

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: May 2024-January 2025

Date of This Report: 2025-01-31

Annual Meeting Date(s): January 4-5, 2025

Participants:

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Brief summary of minutes of annual meeting:

The progress of previous projects: copper supplementation (led by Merlin); phylogenics (led by ML), Phase feeding (led by CL), Histidine (RD), Water quality (ML), and Outcome(s) criteria for sows (EW) were discussed. The plan for new projects entitled Phytogenic feed additives (led by ML), Optimum Histidine (RD, KG), Iron level (CL, EW), Sow Metabolic status (EW) and Water Quality (ML) on sow reproductive performance was visited. Teams also brainstormed on new research projects to sustain sow longevity with the potential benefit of sodium salicylate supplementation, the relationship with drinking water quality, and the level of water intake. It was noted that recent data reported by SDSU indicates blood hemoglobin level declined during gestation, and lactation, and the hemoglobin restoration rate varied between parity, which warrants further research.

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. Previously, 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. In the most recent work, a relationship between Hb and farrowing duration and increased still born pigs has been determined. Extended farrowing duration is a risk factor for sow removal. Hb has promise as a bio-marker for both iron status and sow health.

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: Inflammatory status of sows;** In prior research, gilts fed sodium salicylate 3 days before farrowing, displayed reduces savage behavior in gilts. Sodium salicylate is an antagonist of PGF-2 α and has an anti-inflammatory effect, which might alter the gilt’s behavior during induction and/or farrowings. As opposed to Hb, inflammatory cytokines were found to increase with each parity.
4. **Water Quality:** No new activities reported
5. **Sensory additives:** No outcomes on this objective during this reporting period.

Outputs: Outputs reported are from the previous approved project objectives related 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. Milk samples collected from the copper project have been assayed, and results will be compiled into another paper. Results from the essential oil, boron, and phase feeding projects were summarized and are proceeding for manuscript preparation.

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

The team will discuss the procedures and traits to be measured in each of the projects proposed above. In addition, the project will evolve to investigate responses at the molecular level as a means to identify the biomarkers associated with reproductive performance, and our committee is looking forward to seeking federal funding to support the project. To approach this goal, the team will search for collaboration with molecular geneticists and reproductive physiologists.

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. The current approved project is still in its first year, thus specific impacts are limited.

1. **Iron:** Results of completed study were presented at the Leman Conference and additional research submitted to Midwest ASAS meeting where commercial production nutritionists will be in attendance. ML and RD shared ideas on assessment of iron and trace minerals status. EW discussed idea of using farrowing duration as an indicator of sow health. FD is expected to be highly variable across herds and stations. Injectable iron studies were also discussed as a means of improving iron status. Trace mineral supplementation to maintain sow nutritional status with high late gestation fetal demand (Mahan et al, 2009). Need a list publications that were also influenced by work.

More than a single trace mineral is needed by developing litter. Proposal for evaluation of farrowing duration and stillborn pigs after two levels of trace mineral supplementation in late gestation: Is funding available?

Design a proposal with trace mineral supplementation levels to meet fetal demand. What to measure and how to fund? Consider submission to Pork Board.

2. **Supplemental Histidine:** Lactation study discussed from D110 to weaning. The protocol for His study will be shared with participating stations. Briefly, sows will be allotted to their treatments at d 110 of gestation. Colostrum will be collected at farrowing, and milk will be collected during the lactation. In addition to milk, the collection of other biomarkers was considered, including immunocrit and cortisol.

CJ Bio may have some His set aside-ML will check. Likely dependent variables measured: Sow productivity and litter, milk yield, pre-weaning mortality. Potential diet His levels: 0 or 0.1 % (39% to 49%). NR in recent KSU study provided (KG). Ratio study (1.05% SID at KSU) planned at 0.97% (NRC).

3. **Sow metabolic status:** Results of the sodium salicylate and inflammation results were presented at the Leman Conference and also submitted to 2024 Midwest ASAS meeting where commercial production nutritionists will be in attendance.

Potential project: Obtaining serum samples from gestating sows at D110 for relationship to Hb status and farrowing duration was discussed.

- i. 9 Analyte Multiplex Assay: \$2,300 per plate.
- ii. Analytes: IL-1 β , IL-6, IL-4, IL-8, IL-10, IL-12, IFN- α , IFN- γ , TNF- α
- iii. Sample storage req. (-20° C)

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. It would be interesting to evaluate their impact on sow longevity and intergenerational effect on progeny. Sow groups available for each station needs to be determined. ? To test TC and CM (Lucta) product. 2 groups – increased feed intake. Stations on phytogetic protocol?
5. **Water quality and analysis.** Analysis of water? Mineral levels? Technical notes paper – follows up on sow study. Salt study location explained difference. KSU: KG will provided report of water assessment (for acidification)? High (>0.25 mg Fe/L; SDSU 0.05 mg/L; ML will look at pricing. If regulatory services, no charge if it is an official project.

Milestones:

To discuss the possibility of emerging essential oil and sensory additives as phytogetic feed additives in the coming year.

To lay out a plan to evaluate the relationship of iron status and hemoglobin level in sows and the relationship to farrowing duration in the upcoming year.

To consider incorporation of sow metabolic status markers in study outcomes

To continue the evaluation of phase feeding sows and histidine studies in 2025.

To assess the water quality of participating stations in 2025.

Indicators: The 3 publications related to iron status in sows and piglets are indicators that specific goals/achievements were accomplished during this reporting period. Also, an abstract of histidine evaluation in lactating sows (KSU) was submitted.

Publications:

McClellan K, Levesque C, Weaver E. Evaluating point-of-care testing for anemia diagnosis in pigs: Blood collection location disparities, repeatability, and validity. J Swine Health Prod. Published online November 27, 2024. <https://doi.org/10.54846/jshap/1402>

McClellan K, Lindemann M, Levesque C. Assessment of hemoglobin concentration in sows and their offspring over consecutive reproductive cycles. J Swine Health Prod. 2024;32(6):248-257. <https://doi.org/10.54846/jshap/1399>

T.B. Chevalier, O. Adeola, S.D. Carter, C.R. Dove, M.J. Estienne, C.L. Levesque, C.V. Maxwell, T. Tsai, and M.D. Lindemann. 2024. A cooperative study assessing the effects of a second iron injection administered before weaning on growth performance, hematological status, and tissue mineral concentrations of nursery pigs. Applied Animal Science 40:112-123. <https://doi.org/10.15232/aas.2023-02480>

Committee Participants:

E-mail list to be updated.

List of participants: KSU

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Joel Brendemuhl?

U. of NE.

Statistics/NC

2026

K. Gaffield – Secretary, 2026

TC-Chair

EW-Vice Chair