12 g lysine/day and then “pulled back” to 7 – 10 g/day (adjusted based on parity) early/mid gestation.

A project outside the S-1081 objectives was discussed. The study would determine amino acid and fatty acid composition in sow milk. Dr. Kevin Touchette with Ajinomoto will assist with milk amino acid analyses and Risley from Berg+Schmidt will facilitate fatty acid analyses. Basically, 20 to 50 sows at each participating station would supply 50-mL milk samples at two times during lactation. Samples would be lyophilized and shipped for analyses. Sow breed, parity, litter size, litter ADG, diet composition, lactation weight change, and feed intake would be recorded. Stations expressing interest in participating were University of Arkansas, South Dakota State University, Virginia Tech, University of Kentucky, and North Carolina State University. Lindemann agreed to initiate protocol development that will be distributed to those interested.

The session was adjourned at 12:15 p.m.

NCCC42

NCCC42 breakout session was directed by Ryan Dilger (Chair). The 2018 meeting minutes were reviewed and approved unanimously by the committee members.

Research Discussion - Update, review, planning, execution, publication

The “Microbiome” Project:

Phil Miller (Nebraska station) gave an update regarding the microbiome project and apologized for the delay in getting the project started. He informed the committee of the challenges with getting the feed

mixed at one location. We deliberated on several options including having each location mix its own diet. At the end of the discussion, the committee agreed that the best option is to mix the diet at one location and that each member should be ready to pay the cost of shipping of the diets to their respective locations. After a lengthy discussion, the committee decided to first conduct a preliminary study before embarking on the full study. Based on this, each station is expected to collect fecal samples from two piglets, one barrow and one gilt from the same litter (on the day of weaning) and send samples to Phil Miller for microbiome analysis. Phil Miller promised to send an updated protocol to all of the participating stations. Almost all the experiment stations, except for Hawaii station (lack of swine facility), indicated their interest in being a part of this project. Results from this study (microbiome populations in nursery pigs from different stations) will be used to refine the original protocol before the study is eventually conducted.

Bakery Meal Studies

Hans Stein was unable to make it to the meeting but sent in detailed information regarding the status of all the studies that he is leading:

1. Digestibility of energy in bakery meal fed to growing pigs (11 sources)

Some of the participating institutions have completed the animal portion of the study (UK and SDSU). Diets have also been shipped to MN. Experimental diets will be shipped to the remaining stations (Purdue, NE and NCSU) soon. Dr. Stein requested that 50 g of dried and ground feces and 50 mL of urine should be sent to him for analysis. No additional station showed interest in being a part of this study. All fecal samples must be dried, ground, and thoroughly mixed before sampling (no sub sampling prior to drying and grinding).

2. Digestibility of amino acid in bakery meal fed to growing pigs (11 sources)

Two stations (Purdue and MN) have completed this study. University of Kentucky will be conducting the study around April/May 2019. No additional station showed interest in this study. Between 200 and 300 mL of thoroughly mixed ileal digesta should be sent to Dr. Stein if a station does not have the capacity to dry the ileal digesta. A total of 20 to 30 g of ground, freeze-dried samples should be sent to Dr. Stein (University of Illinois).

3. Collection of commercial diets for analysis for Ca and P.

Since our 2018 meeting when this study was first discussed, Hans Stein has not received a single sample from any committee member. Chris Hostetler (National Pork Board) and Anoosh Rakhshandeh (Texas Tech University) promised to facilitate this by working with large feed integrators to secure samples for this project. They promised to work directly with Dr. Stein in this regard.

DSM Science & Technology Awards 2019

Hans Stein sent in information regarding the DSM Science & Technology Award. There was some confusion regarding eligibility because what was contained in the DSM flier is different from what was available on ASAS website. Ryan reached out to his contacts at ASAS office (email) but had not heard back from them by the time the meeting adjourned. The deadline for the award was Jan 15, 2019.

Sung Woo Kim (NCSU) announced that he was looking for a Ph.D. student (must be a US citizen) to utilize a National Needs Fellowship he currently has. Furthermore, Shengfa Liao (MSU) is also looking for a postdoc.

The NCCC42 morning session adjourned for lunch at 11:50 AM.

Afternoon Session: Thursday, January 3, 2019
Joint Session

Ryan Dilger declared the meeting open at 1:15 PM.

Guest presentation: National Pork Board (NPB)

Chris Hostetler (NPB) provided an update of the NPB 2019 Research Efforts. According to Chris, the current economic indicator is slightly down from 2018; however, pork demand is stable despite the addition of thousands of sows to the existing population last year. The breakdown of NPB revenues for 2019 include \$8 m (13%) for research and technology. The lion's share of this funding (~\$2 m) is allocated to swine health while \$1 m is allocated to Animal Science. Industry Productivity Analysis was removed from NPB priority for 2019. The business model of NPB has also changed. Advertisement such as during major sporting events such as the Super Bowl has been discontinued. They are currently exploring the Business-to-Business Opportunity model (e.g., working directly with companies like Walmart and McDonalds). In addition to this, they are doing marketing in the area of big data analytics. NPB will continue their research efforts in nutrition consortium, novel technology to monitor piglet health, productivity, and survivability. Multidisciplinary collaboration was encouraged. According to him, half of the proposals that were submitted for funding this cycle (2019) were from the industry

NPB currently has 6 committees with 22 members. This will be reorganized into one committee with 30 members which will be divided into smaller subgroups. He encouraged collaboration with other researchers within and outside of our department, university and across universities.

Guest presentation: American Feed Industry Association (AFIA)

Chad Risley (from Berg+Schmidt America LLC) provided us with an overview of AFIA that represents the US feed industry with over 680 companies that include 75% of the commercial feed manufacturers in the US. AFIA has been in existence since 1909 and currently has 48 board members. The areas of activities (including research) that are important to AFIA include animal food safety, ingredient availability, trade, sustainability, networking, education and training, as well as standardized methodology for quantifying greenhouse production (emission). According to Chad, AFIA is well managed and financially sound. He reminded members that were present at the meeting to stop by AFIA booth during the IPPE meeting in Atlanta in February of 2019. He spent some of his time talking about functional lipids and IFEEDER program.

The AFIA top legislative and regulatory priorities include: (1) Food Safety and Modernization Act (FSMA), (2) ingredient approval process [AAFCO vs. FDA], (3) ongoing efforts involving the Veterinary Feed Directive, (4) labeling genetically-engineered products, (5) trade agreements such as Trans-Pacific

Partnership (TPP), and (6) distinguishing animal feed and human food. Additionally, he further reiterated the value of the AFIA IFEEDER Program and how this program continues to grow (usually, IFEEDER funds \$25,000/year per project). The current research priorities set forth by AFIA largely remained the same as what were presented at this committee meeting last year. Briefly, the research needs include feed safety, ingredient evaluation, environment/sustainability, health issues post-AGP, nursery pigs, growing-finishing pigs, heavy pigs, sows, alternative antibiotics, and gastrointestinal microbiome. The market for vitamins and amino acids was also discussed.

IFEEDER's areas of research interest: sustainability, meat quality, heat stress, microbiome, immune response, functional foods, herd efficiency, ideal protein requirement, novel ingredient evaluation, antibiotic free feeding, nursery performance, sows longevity. Chad encouraged every member to visit AFIA website for an in-depth information regarding the organization.

Committee Discussion

Both committees also discussed issues surrounding the DSM Science & Technology Award. The confusion arose from the fact that the information contained in the flyer that was sent out by DSM regarding eligibility was different from that available on ASAS website. Although the deadline was fast approaching (Jan 15, 2019), Ryan Dilger encouraged members to seize the opportunity to nominate any qualifying student(s) for the award.

Station Reports (3:00 PM)

Each station representative presented brief reports for the year 2018 and the meeting was adjourned by Ryan Dilger at 5:09 PM.

Friday Session (Morning): January 4, 2019

Breakout Session

S-1081

Merlin Lindemann called the session to order at 8:00 a.m.

New officers for 2019 were announced: Maxwell from University of Arkansas, Chair, and Estienne from Virginia Tech, Vice-chair. Brendemuhl made a motion that Robert Dove from the University of Georgia be elected secretary for 2019-2020. The motion was seconded by Levesque and passed unanimously.

The milk study discussed on the previous day was again discussed. A sample would be collected and freeze dried and then split. Fatty acid analyses would be conducted at the University of Georgia (Azain) and Lindemann will discuss amino acid analyses with Touchette. Risley stated that Berg+ Schmidt would likely contribute \$5,000 for support of fat analyses.

Data from the S-1061 copper study were discussed and Lindemann supplied copies of tables. Merlin Lindemann also discussed a project that would determine the effects of a second injection of iron given to pigs before weaning on hematology and nursery growth performance. In addition to Kentucky, stations with an interest in participating were Arkansas (Maxwell); North Carolina (van Heugten); South Dakota (Levesque); and Virginia (Estienne). Crystal led further discussion of the late gestation feeding objective and noted that it is likely that altering lysine during gestation will likely impact performance during second and subsequent parities but not first parity.

Estienne will discuss with Dr. Sherri Clarke-Deener regarding her interest in participating in S-1081. Maxwell asked that committee members please provide suggestions for next year's meeting.

Brendemuhl announced that there are tentative plans to tour the nutrition facilities at Disney's Animal Kingdom after next year's meeting.

Session adjourned at 9:30 a.m.

NCCC42

The meeting was called to order by Ryan Dilger at 8:00 AM.

Ryan Dilger introduced the newest member of NCCC42 (Anoosh Rakhshandeh, Texas Tech University) to the group. He is a faculty member in the Department of Animal and Food Science. His responsibilities are research (65%) and teaching and service (35%).

Tofuko Woyengo was nominated for Secretary by Layi Adeola and was seconded by Phil Miller. This nomination was unanimously approved by the committee.

Shengfa Liao will be the Chair while Tayo Adedokun will be the Vice-Chair for the 2020 meeting.

Thereafter, we continued our discussion on potential studies that can be conducted collaboratively across stations. Phil Miller promised to send out an excel sheet indicating what needed to be done regarding the preliminary study that the group agreed to a day earlier. The study centers on the collection of feces (with the aid of fecal loop) from two piglets (one barrow and one gilt per station). Fecal samples should be sent to Phil Miller (Nebraska station) for microbiome analysis. Twelve institutions agreed to take part in the study.

Discussions on how to proceed to the main microbiome study (based on the potential data to be generated from the preliminary study) was discussed. Issues such as adaptive response with about 5 to 10 days lag period (Tom Crenshaw, University of Wisconsin), creep feeding (no creep feeding), piglet size (smaller piglets tend to do much better than bigger pigs in Wisconsin (Tom Crenshaw) while the opposite is the case at Purdue (Layi Adeola). Furthermore, issues with barn cleanliness, the type of disinfectants and the frequency of cleaning and switching of disinfectants were raised (Tom Crenshaw). We also had a brief discussion on the influence of microbiota on animal behavior (Rajesh Jha and Ryan Dilger). Although microbiome project is important, cost and variability associated with data may be our biggest challenge (Ryan Dilger).

New Projects

Anoosh Rakhshandeh (Texas Tech) proposed the possibility of a joint project involving swine nutrition and immune function. Layi Adeola suggested that Anoosh should take into account the cost implication for each contributing station (usually not more than \$3,000/station). This, according to him, would increase more participation and minimizes complexities that could arise as a result of the involvement of multiple stations. Ryan Dilger also mentioned that we should strive to put together studies that will not require pigs to be euthanized as this greatly affects cost.

Shengfa Liao (MSU) raised the issue about the possibility of transforming from being a “Committee” to a true “Multistate” group. Responses to this question varied, including the historical importance of the group being a very successful Committee (Phil Miller). The general consensus was that the group should be kept as it is. Tom Crenshaw (Wisconsin) wanted to know about the possibility of having a funded committee that would spring from NCCC42 while we still maintain NCCC42 in its current form. Ryan Dilger mentioned that a lot of efforts go into forming a new Multistate project and that industry support is also very important.

Tom Crenshaw talked about Vitamin D and immunity in pigs. The main challenge is that we may be able to control several factors in our labs, however, this may not be the case under commercial settings. Ryan Dilger (Illinois) gave a summary of what we agreed to regarding the Ca and P concentration in commercially available pig diets the previous day.

Tom Crenshaw (Wisconsin) proposed doing a barrier function measurement in nursery pigs using FITC-dextran (to be measured in the blood; a quick and easy way). Also, the use of blood endotoxin levels as a measure of gut permeability was also discussed. Yanhong Liu (UC Davis) suggested the use of non-fluorescent dextran (to be measured in urine) as an alternative way to determining gut barrier function. Tofuko Woyengo (SDSU) mentioned that it might not be enough to determine the level of dextran in the urine or blood but that its ratio would be more meaningful. Rajesh Jha (Hawaii) suggested the use of IPEC-J2 cell line for some of the committee’s studies. Mike Azain (Georgia) suggested that a study focusing on the role of fatty acids in intestinal health could be conducted. Ryan Dilger (Illinois) also suggested conducting a study to quantify post weaning stress in pigs. Ryan suggested that each of the ideas on immunology and barrier functions that has been raised should be developed further and presented at our 2020 meeting.

Layi Adeola (Purdue) would like the committee to revive (or form) the two sub-committees that existed in the past. According to Lay, this would enhance our ability to brainstorm and prioritize studies for general discussion. This means each sub-committee would have opportunities to brainstorm on a potential study before such is brought to the floor for general discussion. Layi Adeola then moved that we create two subcommittees and the motion was seconded by Rajesh Jha. This proposal received unanimous support from every member that was present at the meeting.

The committee agreed to and formed the following sub-committees:

- 1) Gut function
- 2) Production

Phil Miller (Gut function) and Layi Adeola (Production) agreed to serve as the Chairs for these sub-committees. Phil Miller suggested that interested individuals should contact the chair of any of the sub-committees they are interested in. Members could belong to one or both of the committees if desired.

Tom Crenshaw informed the committee that Marcia Shannon (University of Missouri) sent an email promising to send the manuscript she has been working on to him (Tom Crenshaw).

Joint Section

Merlin Lindemann called the meeting to session at 10:00 AM.

New officers were announced by the Chair of the respective committees:

Merlin Lindemann for S-1081: Charles Maxwell (Chair), Mark Estienne (Vice-Chair), and Charles Robert Dove (Secretary)

Ryan Dilger for NCCC42: Shengfa Liao (Chair), Tayo Adedokun (Vice-Chair), and Tofuko Woyengo (Secretary)

Merlin Lindemann and Ryan Dilger gave the highlights of the meeting as it relates to the respective committees (S-1081 and NCCC42).

S-1081: This included the newly approved objective on the effect of dietary supplementation of boron or phytogetic compounds on sow reproduction. The other objective was on the effect of phase feeding on reproductive performance of gestating sows. This is going to be a three-diet study that will be fed for a minimum of two parities. Members of the NCCC42 who may be interested were encouraged to be a part of the study. Furthermore, the S-1081 group would be conducting two other side projects:

- i). Amino acid and fatty acid composition of sow milk
- ii) Alternative treatments that may improve pig hemoglobin and hematocrit level

NCCC42: Ryan Dilger gave the summary of the recently published article “Nutritional composition, gross energy concentration, and in vitro digestibility of dry matter in 46 sources of bakery meals” (Liu et al., 2018). Ryan also discussed the status of the phytase superdosing manuscript, which is currently being handled by Marcia Shannon (University of Missouri). The status of this manuscript has not changed since the last meeting (in draft status). The two studies (ME and amino acid digestibility) of 11 bakery meals are at different stages of completion at different stations. Regarding the nursery pigs microbiome study that was discussed at our last meeting (in 2018), the committee has temporarily suspended discussion on it until a preliminary study relating to it is completed. Thirteen stations indicated their interest in being a part of the study. Every participating station is expected to send a small quantity of feces that is collected with the aid of sterile fecal loop to Phil Miller (Nebraska) for microbiome determination. Hans Stein (University of Illinois) is overseeing a study that involves the determination of the level of Ca and P in commercially available swine diets. Samples (100 to 200 g) should be sent to Hans Stein for Ca and P analysis.

We revisited the date for 2020 meeting. Joel Brendemuhl informed the group about the availability of rooms and conference rooms for both dates we were considering for 2020 meeting. The joint committee voted 16 to 3 in favor of meeting on January 7 and 8 with an arrival date of Jan 6, 2020. Joel Brendemuhl informed members to plan for an extra day for the 2020 meeting as plans are in the works for members of both committees to be given a tour of how food and/or feed for the zoo animals at Disney Animal Kingdom are prepared. If everything works out, this tour will be at the end of our annual meeting.

Ryan informed both committees about the NCCC42 plan to contact Dr. Gary Cromwell about the possibility of authoring a manuscript about the history and contributions of NCCC42 committee to swine research.

The secretary for both committees were reminded that the yearly report has to be uploaded within 60 days of our annual meeting and to this effect it would be necessary to make sure that the minutes from this meeting is circulated to committee members within 40 days after the meeting.

Crystal Levesque (SDSU) asked about the possibility of creating a medium through which information could be shared among group members more efficiently. Her concern was that it might get to a stage in which too many emails may be coming from members of the committees. Members at the meeting felt that the same fatigue that could occur with email would definitely occur with the creation of an information (or data) sharing medium. To this effect, the committees decided that we should continue to communicate via email.

Tom Crenshaw made a motion to thank Merlin Lindemann and Ryan Dilger for all the “heavy lifting” they have done to make this year’s meeting a great success.

Layi Adeola moved to acknowledge the support and dedication of Chris Hostetler and National Pork Board to our committees. The committee members thanked Chris Hostetler specifically for the provision of refreshments during our break periods.

The meeting was adjourned at 10:50 AM.

Publication

Liu, Y., R. Jha, and H. H. Stein. 2018. Nutritional composition, gross energy concentration, and in vitro digestibility of dry matter in 46 sources of bakery meals. *J. Anim. Sci.* 96:4685-4692.
doi:10.1093/jas/sky310.

Respectfully submitted
Mark Estienne (S-1081)
Tayo Adedokun (NCCC42)

SAES-422 Multistate Research Activity Accomplishment Report

Project: NCCC42
Project Title: Committee on Swine Nutrition
Period Covered: January 2018-January 2019
Date of This Report: February 28, 2019
Annual Meeting Date: January 3 - 4, 2019
Meeting Location: Rosen Plaza Hotel, 9700 International Drive, Orlando, FL 32819

Meeting Agenda and Minutes

Morning Session: Thursday, January 3, 2019

NCCC42 Members in Attendance: Adedokun, Tayo (tayo.adedokum@uky.edu) – University of Kentucky); Adeola Layi (ladeola@purdue.edu) - Purdue University; Azain Michael (mazain@uga.edu) - University of Georgia; Carter Scott (scott.carter@okstate.edu) - Oklahoma State University; Crenshaw Thomas (tdcrensh@wisc.edu) - University of Wisconsin; Dilger Ryan (rdilger2@illinois.edu) - University of Illinois; Jha Rajesh (rjha@hawaii.edu) - University of Hawaii at Manoa; Kim Sung Woo (sungwoo_kim@ncsu.edu) - North Carolina State University, Liao Shengfa (s.liao@msstate.edu) - Mississippi State University; Liu Yanhong (yahliu@ucdavis.edu) - University of California, Davis; Miller Phillip (Pmiller1@unl.edu) - University of Nebraska; Rakhshandeh Anoosh (anoosh.rakhshandeh@ttu.edu) - Texas Tech University; Woyengo Tofuko (Tofuko.woyengo@sdstate.edu) - South Dakota State University)

Committee Officers:

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Administrative Advisors: Dr. Don Beitz (Iowa State University; NCCC42)

Guests: Dean Boyd, Hanor Company (called in); Chris Hostetler (National Pork Board), and Chad Risley (Berg+Schmidt America LLC)

Day 1 (Jan 3rd; AM meeting)

The meeting was declared open at 8:00 AM by Ryan Dilger (Chair) with the introduction of the new administrative advisor and the guest speakers. An overview of the agenda was presented and changes noted. This was followed by introduction of members that were present at the meeting. Ryan Dilger introduced and welcomed Anoosh Rakhshandeh (Texas Tech University), the newest member, into the group. The 2018 meeting minutes were reviewed and approved unanimously by the committee members. Members were informed that the new proposal has been submitted for review. We discussed the impact of

the proposed relocation of NIFA out of Washington, D.C., especially the effects that such a move would have on the effectiveness and efficiency of the organization to its stakeholders.

Guest presentations:

1. Dean Boyd (Hanor Company) was unable to attend the meeting but was able to call in to give his presentation. The theme of his talk was on perspectives about nutrition research in the future. He stressed a strong interpersonal relationship between academia and the industry among other things.

a). Boyd summarized how pig nutrition research has changed: i) new scientists are highly trained and work at a very high level, ii) funding for research has decreased, iii) multidisciplinary research has increased (e.g., feed efficiency group), iv) some research groups have developed small “armies” of people, v) by today’s standards, university swine facilities are generally small so industry units must be utilized, and vi) pace of research is high and must increase. According to him, Industry-University collaboration is not yet saturated. Industry looks primarily at personal relationships that are mutually beneficial. Universities bring to the table: a) good minds, b) hands to do work, and c) ability to iron out details. Examples of companies with university research ties: Prestage, Iowa Select, Smithfield, Seaboard and Christensen Farms.

2. Chris Hostetler (National Pork Board, NPB). He spent most of the time that was allocated to him to provide in-depth information regarding new updates at NPB as well as information on likely priority areas for future research funding. He also stressed on the importance of collaboration when putting together research proposals for funding consideration.

3. Chad Risley (Berg+Schmidt America LLC) provided us with information about the inside workings of AFIA and AFIA non-ruminant nutrition updates. He also shared with the committee information on IFEEEDER updates and projects.

Oral reports from participating stations were presented. In addition to this, a digital copy of the 14 reports compiled from 14 stations were distributed to those in attendance ahead of the oral reports.

The second half of the morning of the first day was dedicated to research discussion (update, review, planning, and execution). The research projects focused on the following:

1).The “Microbiome” Project:

Phil Miller (Nebraska station) led the discussion on nursery pig microbiome project. He informed the committee of the challenges in getting the feed mixed at one location. Due to some of the challenges our initial plan faced, the committee decided to first conduct a preliminary study before embarking on the full-scale study that was originally planned. Based on this, each station is expected to collect fecal samples from two piglets, one barrow and one gilt from the same litter (on the day of weaning) and send

samples to Phil Miller for microbiome analysis. Phil Miller promised to send an updated protocol to all of the participating stations. Almost all the experiment stations, except for Hawaii station (lack of swine facility), indicated their interest in being a part of this project. Results from this study (microbiome populations in nursery pigs from different stations) will be used to refine the original protocol before the study is eventually conducted.

2. Bakery Meal Studies

Hans Stein was unable to make it to the meeting but sent in detailed information regarding the status of all the on-going studies that he is leading:

a. Digestibility of energy in bakery meal fed to growing pigs (11 sources)

Some of the participating institutions have completed the animal portion of the study (UK and SDSU). Diets have also been shipped to MN. Experimental diets will be shipped to the remaining stations (Purdue, NE and NCSU) soon. Hans Stein requested that 50 g of dried and ground feces and 50 mL of urine samples should be sent to him for analysis. No additional station showed interest in being a part of this study. All fecal samples must be dried, ground, and thoroughly mixed before sampling (no sub sampling prior to drying, grinding, and thorough mixing).

b. Digestibility of amino acids in bakery meal fed to growing pigs (11 sources)

Two stations (Purdue and MN) have completed this study. University of Kentucky will be conducting the study around April/May 2019. No additional station showed interest in this study. Between 200 and 300 mL of thoroughly mixed ileal digesta should be sent to Hans Stein if a station does not have the capacity to dry the ileal digesta. A total of 20 to 30 g of ground, freeze-dried samples should be sent to Hans Stein.

3. Collection of commercial diets for analysis for Ca and P

Since our 2018 meeting when this study was first discussed, Hans Stein has not received a single sample from any committee member. Chris Hostetler (NPB) and Anoosh Rakhshandeh promised to facilitate this by working with large feed integrators to secure samples for this project. They promised to work directly with Hans Stein in this regard.

The morning session adjourned for lunch at 11:50 AM.

Afternoon Session: Thursday, January 3, 2019

Ryan Dilger declared the meeting open at 1:15 PM.

Guest presentation: National Pork Board (NPB)

Chris Hostetler (NPB) provided an update of the NPB 2019 Research Efforts. According to Chris, the current economic indicator is slightly down from 2018; however, pork demand is stable despite the

addition of thousands of sows to the existing population last year. The breakdown of NPB revenues for 2019 include \$8 m (13%) for research and technology. The lion's share of this funding (~\$2 m) is allocated to swine health while \$1 m is allocated to Animal Science. Industry Productivity Analysis was removed from NPB priority for 2019. The business model of NPB has also changed. They are currently exploring the Business-to-Business Opportunity model (e.g., working directly with big companies like Walmart and McDonalds). In addition to this, they are doing marketing in the area of big data analytics. NPB will continue their research efforts in nutrition consortium, novel technology to monitor piglet health, productivity, and survivability. Multidisciplinary collaboration was encouraged

Guest presentation: American Feed Industry Association (AFIA)

Chad Risley (from Berg+Schmidt America LLC) provided us with an overview of AFIA that represents the US feed industry with over 680 companies that include 75% of the commercial feed manufacturers in the US. AFIA has been in existence since 1909 and currently has 48 board members. The areas of activities (including research) that are important to AFIA include animal food safety, ingredient availability, trade, sustainability, networking, education and training, as well as standardized methodology for quantifying greenhouse production (emission). According to Chad, AFIA is well managed and financially sound. He reminded members that were present at the meeting to stop by AFIA booth during the IPPE meeting in Atlanta in February of 2019. He spent some of his time talking about functional lipids and IFEEDER program.

The AFIA top legislative and regulatory priorities include: (1) Food Safety and Modernization Act (FSMA), (2) ingredient approval process [AAFCO vs. FDA], (3) ongoing efforts involving the Veterinary Feed Directive, (4) labeling genetically-engineered products, (5) trade agreements such as Trans-Pacific Partnership (TPP), and (6) distinguishing animal feed and human food.

Station Reports (3:00 PM)

Each station representative presented brief reports for the year 2018 and the meeting was adjourned by Ryan Dilger at 5:09 PM.

Friday Session (Morning): January 4, 2019

The meeting was called to order by Ryan Dilger at 8:00 AM.

Tofuko Woyengo was nominated for Secretary by Layi Adeola and was seconded by Phil Miller. This nomination was unanimously approved by the committee.

Shengfa Liao will be the Chair while Tayo Adedokun will be the Vice-Chair for the 2020 meeting.

Thereafter, we continued our deliberation on potential studies that can be conducted collaboratively across all stations. Phil Miller promised to send out an excel sheet indicating what needed to be done regarding the preliminary study that the group agreed to a day earlier.

Discussion on New Projects

Anoosh Rakhshandeh proposed the possibility of a joint project involving swine nutrition and immune function. Layi Adeola suggested that Anoosh should take into account the cost implication for each contributing station (usually not more than \$3,000/station). This, according to him, would increase more participation and minimizes complexities that could arise as a result of the involvement of multiple stations. Ryan Dilger also mentioned that we should strive to put together studies that will not require pigs to be euthanized as this greatly affects cost.

Shengfa Liao raised the issue about the possibility of transforming from being a “Committee” to a “true” Multistate group. Responses to this suggestion varied, including the historical importance of the group being a very successful Committee (Phil Miller). The consensus was that the group should be kept as it is.

Tom Crenshaw (Wisconsin) proposed doing a barrier function measurement in nursery pigs using FITC-dextran. Yanhong Liu suggested the use of non-fluorescent dextran (to be measured in urine) as an alternative way to determining gut barrier function. Tofuko Woyengo suggested that it might not be enough to determine the level of dextran in the urine or blood alone but that the ratio would be more meaningful. Rajesh Jha (Hawaii) suggested the use of IPEC-J2 cell line for some of the committee’s studies. Mike Azain suggested that a study focusing on the role of fatty acids in intestinal health. Ryan Dilger (Illinois) suggested conducting a study to quantify post-weaning stress in pigs. Ryan suggested that each of the ideas on immunology and barrier functions that has been raised should be developed further and presented at our 2020 meeting.

Layi Adeola would like the committee to revive (or form) the two sub-committees that existed in the past. According to Layi, this would enhance our ability to brainstorm and prioritize studies for general discussion. The committee agreed to and formed the following sub-committees:

- 1) Gut function to be led by Phil Miller (Chair)
- 2) Production to be led by Layi Adeola (Chair)

Interested members were encouraged to contact the chair of any (or both) of the sub-committees they might be interested in.

Ryan Dilger announced the new officers: Shengfa Liao (Chair), Tayo Adedokun (Vice-Chair), and Tofuko Woyengo (Secretary) after which he gave a brief summary of the recently published article “Nutritional composition, gross energy concentration, and in vitro digestibility of dry matter in 46 sources of bakery meals” (Liu et al., 2018).

The joint committee voted 16 to 3 in favor of meeting on January 7 and 8 with an arrival date of Jan 6, 2020.

Ryan Dilger raised the issue regarding checking with Dr. Gary Cromwell about the possibility of authoring a manuscript about the history and contributions of NCCC42 committee to swine research.

The meeting was adjourned at 10:50 AM.

Brief Summary of Minutes of Annual Meeting

Accomplishments

A. Collaborative studies

1. Bakery meal project (initiated and coordinated by Hans Stein) relating to the determination of AME of 11 bakery meal samples is currently on-going.

2. Bakery meal project (initiated and coordinated by Hans Stein) relating to the determination of ileal amino acid digestibility of 11 bakery meal samples is currently on-going.

3. Swine intestinal microbiome project (initiated and coordinated by Phil Miller) will begin with a preliminary study involving the determination of microbiome from piglets across all the participating stations.

4. Calcium and Phosphorus project (a new project) initiated and coordinated by Hans Stein) will involve collection of swine feed samples from several large integrators for Ca and P analysis.

B. Met jointly with the Southern Regional Sow Nutrition Committee (S-1081) to discuss research topics of common interest.

C. Representatives from Hanor Company (Dr. Dean Boyd; called in), National Pork Board (Dr. Chris Hostetler), Berg+Schmidt America LLC (Dr. Chad Risley) provided a lot of input on research priorities in the feed and swine industries.

Impacts

Coordinated research projects among participating experiment stations using common protocols.

Provided essential opportunities for communication and coordination among swine nutritionists at Land Grant Universities, leading not only to joint NCCC-42 projects, but other collaborations as well.

Met annually with S-1081 since 2006 to exchange information and ideas and to collaborate on various projects.

Invited industry leaders to give us update on the swine industry and to deliberate on research areas where we can collaborate with the industry.

Several committee members are engaged as leaders in the National Animal Nutrition Program (NRSP-9).

Almost all members are active in the American Society of Animal Science (e.g., serving in the Editorial Board of the Journal of Animal Science) and in regional and national meetings as speakers and program coordinators.

Publications

Liu, Y., R. Jha, and H. H. Stein. 2018. Nutritional composition, gross energy concentration, and in vitro digestibility of dry matter in 46 sources of bakery meals. *J. Anim. Sci.* 96:4685-4692.
doi:10.1093/jas/sky310.