



The Science of Odor

AND WHAT PIG FARMERS ARE DOING ABOUT IT

Odor. It happens. But does it happen as often as we think? Many who were raised on farms think back fondly of the smell of fresh cut alfalfa, a gentle rain on a corn field...and even the reminder that a farm has livestock.

With Iowa being one of the leading states for animal agriculture, reducing objectionable livestock smells and being good neighbors is top of mind for dairy, beef, poultry, turkey and swine farmers. In this issue of *Homegrown Iowa*, we'll share what we know about odor—what causes it, how often a neighbor will catch a certain smell, and the efforts farmers are making to minimize it.

According to Iowa State University (ISU) Extension, odors from swine operations generally come from three sources—where animals are housed, manure storage and handling facilities and manure application.

Odors are caused by the anaerobic breakdown of organic matter and proteins from these sources. Air quality experts from both ISU and the University of Minnesota (U of M) agree that livestock farmers need to look at not just one odor source or one odor mitigation technology, but assess all of the potential odor sources and use multiple odor best management practices on their farms.

" We'll never be able to eliminate odors from agriculture, but over the last two decades livestock farmers have done a tremendous job of adopting multiple tools and techniques to minimize it."

- DR. KEVIN JANNI, U OF M AGRICULTURAL ENGINEER

Both universities have conducted research and developed objective resources and models to help their state's farmers understand mitigation practices best suited to address odor and dust emissions from their farms.

One example is the Community Assessment Model (CAM) utilized by ISU and the Coalition to Support Iowa's Farmers. The model, operated by Dr. Jay Harmon and his team at ISU, helps predict how odor from a farm will affect nearby residences. It takes into consideration orientation (north, south, east and west) from the farm and prevailing winds.

"The three practices farmers can adopt to make the biggest impact on odor reduction are proper siting, covering and protecting manure storage and injecting manure," said Dr. Harmon.

"There was a tremendous amount of awareness around odor and research in the 1990's that drove a lot of the tools, technology and efforts farmers are using today," said Dr. Janni. "Those efforts—such as covered manure storage and manure injection—have become mainstays, while new strategies are also coming into play."

Modern hog barns with covered, contained manure storage has helped farmers reduce odors

HOW MUCH ODOR IS THERE?

How much odor comes from hog barns and manure handling? The largest odor study in Iowa was conducted over three years—2003-2005—by environmental specialists at the Iowa Department of Natural Resources (DNR). The study found that only 7 percent of 1,708 measurements from hog barns exceeded a threshold for odor. When manure was applied to fields, the standard was surpassed 11 percent of the time. Near public use areas such as schools, churches and parks, exceedances occurred only a mere 4 percent of the time.



THE DNR STUDY RECORDED
ODOR EXCEEDANCES IN

ONLY
7%

OF THE MEASUREMENTS



Storing manure in concrete pits helps reduce odors

In addition to measuring odor levels, the Iowa DNR study also looked at trends associated with various livestock species, sizes of operations, types of operations, conditions and manure application methods.

Iowa DNR staff used a strict ambient air standard of 7:1 odor threshold. "With our CAM tool, we describe this as 'detectable' odor," said Dr. Harmon, who further explained that 7:1 was the ratio of fresh air to sample air. DNR staff used scentometers, called Nasal Rangers, for measuring.

Other key findings of the study included:

- Concrete storage pits holding liquid manure have less odor than manure stored outside the barns in lagoons or tanks.
- The size of an animal feeding operation does not correlate to more odor intensity, meaning, neighbors of bigger farms do not experience a higher degree of odor than neighbors of smaller farms.
- More consequential to odor level is the way manure is managed.
- Injection of liquid manure creates less odor than surface application with subsequent incorporation.

The study showed a lack of odor problems at locations afforded special setback considerations under law such as public use areas, educational institutions, religious institutions, residences and commercial enterprises.

NEIGHBORS OF
BIGGER FARMS
DO NOT EXPERIENCE
A HIGHER DEGREE
OF ODOR THAN
NEIGHBORS OF
SMALLER FARMS

You can access the study results at <http://www.iowadnr.gov/Environmental-Protection/Air-Quality/Animal-Feeding-Operations>



BEST PRACTICES IOWA FARMERS HAVE ADOPTED TO REDUCE ODORS

While not a comprehensive list, there are several best management practices widely used by Iowa pig farmers to reduce odors from the three main sources identified earlier in the article—animal housing (barns), manure storage and manure application. While farmers continuously work to find new and better ways to reduce odors, these best management practices still hold strong.

1. ABIDING BY SEPARATION DISTANCES + EXTRA MEASURES

Separation distances from public use areas and nearby residences play a significant role in reducing the odors experienced by neighbors. State regulations in Iowa, paired with additional considerations such as wind direction and barn orientation, have helped farmers determine the best locations for their barns.

2. HOUSING ANIMALS INSIDE BARNs (I.E. CAFOs, CONFINEMENTS)

Bringing animals indoors not only protects them from the extreme elements and wild predators, but providing care for the animals inside barns with proper ventilation and environmental controls helps reduce odors further. Indoor housing means manure is collected and contained—a benefit to both air and water quality.

3. THE RIGHT DIET AND NUTRITION


Have you ever overindulged at a restaurant or eaten the wrong thing for your body and then felt gassy, bloated and uncomfortable? Most animals raised for food eat far better than humans do, and pigs are no exception. Pigs need just the right protein (soybeans) and carbohydrate (corn) levels to grow efficiently and produce high quality pork.

Swine nutritionists adjust amino acids, fiber, protein and carbohydrate levels to match the needs of the growing pig—and reduce odors. It's not uncommon for pigs to have 12-20 different feed formulations throughout their lives to ensure the nutrients in the feed are utilized by the pig and not excreted into the pits.

4. MANURE INJECTION

In Iowa, we're lucky to have the cropland available to benefit from the fertility—and the soil health attributes—found in manure. Years ago, farmers routinely "broadcast" manure onto their fields. Injecting manure decreases odor by 50-75% compared to broadcasting, and typically shortens the application window. For most farmers, "broadcasting" is a thing of the past, as farmers have upgraded their application equipment, complete with precision and low-disturbance toolbars, resulting in less odor.

And umbilical systems take it even one step further as they are less visible than tankers. "We've evolved to a place where manure is captured, contained, transported and applied in a way that it hardly touches the air," said Dr. John Stinn, Environmental Project Manager for Iowa Select Farms. "Our industry has come a long way and continues to get better."



**INJECTING MANURE
DECREASES ODOR BY
50-75%
COMPARED TO BROADCASTING**

Manure is injected 6-8 inches below the soil





Tree lines can reduce odor by 15 percent



The right feed formulation ensures nutrients are utilized by the pig—and not excreted



Routinely cleaning barns is good for biosecurity and reduces odor

5. TREE LINES AND VEGETATIVE BUFFERS

They say good fences make good neighbors, and tree lines and shrubs lift and disperse odor. Landscape designs with short trees or shrubs paired with progressively taller trees closer to buildings help reduce odors by 15 percent.

A side benefit is that trees provide a visual barrier, and oftentimes the saying holds true, “if they can’t see it, they can’t smell it.” It’s important to note that the impact trees and shrubs can have will vary on the building design. Tunnel ventilated buildings can capture the most benefit of tree lines, while naturally ventilated barns need to consider additional mitigation efforts. “If you get trees too close to the building or block the wind too much you are reducing the natural ventilation potential, and heat stress inside the building will be greater,” said Dr. Harmon. “This is not a concern with tunnel ventilated barns.”

6. MORTALITY DISPOSAL

As much effort as farmers put into animal care, health and productivity, mortality on the farm happens. When that happens, odors can occur from the breakdown of the biological matter. Management practices on farms work to ensure caretakers remove dead animals quickly and dispose of them properly. Farmers have a variety of methods such as rendering, incineration and composting, each of which has its own impact on cost, biosecurity and labor. Farmers weigh these decisions and processes heavily to determine which methods best suit their livestock operation.

7. SPOILED FEED

Feed spoilage, caused by the growth of mold or bacteria, can cause odor on livestock farms. Much like mortality disposal, caretakers have processes in place to identify spoiled feed and remove it from the farm. Daily assessments of the feed equipment, bins and feeders paired with quick removal of spoiled feed and feed spills help keep odors to a minimum.

8. CLEANLINESS

Maintaining the inside of the barns and exterior of the farm not only looks nice, but helps reduce odors. Keeping dust to a minimum, cleaning up feed spills, spraying/scraping manure into the pits below the building, and routinely powerwashing and sanitizing keeps the barns clean and odors minimized.

9. IMPLEMENTING ODOR REDUCTION TECHNOLOGIES... AND MORE!

This list is not comprehensive, in fact quite the opposite. Farmers routinely assess products and other technologies to help reduce odors, such as pit additives, barriers, bio-curtains, scrubbers and more. “We help farmers take the right approach to reducing odors that fits his or her unique farm,” said Harmon. “It’s never one specific thing. It’s always a mix of efforts that results in the best solution for both the farmer and the neighbors.”



IOWA SELECT FARMS' COMMITMENT TO ODOR REDUCTION

Iowa Select Farms recently announced a significant commitment to odor reduction and farm beautification. Moving forward, the company will install trees, shrubs and an electrostatic fence on all new, company-owned farms. Iowa Select Farms' tree program will be carried out as part of the Coalition to Support Iowa's Farmers' Green Farmstead Partner program.

As a Green Farmstead Partner, the farm features three rows of trees and one row of shrubs—conifer arborvitae evergreen trees and dogwood shrub bushes. Selected for their quality, hardiness, growth traits and ability to serve as an effective windbreak, the trees and shrubs will help reduce livestock odors coming out of the barns.

In addition to the Green Farmstead Partnership, Iowa Select Farms unveiled an electrostatic fence technology at the end of each new finishing barn. The technology was included in the plans after the company switched from a naturally ventilated, curtain-sided barn to a tunnel ventilated barn.

"Tunnel ventilated barns mechanically pull the air through the barn and out the exhaust fans," explained Dr. John Stinn. "Now, with air flowing out of barn at one location, odor reduction technologies such as fences, tree lines and other windbreaks can be significantly more effective."

"Odor can attach itself to small dust particles that circulate inside the barns," said Stinn. "What we're really trying to do with the trees and the fence is to knock these particles down, which will in turn reduce transmission of odor. Our best chance to do this is when the particles leave the exhaust fans."

When the dust particles enter the ionization field between the fans and the electrostatic fence, a negative charge is placed on the particles. When the particles hit the fence, it serves as a grounding plate which attracts and grabs the charged particles. The fabric fence also slows the airspeed and mechanically filters the larger dust particles which will be washed off by rain showers, or by a power-washer if necessary.

According to Stinn, the electrostatic fences can reduce odor transmission by 50-70 percent. Stinn and his engineering team have partnered with ISU to continue testing the technology to measure the results.

Paired with the trees and shrubs placed immediately behind the fence, the combined effort to reduce odors experienced by neighbors to the farm should result in an even higher reduction rate.



COALITION TO SUPPORT
IOWA'S FARMERS

"AS MUCH AS I WOULD LIKE THEM TO, THEY DON'T HELP US GROW BETTER OR MORE PIGS. BUT, THEY ARE IMPORTANT. THEY HELP US BE GOOD NEIGHBORS AND RESPONSIBLE MEMBERS OF OUR RURAL COMMUNITIES AND STATE."

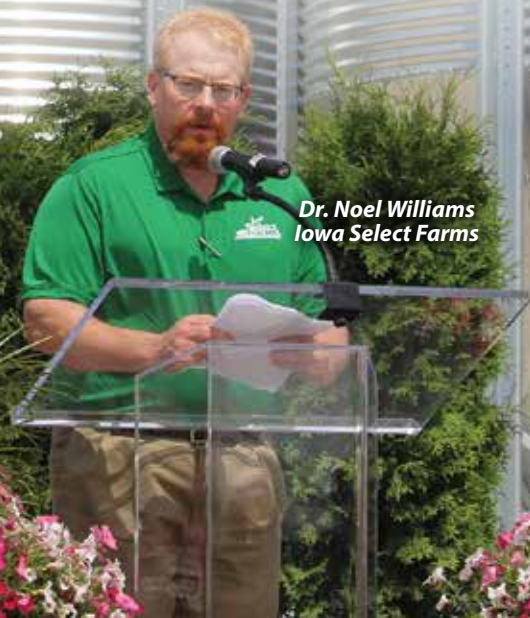
**-DR. NOEL WILLIAMS,
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*Tom Boge,
Construction Supervisor
Allison, Iowa*



*Julie Kenney, Deputy Secretary,
Iowa Department of
Agriculture and Land
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Electrostatic Fence



*(Left-to-Right)
Brian Blumhagen, Ames, Iowa;
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IOWA SELECT FARMS

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