Pork producers are committed to making continual improvements on the farm to raise and market pigs that produce safe, high-quality pork for domestic and international consumers. At the heart of that commitment is a combination of scientific research and adoption of technology.

“Producers today raise more pigs from fewer sows on a smaller environmental footprint than ever before,” said National Pork Board President Derrick Sleezer, Cherokee, Iowa. “Such industry improvements can be attributed to better genetics, health and management, all of which are the direct result of science- and technology-based research that is providing solutions.”

At the forefront of the research effort is the Pork Checkoff. Each year, Checkoff committees made up of producers and scientists, identify and fund projects in such areas as swine health, animal well-being, pork quality, food safety, animal science and the environment. In 2015 alone, the Pork Checkoff awarded more than $5.1 million to fund 65 projects designed to deliver practical, on-farm solutions.

The 2013 emergence of porcine epidemic diarrhea virus (PEDV) is an excellent example of the Pork Checkoff’s research program moving quickly to find answers for an unfamiliar and devastating disease, Sleezer said. To expedite on-farm application, participating researchers agreed to release updates as the PEDV studies progressed.

“Through tremendous cooperation between the National Pork Board, state and federal agencies, universities, various associations and producers themselves, answers to address PEDV surfaced with unprecedented speed,” Sleezer said.

Of course, the job is ongoing. This past year, the Pork Checkoff funded additional PEDV-related research, bringing the grand total to 41 projects since 2013.

“We don’t have all the answers, but in less than three years, research has provided a wealth of information about this virus,” said Lisa Becton, DVM, Pork Checkoff’s director of swine health information and research.

Pork Checkoff research funding often works as seed money, drawing additional dollars from sources such as land-grant universities, allied industry and governmental agencies. In 2014, every Checkoff dollar invested in research resulted in more than two additional dollars from outside sources.

An example of how the Pork Checkoff works to expand research dollars can be found in a joint effort with the Center of Excellence for Emerging and Zoonotic Animal Diseases (CEEZAD), which receives Homeland Security funding. The CEEZAD is a department of the Homeland Security Science and Technology Center of Excellence. The Pork Checkoff and the CEEZAD worked together, identifying five foreign animal disease (FAD) research projects to fund in 2015 on a 50/50 split.

“We’re the first livestock industry to accomplish this,” said Patrick Webb, DVM, director of swine health programs for the Pork Checkoff. “The goal is to fund research that will aid in early detection and rapid response to trade-limiting FADs.”

The first call for FAD research proposals was so successful that a second round is planned for 2016.

“This is a great way to maximize producers’ research dollars and get results,” Webb said.

To see all of the completed Pork Checkoff-funded research projects, go to pork.org/research. Meanwhile, inside is a snapshot of the top research projects for 2015.
Meeting the animal’s needs is key to efficient production, and that includes minimizing stressors as hogs travel to market. The goal, of course, is to deliver animals in excellent condition and free from injury.

Many factors can influence the outcome, including genetics, handling, management and the environment, with some of these already set. But the microclimate inside the trailer, which includes temperature, humidity, ventilation and air speed, are factors that a producer can control.

Researchers John McGlone, Texas Tech University, and Anna Johnson, Iowa State University, conducted a three-part study that looked at bedding levels for cold, mild and warm weather; trailer stocking density; and warm- and hot-weather sprinkling practices. The goal was to provide recommendations to reduce transport losses and improve animal well-being.

The bedding study showed that recommendations in the Transport Quality Assurance® (TQA®) Handbook are on target. Specifically, providing more bedding during winter did not improve in-transit losses of dead or non-ambulatory pigs. During mild and warm weather, excess bedding can actually increase animal losses.

The researchers found that bedding moisture content increased from 5 percent to 26 percent after the first load of pigs. If used for a third load, it approached 51 percent. McGlone concluded that excess bedding can accumulate moisture, and combined with cold air, this can cause pigs to shiver more, increasing the number of fatigued pigs. Also, cold temps and damp bedding increase frostbite potential.

Correct stocking density involves finding a balance between controlling the trailer’s internal temperature and providing appropriate ventilation. The study revealed that stocking density had no effect on pig losses at temperatures above 41° F. The research confirmed that stocking levels outlined in the TQA program for market hog transport are appropriate.

As for sprinkling pigs or bedding within trailers during warm and hot weather, the researchers found no effect on total transport losses, including non-ambulatory or dead pigs. However, in warm weather, sprinkling increased stress signs.

The researchers point out that more study is needed to learn about geographic and seasonal influences. To dig deeper into this study, go to http://research.pork.org/11-181.

For another look at Pork Checkoff-funded Animal Well-being research, check out the Iowa State University investigation of CO₂ gas euthanasia procedures for suckling and nursery-age pigs, at http://research.pork.org/12-100.

Replacement gilts are a high-cost input for sow farms, which makes it a priority to select females that will remain productive over several parities. One way to estimate the gilt’s lifetime productivity is to check the response to early boar exposure. However, providing such exposure is often not only impractical, but can present biosecurity risks.

In this Pork Checkoff-funded study, researcher Billy Flowers, North Carolina State University, wanted to determine whether a gilt’s physiological response (red and swollen vulva) to low levels of gonadotropins given at an early age could serve as a tool to estimate potential sow longevity.

According to the results, 140-day-old gilts that showed any degree of vulva reddening and swelling in response to 200 IU of PG600 had similar retention rates as gilts whose estrus followed boar exposure. For both groups, 62 percent of the females that entered the farm as replacement gilts were still in production after three parities. Also, there was no difference in farrowing rates or number of pigs born alive between the two groups.

Flowers concluded that using low levels of PG600 followed by monitoring gilts for one week has good potential as a physiological test for sow longevity. For some multiplication systems, it may be more practical and safer from a biosecurity standpoint than providing direct boar contact. More details are available at http://research.pork.org/11-103.

To review another project in the animal science area, which studied the effects of pelleting and extrusion on energy and nutrient digestibility in swine diets, go to http://research.pork.org/13-041.
Pork producers continuously work to improve the quality and consistency of fresh pork, but variation still exists in the retail meatcase. Consumers can be confused when faced with a range of pork quality characteristics, packaging types and price levels.

In this research project, David Newman, North Dakota State University, sought to benchmark fresh pork quality at retail grocery stores. The project evaluated the quality of fresh pork from 117 national stores in 67 cities. To obtain subjective color and marbling scores, center-cut loin chops were observed in the package in the store. The research team purchased enhanced and non-enhanced center-cut loin chops, sirloin chops and blade steaks of each brand available to collect objective pH, color and tenderness measures.

“Along with this benchmarking study, my team and I are focused on finding tools that can rapidly and consistently measure quality traits of pork products,” Newman said.

“Pork is the protein of choice for millions of people around the world,” he said. “As we continue to improve the quality of pork that we offer consumers, the opportunities will be abundant.”

To read more about this study, go to http://research.pork.org/11-163. You can find more pork quality research online, including a study on iodine value predictions for various carcass fat deposits at http://research.pork.org/13-077.

Pork Safety: Pre-harvest Salmonella Control under Review

With nearly 25 percent of U.S. pork sold to foreign markets, understanding other nations’ food safety programs and requirements is necessary to anticipate possible trade implications. This multi-faceted Iowa State University study looked at control programs for pre-harvest Salmonella, including a review of mandated Salmonella pre-harvest control approaches in major pork exporting/importing countries.

“Our conclusion was that, except for Denmark, no major pork producing countries have mandatory Salmonella-specific pre-harvest control programs,” said Annette O’Connor, lead researcher.

Although the Danes suggest their combined pre-harvest and post-harvest approach is effective, the study showed that the pre-harvest effect is not clear. An assessment of Belgium’s voluntary program, focused on primary production concluded that it had little effect on Salmonella infection levels in pigs.

In two published cost/benefit assessments, the European Food Safety Commission concluded that it’s not possible to demonstrate cost-beneficial interventions to reduce Salmonella infections in either breeding or market pigs, except within extreme scenarios.

Finally, the study assessed pre-harvest interventions using the GRADE system’s four factors to determine whether to adopt an intervention: 1) quality of the evidence, 2) cost/benefit, 3) balance of benefits and harms and 4) balance of values and preferences.

The panel concluded that it was unlikely that any of the interventions would be strongly recommended to pork producers because they lacked effectiveness or would cost much more than the benefits received.

To learn more about this research project, go to http://research.pork.org/11-082.

More pork safety research is available, including an assessment of Salmonella prevalence in retail ground pork, found at http://research.pork.org/12-145.
Swine Health – FAD:
Disinfectants Prove Effective

The United States has long been free of foreign animal
diseases (FADs), but cases continue to surface through-
out the world, keeping U.S. food-animal industries on
alert. Research is part of the ongoing effort to protect
the U.S. herd and to provide solutions should FADs ever
reach the United States.

Conducted through USDA’s Agricultural Research Ser-
vice, this Pork Checkoff-funded research was designed
to test the efficacy of disinfectants used in packing plants
against FAD viruses. While packing plants have thorough
sanitization procedures, the focus is on bacterial con-
tamination not viruses, so the effect on FADs has been
unknown.

Contained within Plum Island Animal Disease Center,
New York, the researchers tested two commonly used
disinfectants against foot-and-mouth disease virus, clas-
sical swine fever virus and African swine fever virus. Vi-
ruses were tested in contaminated swine products dried
onto surfaces (stainless steel, plastic, concrete) typically
found in pork packing plants.

The results showed that both disinfectants were ef-
fective against the FAD viruses that were studied. As
with most disinfectants, pre-washing surfaces improved
efficacy and sealing concrete also was beneficial. The
bottom line is that having this new science-based infor-
mation will help packing plants stay on-line if there was
an FAD outbreak.

For more details about this research project, go to
http://research.pork.org/12-204.

To review research results of using oral fluids to diag-
nose African swine fever, go to http://research.pork.
.org/13-048.

Swine Health: More Tools to
Tackle Influenza-A Virus

Influenza viruses continue to evolve and challenge the U.S.
swine herd, so the ongoing search for on-farm tools to
prevent and diagnose infection remains critical. Today, most
swine vaccines available for influenza-A virus are formulated
as whole-inactivated virus and are delivered intramuscu-
larly. While these vaccines protect against strains that are
closely related to strains in the vaccine, cross-protection
is limited. However, because numerous influenza-A virus
strains are circulating in U.S. swine, cross-protection is not
only important, but needed.

Live influenza virus vaccines delivered intranasally have
been shown to provide increased cross-protection compared
with inactivated-virus vaccines. However, the immune re-
sponse is different, which has caused inaccurate results from
the immune assays typically used to predict cross-protection.
The study, conducted by USDA Agricultural Research Service
researchers, evaluated the ability of oral fluids to predict the
cross-protection of live-influenza virus vaccines.

Groups of pigs were vaccinated nasally with live-attenu-
ated influenza virus or replication-defective virus, with oral
fluids collected over six weeks. The pigs were then chal-
lenged with different influenza-A virus strains and efficacy
was evaluated. The study showed that oral fluids can be
used for diagnosis and that live vaccine can protect against
different virus strains.

For more on this Pork Checkoff-funded study, go to

To review the study that set the stage for future PEDV re-
search and provided sample standards for other laboratories
to use, go to http://research.pork.org/13-228.
Public Health: MRSA Link to Livestock, Human Health Risk Remains Very Low

Over the last 10 years, concerns have grown about the possible importance of livestock reservoirs as a source of methicillin-resistant *Staphylococcus aureus* (MRSA), a normal bacterial inhabitant of healthy people and many animals including pigs. However, *S. aureus* is also an important cause of human infections and among the most significant problems related to antibiotic resistance in human medicine.

A small number of studies have confirmed the presence of several variants of MRSA in pigs (types ST398, ST5 and ST9) in the United States, but the epidemiology of *S. aureus* in U.S. pigs has not been well documented.

Peter Davies, a veterinarian at the University of Minnesota, conducted a study of 36 farms located in 11 states to describe the prevalence and types of *S. aureus* (including MRSA) in swine. This Checkoff-funded study also determined patterns of antimicrobial resistance and the presence of genes producing toxins that can cause food poisoning in people.

Because zinc resistance has been linked to the emergence of “livestock-associated” MRSA in Europe, the researchers also tested for resistance to zinc and for the presence of a specific gene linked to ST398 MRSA in Europe.

“The most striking finding was that none of the 36 study farms were positive for MRSA,” Davies said. “This was despite previous findings of up to a 30 percent prevalence rate in the United States.”

Overall, 76 percent of nasal swabs tested positive for *S. aureus* from 35 of the 36 farms. Among the positive farms, Davies found considerable type diversity and also found that zinc and other selective factors (e.g., disinfectants and therapeutic use of cephalosporins) are likely to have had a much greater role in the emergence of these organisms than antibiotic growth promotant usage.

“It wasn’t surprising that we found multiple antimicrobial resistance in *S. aureus* isolates from pigs,” Davies said, noting that 116 of 130 isolates were resistant to five or more antibiotics.

Evidence suggests that pig-adapted *S. aureus* rarely harbors major virulence factors associated with human disease. Hence the human health significance, if any, of multiple resistance in this group of organisms is yet to be established.

The full research report will be available soon on pork.org.
Practical Answers for Producers Is Priority No. 1

By Dave Pyburn, senior vice president of science and technology for the Pork Checkoff

Pork production is a science-based business. Producers are always looking for ways to improve the efficiency and the quality of their products. Producers want to get the maximum return on their investment, and Pork Checkoff research has a long history of delivering positive results for people, pigs and the planet. Although producers are the first priority, Checkoff research results also are important to veterinarians, nutritionists, geneticists and other specialists who provide on-farm services.

Much Pork Checkoff research falls under the Science and Technology Department, which includes animal science, swine health, environment, animal well-being, public health, pork quality and food safety. Producer committees identify annual research priorities for each area, with a call for proposals to nearly 1,200 researchers and institutions. An independent panel reviews each proposal to ensure scientific credibility, and producer committees make the final funding decisions. Funded projects are monitored regularly, with most completed within a year. Final reports are published on pork.org.

The number of projects selected and dollars allocated each year vary, but the deciding factor is always based on producer needs and benefits. Here are examples of recent research that has directly benefited pork producers. For more, go to pork.org/research.

• Provide science-based information for production decisions: Research determined the time and temperature needed to kill porcine epidemic diarrhea virus (PEDV) in feces.
• Save producer dollars by reducing production costs: Research determined optimal particle size for wheat in nursery and finishing pig diets to maximize feed efficiency.
• Provide non-biased information to ensure producers’ right to operate: Research determined that sufficient Midwest cropland is available to use swine manure nutrients.