A NEW LENS ON
DISEASE PREVENTION AND HEAT STRESS MITIGATION

A SOLUTION ADDRESSING BOTH DISEASE AND HEAT STRESS

DISEASE INTRODUCTION CAN BE **CATASTROPHIC.**

BUT DID YOU KNOW?

HEAT STRESS IS **JUST AS HARMFUL.**

DENOVO'S **FILTERED, CONDITIONED AIR** STRATEGY

- **Prevent Disease**
- **Mitigate Heat Stress**
- **Maximize Production Output**
- **Improve Employee Satisfaction**

ELIMINATING FILTER WALLS CREATES AN AFFORDABLE CONDITIONED AIR SOLUTION.

Denovo
ENGINEER-LED

EXPERIENCE
THE DENOVO DIFFERENCE

Denovo serves a gap in the market: one of unmet needs of clients hungry for a smarter, more sophisticated team to provide engineering solutions.

TEAMDENOVO.COM

AIR CONDITIONING SOLUTIONS FOR SWINE PRODUCTION

Maximize swine production output through filtration and temperature control (Boar Studs and Sow Farms)

DENOVO IS TACKLING BOTH DISEASE INTRODUCTION & HEAT STRESS LIKE NO ONE ELSE CAN

Many groups have gone to expensive filter walls to mitigate disease risk without understanding the equally catastrophic hazard of heat stress.

Heat Stress *"results in a loss of productivity of 10%. That's pretty substantial - a 10% loss of productivity for 5 months of the year. If we could mitigate it, it would make a big difference."*

- **Chris Hostetler, director of animal science for the National Pork Board**

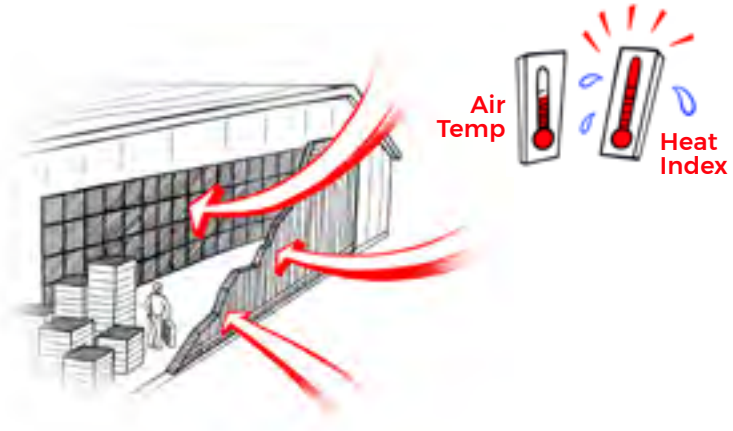
"If a sow is heat stressed in utero, her in utero heat-stressed offspring have an increased body temperature setpoint their whole life compared to thermal-neutral offspring. This increased body temperature (thermal energy) comes at a cost of 11% worse F:G."

- **Lance Baumgard, professor at Iowa State University**

Denovo's team of swine industry experts, engineers, and equipment professionals have addressed these problems by providing filtered, conditioned air to the pig space, eliminating the cost of large filter walls. Therefore, making air conditioning affordable.

TODAY'S COOLING APPROACH IS JUST "MOVING AIR"

In more humid areas, evaporative cooling is not very effective and is only able to drop the temperature a few degrees. On a 95º day, you may be able to cool the barn to 80º, but with 95% humidity, the heat index is 88º, and heat stress occurs. Additionally, having to move so much outside air volume creates a biosecurity risk to your operation. But then if you want to filter your barn, these high airflow rates require you to have very large and expensive filter walls.



DENOVO'S BETTER SOLUTION IS "CONDITIONING AIR"

When conditioned, filtered air is provided to the pig space, you gain two big advantages:

1) Heat stress is reduced, giving your animals the best environment to maximize production output.
2) With a 90% reduction in air flow, you can convert to positive, filtered ventilation and avoid the large first cost and ongoing costs of filter walls.

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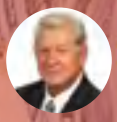
Dr. Lance Baumgard
Professor, Iowa State University

Dr. Chris Hostetler
Director of Animal Science
National Pork Board



Dr. Steven Pollmann
Principal Owner at DSP Consulting

INTRODUCTION: INDUSTRY INSIGHTS

Hear the most recent news about heat stress from industry experts.

Heat Stress: How Much Does it Drain Your Pigs and Profits?

PIGHEALTHTODAY.COM JULY 16, 2018 (edited for relevancy)

Most people in the pork industry know the toll heat stress takes on pigs: reduced performance, a compromised gastrointestinal system, chronic disease, reduced feed intake and higher mortality rates.

Less known are the staggering financial losses wrought by heat stress on producers and the pork industry in general. Each year, heat stress costs US pig farmers about $900 million in revenues — about twice the amount lost as a result of the porcine reproductive and respiratory syndrome virus, according to an estimate by Steven Pollmann, PhD, a livestock consultant and former president of western operations for Murphy-Brown LLC, a division of Smithfield Foods.

Since pigs lack the ability to sweat, they are extremely sensitive to heat. They become susceptible to heat stress at about 70° F (21° C). If temperatures stay at 80° F (27° C) or higher for several days, it could have a myriad of negative effects on breeding herds, sows and those at the grow-finish stage of production.

“Heat stress is far and away the single biggest loss we see,” Pollmann says. “It will have more impact on the industry than disease because it hits every farm.”

“It affects all of our producers regardless of geographic location,” adds Chris Hostetler, director of animal science for the National Pork Board. “It results in a loss of productivity of 10%. That’s pretty substantial — a 10% loss of productivity for 5 months of the year. If we could mitigate it, it would make a big difference.”

SEASONAL INFERTILITY AND REDUCED GROWTH

Breeding herds are particularly susceptible to an array of reproductive issues, including decreased farrowing rates, smaller numbers born per litter, a reduced number of piglets born alive per litter, higher embryonic deaths during early gestation, a larger number of stillborn piglets and miscarriages. Heat stress is also responsible for increased mortality among sows.

LIFELONG IMPACT ON PIGLETS

And the estimated economic loss to producers does not include the lifelong impact on piglets born during these hot months, says Lance Baumgard, a professor in the department of animal science at Iowa State University.

Piglets born to heat-stressed sows become fatter and have a higher body temperature their whole lives, he says. “That’s important because that thermal energy has to come from feed energy, and that feed is purchased by the farmer,” Baumgard says.

These piglets are also more susceptible to chronic health problems. He figures that if the impact on embryos and piglets is factored in, the loss could probably be twice the $900 million figure.

Tim Safranski
Swine Specialist, University of Missouri

Dr. Lance Baumgard
Professor, Iowa State University

Jay Johnson
Research Animal Scientist,
USDA Agricultural Research Service

Dr. Jason Ross
Associate Professor, Iowa State University
Director, Iowa Pork Industry Center

INTRODUCTION: INDUSTRY INSIGHTS

Hear the most recent news about heat stress from industry experts.

Cost of Heat Stress Has a Long Reach

Research shows negative effects of heat stress in gestation linger in growing pigs

FARMWELD'S PROGRESSIVE PORK PUBLICATION SPRING, 2018 (edited for relevancy)

Regardless of the production stage, heat stress can cause negative outcomes for pigs. It can cause delayed puberty in replacement gilts and increased mortality in farrowing sows. In the lactating sow, a drop in her feed intake risks her milk production, body condition and future reproductive performance, not to mention her litter's growth. In the gestating sow, heat stress in early gestation can cause lost pregnancy; in late gestation, it can cause still births. Those are the more obvious or direct effects of heat stress, that cause the industry as much as $900 million annually.

"We've seen there are indirect or delayed consequences that begin in gestation," says Jason Ross, associate professor and director of the Iowa Pork Industry Center, Iowa State University (ISU). "Heat stress is costing us more than we realize."

To learn more, ISU researchers outlined an investigation into the heat stress impact on gestating sows and their eventual offspring. They secured a $2.5 million USDA grant in 2010, which eventually spun into a series of collaborative research efforts involving multiple institutions — ISU, University of Missouri, Virginia Tech University, as well as USDA's Agricultural Research Service (ARS) and Purdue University. The National Pork Board provided additional funding and the research has continued.

IN UTERO HEAT STRESS

The research began at the University of Missouri where gestating sows, typical of today's highly prolific commercial genetic lines, encountered either a thermal-neutral environment or heat stress between day 30 and 60 of gestation for as many as 30 days. To mimic the real world, sows were exposed to a cyclical heat stress, says Jay Johnson, research animal scientist, USDA ARS, who was involved with the ISU research. "It was only acute heat stress for part of the day.

It's worth noting that the growing-pig results obtained in a university setting have been replicated. The Australian hog industry also has verified the negative impact of in utero heat stress on future production traits.

IMPACT ON THE GROWING PIG

In some respects, the researchers are just scratching the surface, but the evidence is compelling. According to Lance Baumgard, professor at ISU, and Johnson, if a sow is heat stressed while pregnant, the following occur in her offspring:

- The in utero heat-stressed offspring have an increased body temperature setpoint compared to the thermal-neutral offspring. "This increased body temperature (thermal energy) comes at a cost, as that thermal energy likely comes from feed energy," Baumgard notes.
- Maintenance of that higher body temperature requires an increase in metabolic heat production, which increases the pig's maintenance cost by as much as 12 percent to 14 percent. This is further verified by alterations in thyroid-hormone production, which affects post-natal metabolism.
- The higher body temperature "might also increase the pigs' heat stress susceptibility because it may decrease their thermal gradient and ability to dissipate heat," Johnson adds.
- They have increased circulating insulin levels their whole life, which causes them to accumulate more adipose (fat) tissue. "Thus, the pig derived from a heat-stressed sow partitions more nutrients toward fat and less toward muscle," Baumgard notes. In fact, heat-stressed piglets have an increased ratio of fat to protein/lean-muscle deposition.
- Feed efficiency for in utero heat stressed offspring declined by 11 percent. "This negatively impacts the time it takes to reach market weight and the feed costs to get them there," Baumgard adds.

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AND CONSTRUCTION MANAGEMENT
OF MEP SOLUTIONS

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