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# 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



**Pig  
Welfare  
Symposium**

## **Submit Your Abstracts for the Pig Welfare Symposium**

Professionals and students interested in submitting abstracts for a technical poster presentation should visit [www.pork.org/pws](http://www.pork.org/pws). All submissions due by June 15, 2017.

For more information, contact Sherrie Webb at [SWebb@pork.org](mailto:SWebb@pork.org)



**Study Name:** Evaluating Linoleic Acid and Antioxidant Supplementation for Lactating Sows Housed Under High Ambient Temperatures

**Principal Researcher:** Dr. Eric Van Heugten, North Carolina State University

### **Key Points:**

- Supplementing lactating sows with linoleic acid decreased total antioxidant capacity in serum, and vitamin E concentrations in serum and milk.

- Supplementing with a commercial antioxidant blend increased serum vitamin E concentrations.
- Supplementing linoleic acid (at 3.3%) did not improve lactation performance or subsequent reproductive performance.
- Supplementing a commercial antioxidant blend did not improve lactation performance or subsequent reproductive performance.

**Summary:** The goal was to determine and verify the impact of linoleic acid supplementation on reproductive performance of sows under practical field conditions, and evaluate the impact of commercial antioxidants on oxidative stress and sow performance. A total of 605 sows entered the farrowing room and finished lactation in groups of 22 to 24 sows per group. Sows were fed one of four treatments consisting of diets with two linoleic acid levels (LA) 1.4 percent or 3.3 percent. Each diet was either supplemented with a commercial antioxidant blend or not (0.1% or 0%). Sow body weight change and feed intake during lactation were not affected by dietary treatments. Sow body weight at the end of lactation tended to be higher for mature sows consuming 1.4 percent LA. Feed efficiency improved in sows consuming 1.4 percent versus 3.3 percent LA. Litter performance, number of pigs weaned and pre-weaning mortality were not affected by dietary treatment or parity group. The diet's impact on oxidative stress markers varied in sows fed LA. For subsequent reproductive performance, no improvements in wean-to-estrus interval, percentage of sows bred, returns, wean-to-farrow interval, farrowing rate, culling rate or number of pigs born alive were observed. Collectively, these data indicate that supplementing antioxidants during lactation did not improve oxidative stress status of sows.

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### **Study Name: Nutritional Strategies to Mitigate PRRS Impact on Grow/Finish Performance**

**Principal Researcher:** Dr. Nicholas Gabler, Iowa State University

#### **Key Points:**

- There were no differences in weekly performance or overall performance among treatments.
- The pigs' whole body, bone mineral content, fat, lean and protein accretion rates, did not differ among water or feed treatments.
- No differences in sickness behavior (eating, drinking, and sitting) were observed until 6 days post-inoculation. Overall, nutrient treatments had minimal effect.

**Summary:** The objective was to determine the growth performance and tissue accretion of pigs given nutritional supplement via water or feed during a PRRSV challenge. Another goal was to test and identify applied nutritional mitigation strategies for PRRS-challenged pigs and to address the associated growth and feed efficiency declines. A total of 108 PRRS-naïve maternal line barrows were allotted to one of three treatments, six pens per treatment and six pigs per pen. The treatments included: 1) PRRSV-control diet, 2) PRRSV-control diet with water additive, and 3) PRRSV-control diet with feed additive. Water and feed additives contained a combination of proteins, amino acids, carbohydrates and electrolytes, which included betaine, soy protein isolates, monosodium glutamate and high fructose corn syrup. All pigs were inoculated with a field strain PRRSV and performance monitored weekly for 42 days. Pig sickness behavior, blood metabolites and immune markers were assessed over the challenge period. All pigs became PRRSV positive. No treatment or treatment by time interaction was observed. From 0 to 14 dpi, all treatments gained 37 percent less on average and consumed 30 percent less feed than predicted for 25- to 50-kg pigs. By 28 to 35 dpi all pigs, regardless of treatment, on average, performed similar to predictions for pigs weighing 25 to 50 kg. These nutritional strategies during peak PRRS infection did not alter grow/finish pig performance.

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### **Study Name: Designer Diets Decrease Aggression and Increase Welfare**

**Principal Researcher:** Dr. Donald Lay Jr., Agriculture Research Service, USDA

#### **Key Points:**

- Sham chewing increased for sows on all diets during the study's duration but was lowest for sows on soy hulls.
- Once mixed, the sows on the control diet bit at each other the most, while sows on the resistant-starch diet bit

the least.

- Dietary inclusion of resistant starch or soy hulls helped improve welfare by reducing aggression and increasing satiety, without effecting production.

**Summary:** This study proposed to modify diets by increasing fiber and fermentable carbohydrate to increase satiety in pregnant sows. One mechanism increases gut fill, which reduces but does not eliminate hunger. The second, increases nutrient provisions in the blood as time extends from the meal and triggers a feeling of satiety. This method does not eliminate hunger but helps maintain satiety longer. The study combined these two methods, as we hypothesized that the effects would be additive and more useful than each separately. The goal was to evaluate each diet. A second experiment made diet combinations to determine if there was any additive effect. In Experiment 1, sows were fed one of five diets: 1) control (corn/soybean standard diet); 2) resistant starch, 10.8 percent inclusion rate; 3) beet pulp, 27.2 percent inclusion; 4) soy hulls, 19.1 percent inclusion; or 5) soy hulls, 14.05 percent inclusion, but the amount of feed per sow increased by 0.44 pounds over the 4.4 pounds fed in the other treatments. Sows received these diets for three weeks, after which they were mixed into groups of five. Data were recorded to determine if sows fought less based on diet. In Experiment 2, sows were fed one of four diets: control, ad libitum, 1.5 x the amount of resistant starch as fed in Experiment 1, and a 50:50 combination of resistant starch and soy hulls as fed in Experiment 1. It followed the same procedures and measures as in Experiment 1. Aggression of control sows was very low in Experiment 1 versus Experiment 2, which likely prevented treatment differences from being realized. It's not clear why aggression was low. In conclusion, resistant starch and soy hull diets similar to those in Experiment 1 can be useful to decrease aggression and abnormal behaviors.

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**Study Name:** Swine Manure Nutrient Fate and Pathogen Reduction for Midwestern Corn Production with Cover Crop

**Principal Researcher:** Dr. Morgan Hayes, University of Illinois

**Key Points:**

- Cereal rye was similarly effective at reducing nitrogen and nitrate in water drained from soil treated with manure as it was from fertilizer (urea).
- No significant differences noted in the soil's nitrogen, phosphorous or organic carbon levels based on cover crop status or fertilizer source.
- For corn production, cereal rye inhibited yields with urea and manure as the nutrient source. However manure produced nominally higher yields.

**Summary:** The Midwest U.S. has faced a push to improve water quality for waters that eventually reach the Gulf of Mexico; this is in an effort to reduce the hypoxic zone. Cover crops are effective at reducing nitrogen and phosphorus loads in waters leaving agricultural fields. However, one concern is the cover crops' impact on grain production as they tend to tie nutrients into organic forms, which are not immediately plant available. Most studies have looked at how cover crops interact with commercial fertilizers in terms of future crop performance, but limited data is available for how cover crops and manure interact. Since manure tends to be higher in carbon, it's more likely to have a slower transition from organic to plant-available nutrient forms. This study looked to identify whether manure would act differently than a commercial fertilizer (urea) when interacting with a cover crop (cereal rye). Cereal rye produced 20 percent more biomass when a surface application of urea was used instead of injected manure, however the cereal rye's nitrogen uptake per acre was similar and phosphorous uptake was higher when manure was applied. Overall, during the 2015-2016 season, there was no significant differences in how the manure and urea interacted with the cover crop.

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**Study Name:** Anabolic Sensitivity of Muscle Protein Synthesis to a Protein-dense Food in Overweight and Obese Young Adults

**Principal Researcher:** Dr. Joseph Beals, University of Illinois

### Key Points:

- There is a diminished protein synthetic response to protein-dense food in overweight and obese adults compared with healthy-weight controls.
- This may be an early defect with increasing fat mass and may be dependent on altered anabolic signals that reduce muscle sensitivity to food ingestion.
- Instructing overweight or obese individuals to eat more protein to overcome the defect would be unproductive.
- Strategies aimed at improving amino acid sensitivity of muscle (i.e. increased physical activity) are likely more prudent.

**Summary:** Excess body fat diminishes muscle protein synthesis rates in response to hyperinsulinemic-hyperaminoacidemic clamps. However, muscle protein synthetic responses after the ingestion of a protein-dense food source across a range of body mass indexes have not been compared. This study compared the myofibrillar protein synthetic response and underlying nutrient-sensing mechanisms following the ingestion of lean pork between obese, overweight and healthy-weight adults. Skeletal muscle metabolism has a prominent role in the regulation of blood glucose and blood lipids and is a primary contributor to basal metabolic rate. In conclusion, greater adiposity abolishes the increase in postprandial myofibrillar protein synthesis rates seen after the ingestion of a protein-dense meal in apparently “healthy” young overweight and obese adults.

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**Study Name:** Evaluating Strength, Sharpness and Detection of Swine-use Hypodermic Needles

**Principal Researcher:** Dr. Steven Hoff, Iowa State University

### Key Points:

- Needle detection differences between all X-Ray (62.5 percent) and all magnetic-based (21.4 percent) detectors were significant.
- Needle detection using X-Ray based detectors varied widely. Therefore, some level of standardization is required to improve the outcome.
- Having needles end up as a physical hazard in pork today is most likely the result of needle misuse as was shown previously.

**Summary:** The study aimed to provide the U.S. swine industry complete documents outlining all veterinary-used hypodermic needles of 16, 18, 20 and 22 gauge and ranging from 1/2 inch to 2 inches in length. The objectives were to determine: 1) strength, static load to failure and failure modes; 2) dynamic failure modes for all veterinary-used hypodermic needles; 3) sharpness characteristics. Finally, using 1/4-inch, 1/2-inch, and 3/4-inch needle fragments from the 16-, 18-, 20- and 22-gauge needles tested, determine detectability as a function of needle fragment size and orientation embedded in a pork cut as it passes through magnetic-based and X-Ray-based detectors used in U.S. packing plants today. Five independent pork packing plants located in Iowa, Minnesota and Nebraska were selected for the study to achieve the objectives. The results indicate that needle strength and detectability are similar to a previous study conducted in 2000. The overall state of needle detection (all needles through all magnetic-based detectors) was 21.4 percent, representing a 6.5 percent improvement in magnetic-based detection. Reviewing all needles through all X-Ray based detectors averaged a 62.5 percent detection rate. However, a large variation in X-Ray detection was observed, ranging from 10.4 percent to 100 percent.

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**Study Name:** Evaluation of Electrostatic Particle Ionization to Decrease Zoonotic Infection Risks

**Principal Researcher:** Dr. Montserrat Torremorell, University of Minnesota

### Key Points:

- The electrostatic particle ionization (EPI) system effectively reduced influenza A virus (IAV) and *Staphylococcus aureus* (*S. aureus*) aerosols.
- Reduction levels varied based on the location of the EPI line and pathogen type.
- The EPI system has the potential to reduce exposure of zoonotic agents, improving the overall health and well-being of pigs and farm workers

**Summary:** Influenza A virus (IAV) and *S. aureus* are important swine pathogens that are able to transmit via aerosol and have the potential to affect human health. EPI is a technology that is able to reduce particles from the air, thereby, improving air quality and potentially the risk of pathogen spread. The objective was to determine The EPI system's effect on IAV and *S. aureus* in aerosols generated under experimental conditions. Researchers also evaluated whether the EPI line placed at various distances to the ground and the relative humidity (RH) impacted the particle removal efficiency. Aerosols were generated artificially and separated into different sizes. Air samples were collected with the EPI system "off" and "on" for 30 minutes with the EPI line connected at 1, 2 and 3 meters from the ground. Results indicate that the EPI system was effective at reducing the levels of IAV and *S. aureus* found in the air. Under the conditions of this study, relative humidity did not affect the efficiency the EPI system's efficiency. Also, reduction levels were greater for both pathogens when the EPI line was installed at 3 meters from the ground, which corresponded to the closest distance to the aerosol source.

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**Study Name:** PEDV Survivability in Manure-Amended Soil and Evaluation of Lime as a Biosecurity Measure

**Principal Researcher:** Dr. Amy Schmidt, University of Nebraska

**Key Points:**

- Soil or manure pH of 7.5 or greater is sufficient to inactivate the porcine epidemic diarrhea virus (PEDV).
- If the soil pH is lower than 7.5, adding lime to the soil is recommended to prevent PEDV survival.
- Adding lime to manure-pit storage is not recommended; adding lime to a manure-tank wagon prior to transporting to land application is preferred.

**Summary:** This project was conducted to determine the PEDV transmission risk in stored manure and manure-amended soil. Specific objectives were to: 1) determine PEDV survivability over time in two common soils at two moisture regimes treated with PEDV-positive swine slurry and held at temperatures representing three climates; and 2) determine the impact of lime application to manure on PEDV survivability. Multiple experiments were conducted. The manure+soil incubation experiment investigated how PEDV survived in silty clay loam and loamy fine sand at 10 percent and 30 percent water-holding capacity, under three winter climate conditions. PEDV-positive manure slurry was divided into samples to which variations of quick lime were added to test different pH levels and time exposures. PEDV survivability was evaluated. Results revealed that PEDV RNA decreased immediately following manure addition to soil, regardless of whether the manure was limed or un-limed. No differences were observed based on soil type, initial soil moisture, or incubation condition. Next, three separate manure slurry studies were conducted to determine whether adding quick lime could impact pH levels and PEDV survivability in slurry. The study also looked at lime addition levels and exposure timelines required to inactivate PEDV. Worth noting, adding lime to manure in a storage pit is not recommended due to significant precipitation of solids that result, which can result in a thick sludge that's difficult to remove. Likewise, ammonia volatilizes more rapidly as pH increases so liming of stored manure can create significant odor and a potentially harmful concentration of ammonia gas. Liming of manure in a tank wagon prior to transporting to land application is the recommended alternative.

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