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 NIFA through NIMSS.*

Project/Activity Number: S-1081 Nutritional Systems for Swine to Increase Reproductive Efficiency
Project/Activity Title: Committee on Swine Nutrition
Period Covered: January 2025 – December 2025
Date of This Report: 2026-01-31
Annual Meeting Date(s): January 8-9, 2026

Participants:
In-person/Virtual: Dove, Robert (crdove@uga.edu) – University of Georgia; Levesque, Crystal (crystal.levesque@sdstate.edu) – South Dakota State University; Lindemann, Merlin (Merlin.Lindemann@uky.edu) – University of Kentucky; Van Heugten, Eric (Eric_vanHeugten@ncsu.edu) – North Carolina State University; Weaver, Eric (eric.weaver@sdstate.edu) – South Dakota State University; Tsungcheng, Tsai (ttsai@uark.edu) – University of Arkansas; Richert, Brian (brichert@purdue.edu) – Purdue University; Suman, Surendranath (spsuma2@uky.edu) – University of Kentucky (Advisor).

Brief summary of minutes of annual meeting:

The progress of previous projects: essential oils (led by ML), boron (led by ML), and phase feeding (led by EW) were discussed. Progress on the current objectives: supplemental histidine (led by RD), sow metabolic status (led by EW), sensory additives (led by TCT), and iron (led by CL) were discussed. The discussion of previous projects focused on outcomes and whether the outcomes demonstrated a response worthy of continued investigation (i.e. phase feeding) or insufficient evidence to justify continued efforts (i.e. boron). The discussion of current projects centered on what were the ongoing efforts (i.e. iron), the potential to initiate a study (i.e. histidine), and the potential for industry sponsorship for a future study (i.e. sensory additives). The team decided to move forward with the histidine sow study. Members exchanged their ideas for the project.

Accomplishments:
Short-term Outcomes: short term outcomes are reported within each research objective.

In the United States, sow mortality is a major concern in swine production. New genetic lines are selected to increase the number of pigs per year, but the culling rate remained around 50 to 60% after the primiparous cycle. The leading causes of euthanized sows are lameness and prolapses, while the top causes of sudden death loss remained unknown as is the contribution of nutritional status. In addition, nonintentional culls are found in reproductive inefficient females. As such, short term outcomes are related to investigation of nutritional tools to enhance sow health and productivity.

1. **Iron.** Outcomes reported in previous year (i.e. sow blood hemoglobin (Hb) as an indicator of iron status was reported to decline with progressing pregnancy and into lactation with some recovery within the first 30 d of the subsequent pregnancy but the ability to recover declined with each pregnancy; a relationship between Hb and farrowing duration and increased still born pigs; extended farrowing duration in combination with low Hb is a risk factor for sow removal; Hb as a bio-marker for both iron status and sow health) were published in peer-reviewed articles.

2. **Supplement Histidine:** No specific outcomes related to this objective were reported. Activities completed and/or planned for this objective are reported under "Activities".

3. **Sow metabolic status:** No specific outcomes related to this objective were reported. Activities completed and/or planned for this objective are reported under "Activities".

4. **Water Quality:** No new activities reported.

5. **Sensory additives**: No outcomes on this objective during this reporting period. The proposal has been submitted to Lucta and is pending review (TC).

Outputs: Outputs reported from the previous approved project objectives relate to 1) copper supplementation, 2) phytogenics, and 3) phase feeding. Performance data from the copper supplementation project were collected, and the manuscript is being prepared (manuscript preparation lead by ML). Results from the essential oil and phase feeding projects were published (see details below). The boron information was presented as part of a MS thesis, results are proceeding for manuscript preparation. Outputs from the current project objectives include one manuscript, multiple abstracts, and one thesis (detailed under Publications).

Activities: activities reported are specific to current project objectives on 1) iron, 2) histidine, 3) sow metabolic status, and 4) sensory additives.

Current progress made on all project objectives will continue in the next year as outlined throughout this report. The committee acknowledged the importance of being able to study sow responses to nutritional strategies across multiple parities but the challenges to accomplishing this work at a given research station has hindered progress on this front. Members will consider their respective industry contacts for the potential to collaborate with a smaller commercial farm that may have potential to run a longer-term study and will discuss this in more detail at the next annual meeting.

Members discussed preparing the current proposal for renewal. The deadline for the submission of the new proposal will be in December 2027 following peer-review; therefore, a draft should be available during the summer of 2027. Members recommended two main objectives for the renewal proposal: phytogenic application on sow reproductive performance (essential oils, sensory additives, and more) and phase feeding intervention on the current high-profile sow (dietary nutrient levels and single or multiple vitamins or trace minerals such as magnesium sulfate). Further details and finalization of the project objectives will be completed at the next annual meeting.

Impacts: In general, primary impacts of the project research are expected to alter sow management (nutritional and daily care) during gestation and lactation when research results are

shared with commercial swine nutritionists and production managers.

1. **Iron:** The correlation of Hb status and farrowing duration, stillborn, and sow removal rate suggests further understanding of the connection between these variables is needed. Early investigations suggest Hb may be a potential indicator of sows requiring additional attention during farrowing.

2. **Supplemental Histidine**: Lactation study from d 110 to weaning. The protocol for His study will be shared with participating stations by RD. Briefly, sows will be allotted to their treatments at d 110 of gestation. Whole blood (UAK) and serum Hb evaluated at entry and just prior to weaning; milk (UKY) will be collected at farrow, d 7, d 14, and/or d 18-21 as possible for each station. Water quality (emphasis on mineral content) will be evaluated at trial start and at weaning; general sow and litter reproductive performance will be evaluated. Where possible, piglet performance into the nursery and later stages of growth will be collected.

   Crystalline histidine is secured and will be distributed to each participating station. The study will take place in Fall of 2026 from committed stations. RD will lead the project and KG and TC will help data summary and analysis. A common vitamin-mineral premix will be secured by BR or EVH and sent to each station as needed; RD will provide a common diet formulation (target SID lysine at 0.90% with SID His:Lys ratio of 40, 50, and 60%) to reduce feed variation between stations. At present, stations with potential to place 30 – 50 sows on test were SDSU, NCSU, Purdue, UAK, and UGA.

3. **Sow metabolic status:** Cytokine levels were observed higher by sow parity which may contribute to the observation of increased prevalence of anemia in older, prolific sows. Cytokine levels were also observed to be lower in sows with higher farrowing difficulty. Positive correlations were observed between the number of liveborn and total pigs born with TNF-α and IL-10 concentrations. Farrowing difficulty continues in sows in subsequent parities. Understanding the basis for difficult parturitions may improve sow and pig outcomes and aid in the efficient use of labor.

4. **Sensory additives:** The preliminary study on sensory additives demonstrated their benefit on sow lactation intake during summer and promoted nutrient utilization during winter seasons. This effect on intake can help sows restore their body condition for subsequent cycles. Efforts are ongoing to collaborate with a commercial entity to complete an additional study.

5. **Water quality and analysis.** No new outcomes on this objective were accomplished in the previous year.

Milestones:

To finalize the protocol for the histidine:lysine ratio in lactation study and initiate trials at as many stations as sows are available in the coming year.

To gain a better understanding of global swine research and commercial production through invited speakers at upcoming annual meetings.

To consider other investigators conducting work in relevant areas that may be interested to

increase the number of participants and improve time management.

To begin the process of developing a new proposal for S1081 regional committee considering the current proposal will end in 2028.

Indicators: There were a total of 3 journal publications and 3 abstract submissions throughout the duration of this reporting period, showing significant advancements on finalizing previously approved project objectives (2 published journal papers: 1 on phytogenics and 1 on phase feeding) and progress towards generating valuable information on the current project objectives (1 published journal paper and 2 abstracts on iron). Furthermore, there are indicators showing proactive efforts on the other project objectives including development of supplemental His protocol and submission of a sensory additive proposal to Lucta.

Publications:

Estienne, M., Lee, J.W., Niblett, R.T., Humphrey, B.D., Monegue, H.J., and Lindemann, M.D. 2025. Reproductive performance and milk composition of sows fed diets supplemented with an immunomodulator. Animals 15:1427. https://doi.org/10.3390/ani15101427

McClellan, K., Sheffield, S., and Levesque, C.L. 2024. The impact of hemoglobin concentration on farrowing duration in sows. Trans Anim Sci. https://doi.org/10.1093/tas/txae158

McClellan KA, Acosta J, Lawrence B, Hough S, Bergstrom J, Weaver M, Robbins R, Weaver EM. Feeding a nutrient enriched diet to late gestating sows across consecutive cycles improves micronutrient status, farrowing duration, and prolificacy. Transl Anim Sci. 2025 Nov 24;9:txaf155. https://doi: 10.1093/tas/txaf155.

McClellan K, Aldrich S, Pohlen C, Harrell R, Weaver E. Low sow hemoglobin status is a risk factor for sow removal in commercial herds. J Swine Health Prod. Published online: December 16, 2025. https://doi.org/10.54846/jshap/1438.

Olson L, Weaver E. PS-1 An evaluation of sodium salicylate in the periparturient management of the sow. J Anim Sci. 2024 May 4;102(Suppl 2):347. doi:10.1093/jas/skae102.397.

Soler, F, H. Williams, X. Paz, D. McKilligan, and E. van Heugten. 2026. Effect of late-gestation micronutrient supplementation on sow hemoglobin concentration and farrowing outcomes. Midwest Section Am. Soc. Anim. Sci. Meeting, March 8-11, 2026, Omaha, NE.

Committee Participants:

Efforts will be extended to ensure the current list includes those with interest and active interest in these research areas.

Two members need to be removed from the list

1. Maxwell, Charles. Deceased.
2. Lindemann, Merlin. Retired.

2027

Brian Richert – Secretary, 2027

Katelyn Gaffield – Vice president, 2027

Eric Weaver – Chair, 2027