

January-February 2017

Results from your
Pork Checkoff investment
in research and technology

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checkoff.**



Research REVIEW

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Welcome to this issue of *Research REVIEW* brought to you by Pork Checkoff. The purpose of this e-newsletter is to give you a user-friendly way to learn more about research funded by the Pork Checkoff, what it means to the industry, and where to go if you want more information. We hope you find this publication useful. Feel free to forward to others. Archived issues are found [here](#).

ANIMAL SCIENCE

Includes pork quality, reproduction, nutrition and genetics

ANIMAL WELL-BEING

Includes animal assessment, handling and transportation, sow housing, euthanasia and animal space requirements

ENVIRONMENT

Includes manure management, air quality, water quality, water use/conservation and carbon footprint

HUMAN NUTRITION

Includes dietary nutrition, food preparation technology and ingredient health implications

PORK SAFETY

Includes pre- and post-harvest safety issues, pathogens and intervention technologies

PUBLIC HEALTH

Includes antibiotic use and resistance, disease transmission, risk assessment and worker health and safety

SWINE HEALTH

Includes domestic and foreign swine diseases, swine ID, biosecurity, disease surveillance and emergency preparedness

Learn About the New USDA Welfare Assessment Program

What is it? How does it fit with PQA Plus® and the Common Swine Industry Audit?

Learn this and more on **Feb. 16 at 1 p.m. CST** by participating in the Pork Checkoff's free webinar.

Click this notice to register.



CONGRATULATIONS to Rob Stout of Washington, Iowa, winner of the Pork Checkoff Blanket in our recent swine health survey.



Webinar: How to Succeed with the New Antibiotic Regulations

Feb. 21st 1 p.m. CST

Now that the FDA antibiotic regulations are in place, it's your chance to hear from the experts and ask questions.

- Dr. Dave Pyburn, National Pork Board
- Dr. Liz Wagstrom, National Pork Producers Council
- Dr. Harry Snelson, American Association of Swine Veterinarians

Register today by clicking this notice.



RESEARCHER SPOTLIGHT:

Dr. Nathalie Trottier
Professor at Michigan State University

What is your current role at MSU? How did your career bring you to the university?

My primary role is to conduct research for the swine and equine industries; specifically, to design and test nutritional strategies to improve the efficiency of nitrogen utilization. I graduated with a Bachelor's degree in agronomy and a Masters in animal nutrition from McGill University, in Canada. I received my doctorate in animal science from the University of Illinois in 1995. As advisor for the Animal Science Undergraduate Research Association at MSU, I work with students on swine-related research projects, providing them hands-on experience growing pigs and sows. Also, I teach several courses to undergraduate and graduate students.

How long have you been involved in livestock and swine industry research?

I began farm animal research in 1984. I worked at the poultry facilities doing daily chores and as an undergraduate research assistant with laying hens on nutrition and eggshell quality. Throughout my graduate training, I worked with the reproductive swine herd and decided to focus on gestating and lactating sow nutrition for my academic research career. I incorporated equine nutrition as part of my broader research program. Thus, my animal nutrition research and teaching has evolved into a comparative process over the last 10 years. Horse nutrition research can teach us a lot about swine nutrition and vice versa.

What Pork Checkoff-funded research are you most proud of and why?

I am grateful to pork producers for their funding. Perhaps the Pork Checkoff-funded projects that I am most proud of are those showing that amino acids are better utilized for protein synthesis when lactating sows are fed diets that are near ideal in amino acid profile. For the first time, we reported a potential mechanism by which a near-ideal-protein diet improves performance and efficiency. The results have culminated in the formulation of novel diets that have been tested with lactating sows in several studies co-funded by the Michigan Animal Agriculture Alliance (formally Animal Agriculture Initiative), Pork Checkoff and Ontario Pork (Canada), along with the amino acid industry. These projects were the first to quantify the impact of feeding lactating sows near-ideal-protein diets on urine volume and excretion of nitrogenous wastes.

How do pork producers benefit from your research?

Results from our research provide the data the swine industry needs to begin implementing sustainable and affordable dietary strategies for the breeding sow population. Very little is known about the efficiency of nitrogen and energy utilization in lactation sows. Due to growing concerns over nitrogen losses into the environment, research has focused on improving dietary protein utilization in growing pigs, but information for the breeding herd is lagging.

Understanding how the sow utilizes dietary protein and amino acids, and energy for milk production and piglet growth rate is critical to minimize nitrogen losses from the breeding herd yet maintain or improve lactation performance. Thanks to Pork Checkoff funds, we know now that we can reduce crude protein in lactating-sow diets by as much as 6 percent with crystalline amino acids added to replace the limiting amino acids.

Why do you think it's important for pork producers to continue to fund swine research?

It's critical that pork producers continue to fund swine research as they are selecting the research that's

of most interest and direct value to them. I strongly believe that applied research is as valuable as fundamental research. For instance, improved management of lactating sow feed intake and the peri-parturient period are two areas that need more research, especially as we move toward electronic-sow-feeding systems. Such research would not be funded by federal granting agencies, which favor fundamental and mechanistic type research. Understanding mechanisms of how amino acids are utilized is crucial to optimizing sow management and should be a priority. For instance it's increasingly apparent that a longer lactation improves long-term sow productivity and that feeding gestating sows with higher fiber content diets decrease dystocia and subsequent sow lactation performance.

What else would you like producers to know?

As sow productivity has continued to grow over the years, the sow's lactation performance has been expected to increase accordingly to meet nutrient needs of the progeny. Consequently, I believe that we will need to readjust how sows are fed in gestation and what's expected of them in lactation. Optimizing lactation feed intake to ensure maximum milk production to accommodate increasing number of pigs weaned per sow is critical. I would like producers to know that more research is needed in a coordinated and systematic way to reach a consensus among researchers and nutritionists on feeding management in gestation, transition and lactation periods.

To view some of Dr. Trottier's work, click [here](#).



Study Name: Impact of Relocating Replacement Gilts from Pens to Stalls on Gilt Fertility and Sow Longevity

Principal Researcher: Dr. Robert Knox, University of Illinois

Key Points:

- Relocation timing did not affect gilt well-being or most reproductive events, therefore, producers may relocate gilts any time during the estrous cycle.
- Gilts relocated in the third week did have a higher proportion of extended estrus intervals, and when bred, had a lower farrowing rate.
- To accommodate unified breeding management, relocating gilts in the second week might be the optimal time.

Summary: The study investigated the day of gilt relocation into stalls and the duration of acclimation before breeding on measures of stress, reproduction, gilt feed intake, growth and fertility, as well as the impact on subsequent parity performance and sow longevity. The study was performed at a large, commercial research farm in Illinois, with time required to obtain parity 1 re-breed rates. Gilts were randomly assigned to treatments for relocation into stalls on days 4 to 7 (RELwk1), 8 to 14 (RELwk2) or 15 to 19 (RELwk3) after first estrus. Body condition score, lameness and leg inflammation, head lesions, body lesions and vulva lesions at breeding, during 5, 9, 13 and 16 weeks of gestation did not differ among treatments. Relocation timing did not affect the proportion of gilts expressing a normal inter-estrus interval of 18 to 24 days, but did influence the proportion expressing shorter and longer inter-estrus intervals. Gilts in RELwk1 had a shorter inter-estrus interval (20.7 days) compared to RELwk2 and RELwk3 (22.6 days). For all gilts inseminated, there was no treatment effect on conception or farrowing rate. Litter response measures indicated no treatment effect on total born, born alive, litter birth weight, weight variation or pigs born alive weighing less than 1.5 lbs. (0.68 kg). Treatment did not affect the percentage of gilts rebred within 7 days after weaning. These results suggest that timing of gilt relocation prior breeding had no effect on well-being measures or on the percentage of gilts with normal estrous cycles and their subsequent fertility.

[To learn more, click here.](#) 📄

Study Name: Impact of *in utero* Heat Stress on Subsequent Growth, Composition and Reproduction

Principal Researcher: Dr. Tim Safranski, University of Missouri

Key Points:

- Heat-stressed pigs were more active, spent more time at the feeder and ate more, but did not differ in weight or body composition than thermoneutral pigs.
- Pig numbers born, born alive or stillborn did not differ significantly by treatment, though numerically all favored thermoneutral gilts.

Being a fetus in a heat-stressed dam appears to have negative impacts on feed efficiency and reproductive performance.

Summary: This project was designed to collect data on growth, body composition, carcass quality, fat quality, puberty and subsequent reproductive performance on piglets developing *in utero* under heat stress (GHS) or thermoneutral (GTN) conditions. Parity 1 females were artificially inseminated and housed under GTN (64.5–71.5Å°F) or GHS (82.5–93Å°F) daily temperature cycles throughout gestation, then lactated about 21 days under GTN conditions. At weaning, GHS and GTN gilts were housed together in pens of 22 to 25 gilts per pen. Barrows were double-stocked until 55 lbs., after which 80 were individually housed and fed in attempt to correct the impact of *in utero* heat stress: a corn/soybean meal diet that met or exceeded NRC lysine requirements. In the last 30 days, barrows received a diet with 7.4 ppm of Paylean or none until 266 lbs. Weight, average daily gain and feed disappearance were recorded, as were a range of carcass measures. Heat stress during gestation altered muscle development, resulting in increased muscle fiber size at harvest and a tougher product. Gilts at 193 to 198 days of age were transported to Virginia Tech. Estrus was recorded and synchronized to facilitate 68 litters born in four farrowing groups. GHS gilts tended to eat more during lactation with no effect on lactation weight loss. Reproductive differences between GHS and GTN gilts were largely non-significant but all favored GTN gilts. GHS gilts tended to have lower piglet survival than GTN gilts. Preliminary data and data from other species suggest *in utero* environment could have a significant effect on subsequent progeny performance. This concept has not received due consideration and could more accurately identify the value of cooling in gestation facilities.

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Study Name: Behavioral and Genomic Tools to Identify Pigs Suited for Group Living

Principal Researcher: Dr. Janice Siegford, Michigan State University

Key Points:

- Immediate prior social experience reduces aggression between pigs as they move from the nursery to finisher.
- “Pressing” behavior between pigs could be used as a reliable predictor of physical aggression.
- Expanding genetic selection programs to encompass behavior will improve welfare and productivity for group-housed pigs.

Summary: This study compiled behavioral, genomic and production data from more than 4,000 pigs to better understand the potential for selecting pigs that are behaviorally adapted for group housing without compromising other traits of interest. We characterized key aggressive pig behaviors in group-housing environments at the nursery, finisher and breeding stages. We related these responses to productivity measures and genetic components for breeding program application. “Pressing” behavior between pigs leads to damaging aggression in a majority of instances, suggesting it could be used as a reliable predictor of physical aggression. Immediate prior social experience, but not relatedness alone, reduces aggression between pigs as they move from the nursery to finisher stage. Social aggression does not appear to be related to fear responses, nor to the pig’s response to human approach or to backfat. As assessed using lesion scores, aggression is variable between pigs with regard to the level and type of aggression. Packages and programs have been developed to facilitate genetic analysis of behavioral and performance data, along with improved models to estimate indirect genetic effects. Together the findings and tools generated from this project can be used to improve selection models used in the swine industry to breed pigs better suited to modern husbandry environments, which will enhance the sustainability of pork production.

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Study Name: Effectiveness of Vegetative Environmental Buffers to Reduce Swine Emissions



Principal Researcher: Dr. Zifei Liu, Kansas State University

Key Points:

- Multi-row vegetative environmental buffers (VEBs) are recommended to effectively reduce air-pollution from swine facilities.
- Downwind distance from VEBs for effective reduction can be estimated by multiplying the VEB height by 20.
- At high wind speed, a single-row VEB could result in higher downwind concentrations due to turbulence and downwash effect induced by the VEB.
- More research is needed to quantify VEBs' effect in reducing volatile organic compounds (VOCs) and odor.

Summary: Lack of information on performance and technical guidelines are barriers to adopting VEBs. The main research objective is to determine the effectiveness of a VEB to mitigate multiple air emission constituents, including ammonia, hydrogen sulfide, volatile organic compounds, nitrous oxide, methane, odor and dust, from a swine production facility. The specific objectives of this study include: 1) Measure concentrations of multiple air emission constituents at various distance from a swine facility, with and without a VEB, and correlate VEBs' effectiveness to reduce these compounds under various weather conditions; 2) Determine VEBs' effectiveness under various design parameters (height and depth) and evaluate how these will affect the mitigation effectiveness; 3) Develop design suggestions and best-management procedures to utilize a VEB.

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Study Name: Daily Total Red Meat Intake Does Not Negatively Influence Cardiovascular Disease Risk Factors

Principal Researcher: Dr Lauren O'Connor, Purdue University

Key Points:

- Red meat intake did not affect cardiovascular disease risk factors.
- The findings support the idea that consuming >0.5 servings of total red meat per day does not influence blood lipids and lipoproteins or blood pressures.

Summary: Observational associations between red meat intake and cardiovascular disease (CVD) are inconsistent. There are limited comprehensive analyses of randomized controlled trials that investigate the effects of red meat consumption on CVD risk factors. The purpose of this systematically searched meta-analysis of randomized controlled trials was to assess the effects of consuming >0.5 servings or <0.5 servings of total red meat per day on CVD risk factors. These included blood total cholesterol, low-density lipoprotein (LDL = bad cholesterol) and high-density lipoprotein (HDL = good cholesterol), triglycerides, ratio of total cholesterol to HDL cholesterol, and systolic and diastolic blood pressures. We hypothesized that the consumption of >0.5 servings of total red meat per day would have a negative effect on these CVD risk factors.

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Study Name: Correlation of Loin Quality with Fresh-Belly Characteristics and Fresh- and Processed-Ham Quality

Principal Researcher: Dr. Dustin Boler, University of Illinois

Key Points:

- Loin, belly and ham quality must be evaluated independently.

- Seasonality influences quality within pork carcasses.
- Fresh-loin quality was not related to fresh- or processed-ham quality.

Summary: The study objective was to correlate fresh-loin quality with fresh-belly quality and fresh- and processed-ham quality. Other goals included: 1) evaluate quality differences in the loin, belly and ham of pigs marketed in cold and warm seasons, and 2) characterize overall quality variation. Fresh loin was used as a benchmark compared to other primal cuts. Market pigs (8,042) were raised in eight different barns with a production focus of lean growth or meat quality. Half of the pigs were raised during hot months and slaughtered in July, August and September. The other half were raised in cold months and slaughtered in February and March. In total, 7,684 pork carcasses were evaluated. Not surprising, heavier carcasses produce heavier loins, bellies and hams. Additionally, the weight of each individual primal is strongly related with the weight of the other primal pieces. These correlations were among the strongest in the study. The relationships among loin and ham quality and loin and belly quality were weak. Along those lines, belly firmness, a belly quality indicator, was not indicative of cured ham color or processing yields. Overall, fresh-loin quality was not related to fresh- or processed-ham quality. Though most academic research uses the loin as the indicator of whole-carcass quality, these results indicate that using loin quality to draw conclusions about ham or belly quality can be misleading.

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Study Name: Prebiotic Intervention to Reduce Pathogens at the Farm and the Packing Plant

Principal Researcher: Dr. Robin Anderson, USDA, Agricultural Research Service

Key Points:

- The pig gut can be colonized with foodborne and disease-causing bacteria such as *Salmonella*, *E. coli* and *Campylobacter*.
- Thymol, a natural product, exhibits potent antimicrobial activity against those bacteria, making it an attractive antibiotic alternative.
- However, when fed to swine, thymol is absorbed rapidly and isn't delivered to the lower gastrointestinal tract where the bacteria reside.
- More study is needed to overcome absorption challenges.

Summary: Conceptually, once the beta-D-thymol arrives to the cecum and intestine, gut bacteria there can degrade the protective bond and thus liberate free thymol, thereby making it available to kill *Salmonella*, *E. coli* and *Campylobacter*. The research objective was to determine if beta-D-thymol could be fed to pigs to reduce gut concentrations of *Salmonella*, *E. coli* and *Campylobacter*. Results from live-animal studies were not successful in achieving significant reductions in cecal and rectal concentrations of the three bacteria, possibly because hydrolysis and absorption of beta-D-thymol and free thymol in the small intestine may still have been rapid enough to preclude delivery to the cecum and large intestine. It's also possible that uptake and internal compartmentalization of beta-D-thymol by gut bacteria, or its chemical attraction to fats and oils, may isolate the beta-D-thymol thus preventing the release of free thymol. Comparison of antimicrobial resistance profiles between *E. coli* isolates or multi-drug-resistant *Salmonella* strains did not support a hypothesis that exposure to beta-D-thymol or thymol may co-select for antimicrobial resistance. Additional research is underway to try to overcome obstacles preventing efficacious activity of beta-D-thymol in the lower gastrointestinal tract.

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Study Name: Using Interferon Alpha as Therapy during PRRS Outbreaks

Principal Researcher: Dr. Susan Brockmeier, USDA-ARS, National Animal Disease Center

Key Points:

- Results demonstrate that Interferon alpha (IFN α) can inhibit viral replication and transmission of a vaccine strain of PRRS virus (PRRSV).

- Administration timing of IFN β (a day or two after vaccine) as well as the method (intranasally) may produce the more desired adjuvant effect.
- Preliminary data generated indicate that IFN β may be very effective at minimizing disease impact and spread of PRRSV.

Summary: IFN β plays a significant role in the antiviral immune response by stimulating the production of an antiviral state that inhibits viral replication in host cells. IFN β also plays a role in stimulating the adaptive immune response which is responsible for clearing the virus and preventing future infections. Porcine reproductive and respiratory virus (PRRSV) appears to induce little IFN β production in the pig, which might be one reason for PRRSV persistence in the host and the inadequate immune response to the virus and vaccines. The objectives were to 1) determine whether IFN β could be used as an adjuvant (a substance that enhances the body's immune response to a vaccine) with attenuated PRRSV vaccine; and 2) determine the effectiveness of metaphylactic use of IFN β during an outbreak of PRRSV. Metaphylactic use is defined as the timely mass medication of a group of animals to eliminate or minimize a disease outbreak. For objective 1, the presence of IFN β did not prove useful as an adjuvant when given simultaneously with a PRRSV attenuated vaccine under the conditions of this study, but the results demonstrating the total inhibition of vaccine virus replication and transmission provides further evidence that IFN β has potential for metaphylactic use during an outbreak of PRRSV. The second objective, determining the effectiveness of metaphylactic use of IFN β has yet to be completed. This experiment will mimic the early phases of a PRRSV outbreak where some pigs have been infected and some have yet to be exposed. It will examine the treatment effectiveness with IFN β to control viral replication and disease, as well as transmission during an outbreak.

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Study Name: Virulence of an Emerging Porcine Parvovirus and Possible Interaction with PCV2 in PCVAD

Principal Researcher: Dr. Tanja Opriessnig, Iowa State University

Key Points:

- Results indicate that PPV2/PCV2 coinfection can result in enhanced disease and lesions consistent with PCVAD.
- Intervention strategies to control PPV2 infection in pigs may help control PCVAD.
- Future studies should focus on PPV2 control in order to minimize its impact on other viruses including PCV2.

Summary: The objective was to characterize a novel porcine parvovirus (PPV) previously designated as PPV2 in pigs and to determine its interaction with porcine circovirus 2 (PCV2). Forty-seven, two-week old, colostrum-fed, arbitrarily selected crossbred pigs were bought from a herd free of major swine pathogens and with low levels of antibodies to PCV2 in a portion of the dams. At arrival at the research facility the pigs were randomly assigned to one of seven groups with 4 to 8 pigs in each group. Colostrum-deprived pigs experimentally infected with PPV2 did not show any clinical signs or lesions despite developing PPV2 viremia and having high tissue levels of PPV2 DNA. Similarly, conventional pigs infected with PPV2 showed no clinical signs and had no macroscopic or microscopic lesions. When pigs were co-infected with PCV2 and PPV2, the co-infected pigs had more severe microscopic lesions compared to singular-PCV2-infected pigs.

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Porcine Epidemic Diarrhea Virus (PEDV) Information

The National Pork Board has Checkoff-funded research underway right now to help find solutions to PEDV. To get the latest research updates and resources, go to www.pork.org/pedv.



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