

Full paper is published in the proceedings of:

**MITIGATING AIR EMISSIONS FROM
ANIMAL FEEDING OPERATIONS
CONFERENCE**

Iowa State University Extension
Iowa State University College of Agriculture
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**Conference Proceedings
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Vegetative Buffers for Swine Odor Mitigation - Wind Tunnel Evaluation of Air Flow Dynamics

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Species: Swine

Use Area: Animal Housing

Technology Category: Environmental Barriers

Air Mitigated Pollutants: Ammonia, Hydrogen sulfide, Volatile Organic Compounds and Odor

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System Summary:

Plantation of forest vegetative buffer as windbreak barrier is a cost-effective method to mitigate odor and particulate emissions from confined swine facilities. Vegetative buffers planted upwind confined swine facilities have showed definitive benefits on regulating air flow around buildings, and mitigate odor constituent transport downstream. Design of vegetative buffers (e.g. tree arrangement) should consider prevailing wind direction and speed, tree specie growth habitat, and tree longevity as well as climate and soil conditions. As odor mitigation strategy around swine facilities, vegetative buffer should consider building type, facility management, animal diet, climate, and local environmental conditions (especially wind speed and direction, turbulence, vegetative cover, and topography). Additional potential benefits of using vegetative buffers upwind in swine facilities include: tree products (e.g. firewood), aesthetics, snow control, wild life habitat, buffer for extreme temperature fluctuations, and potential soil erosion control.

Applicability and Mitigating Mechanism:

- Forest vegetative buffer upwind of swine facilities as odor control technology may reduce air quality impacts at low cost.
- Single or multiple rows of trees near swine feeding facilities can mitigate odor constituent transport by intercepting gaseous compounds and particulates.
- A single row of willow trees as a vegetative buffer upwind of swine facilities is a cost effective method to reduce wind speed.

Limitations:

- Poorly designed vegetative buffer (too dense) may decrease wind speed to the extent in which animal comfort and performance can be compromised.
- Vegetative buffer required initial planting cost plus low maintenance cost.
- There is a lack of direct, short-term economical benefit after tree plantations.
- Interpretation of wind tunnel experiments is limited because they simulate scenarios at small scale in highly controlled conditions.

Cost:

Vegetative buffers represent a cost-effective feasible method for mitigation of swine odor and particulates transport. Upfront costs (site preparation and establishment phase) were more than half of the total costs to producers. Cost of the planting stock was the highest single cost with prices ranging from 0.75 to 18 dollars for Austree willow and eastern red cedar/jack pine, respectively. Costs may also depend on long-term health of trees and choices of weed control. A financial assessment for three planting scenarios of vegetative buffers over a 20 year period indicated that a three row vegetative buffer system would cost a producer just over \$3,000, with just under \$1,800 coming during the initial establishment phase. These costs translate to about \$0.03 per pig produced. A single row of Austree willow would cost \$460, less than 1 cent per pig produced. A single row of mixed hardwoods would cost about \$1,700 with the vast majority (70 %) of the costs coming upfront; costs per pig come out to about \$0.02 per pig.