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EFFECTS OF MANURE HANDLING SYSTEMS ON SWINE HEALTH

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Modern swine production confinement systems have brought about significant improvements in the quantity and quality of meat products for human consumption. This has been achieved because of the ability to maintain good environmental conditions and to apply sound management techniques, therefore, allowing the animals to achieve maximum performance. These intensive production systems have animals in close proximity to each which results in the large quantities of manure that must be handled. Thus the manure system becomes an integral part of the total production system. If the manure is not handled in a sanitary manner, if the gases and odors from decomposing manure are not reduced through ventilation; there are increased risks of disease and reduced performance to the confined animals. But ventilation for the reduction of odors, if not properly designed and utilized, can lead to increased draftiness in the environment and also can have a chilling effect on the pigs which increase health problems and reduce performance.

The objective of this paper is to summarize these effects based on research that has been performed around the country.

SWINE MANURE HANDLING SYSTEMS

There are five alternate waste management methods for confinement swine housing:

¹This paper is a summary of four papers noted on last page.

- 1) Bedded in house storage of manure,
- 2) Under-slotted floor anaerobic storage of manure,
- 3) Hydraulic flushing systems in open gutters or under a slotted floor using fresh or recycled water,
- 4) Mechanical manure removal systems, and
- 5) Gravity drain systems.

NOXIOUS GASES

Ventilation systems in confinement housing must be designed to remove the odors and gases produced from the decomposition of manure. Of particular concern is ammonia and hydrogen sulfide. The effect of ammonia has been studied using nursery, grower and finishing pigs at Agriculture Experiment Stations in Illinois and Indiana. Ammonia (50 to 75 ppm) and hydrogen sulfide (2-8.5 ppm), which normally exist in ventilated confinement buildings, did not affect the gains, feed efficiency and the respiratory tract structure for grower or finisher pigs. But in that normal resistance and defense mechanisms were reduced. The most dramatic effects were found with young pigs which were exposed to ammonia. At 50 ppm, the rate of gain of young pigs was reduced by 12% and, at 100 or 150 ppm, the rate of gain was reduced 30%. Young pigs with ascarid infection had a rate of gain reduction of 60% with exposed to 100 ppm of ammonia. If the pigs were exposed to ammonia and ascarid infection separately, the rate of gain was reduced by 32% and 28% respectively.

The type of waste collection and waste storage system affects the rate of release of hydrogen sulfide and ammonia. Larger quantities of ammonia are released from accumulations of solid waste on concrete floors with large surface areas and bedding systems than from under-slotted floor liquid anaerobic waste pits. But very large quantities of hydrogen sulfide can be released during agitation of liquid anaerobic manure pits prior to it being pumped out. This situation may be lethal to the pigs housed in the building. Hydraulic flushing systems reduce the amount of the gases released particularly if the pigs can be trained to dung in the open gutter or on the slotted floor over the gutter. Mechanical scrapers do not completely remove all the manure in under-slotted floor gutters and thus may release as much or more noxious gases than does the liquid anaerobic pit. Gravity drain systems which utilize either a Y- or V-shaped gutter under the floor or under raised floors or crates have a minimum release of noxious gases particularly if they are emptied frequently. The frequency of emptying these gutters has been studied for both the below-floor and above-floor situations in a farrowing or nursery building. These two situations tested where 60F simulated a below-floor gravity gutter and 73.5F simulated an above-floor gutter. These temperatures were indicative of a nursery building. The production rate of hydrogen sulfide (Fig. 1) and ammonia (Fig. 2) are shown as a function of storage time. The average production rate of hydrogen sulfide at 73.5F was two times the rate at 60F while the production rate of ammonia at 73.5F was 20% higher than at 60F. Thus the above-floor gravity gutter would

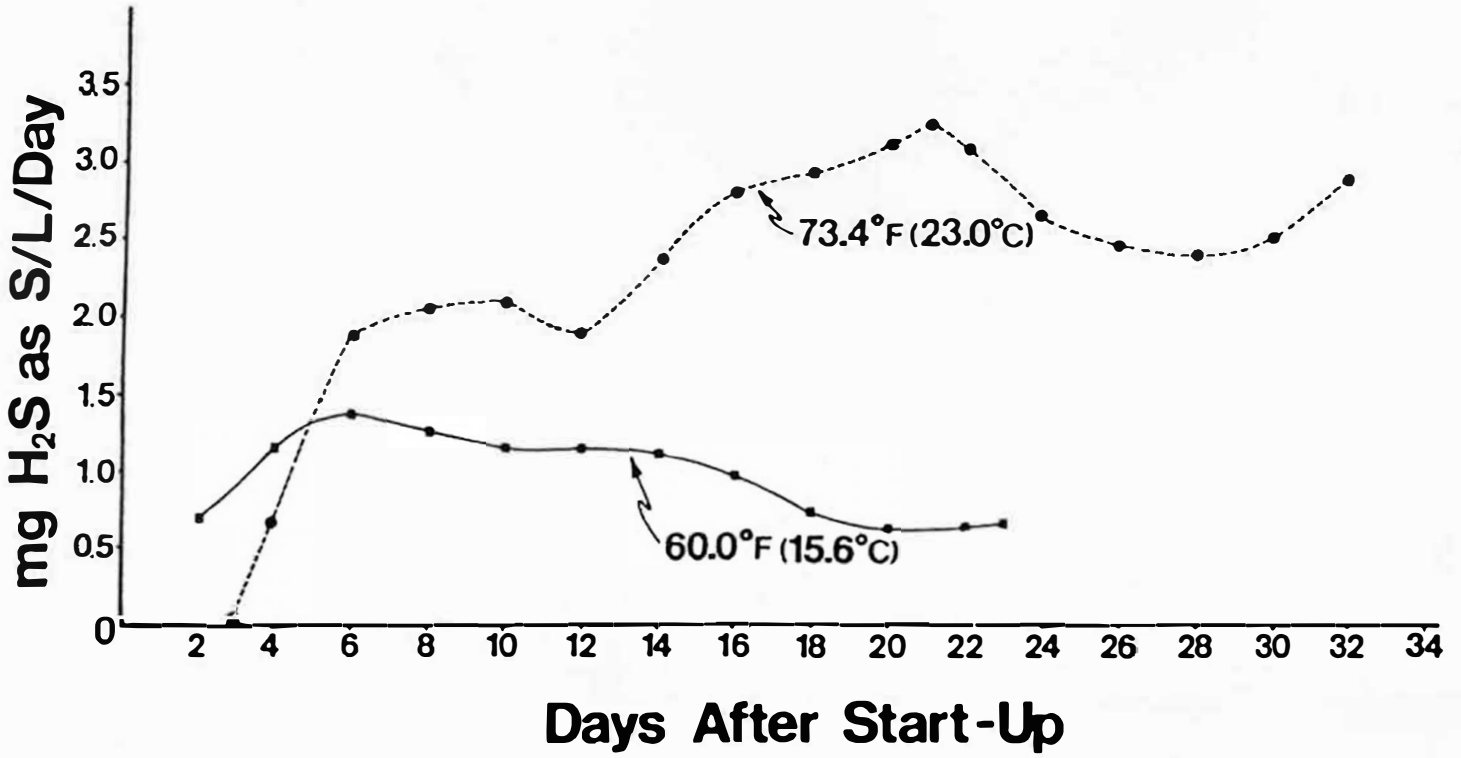


Figure 1. Hydrogen Sulfide Production vs. Storage Time

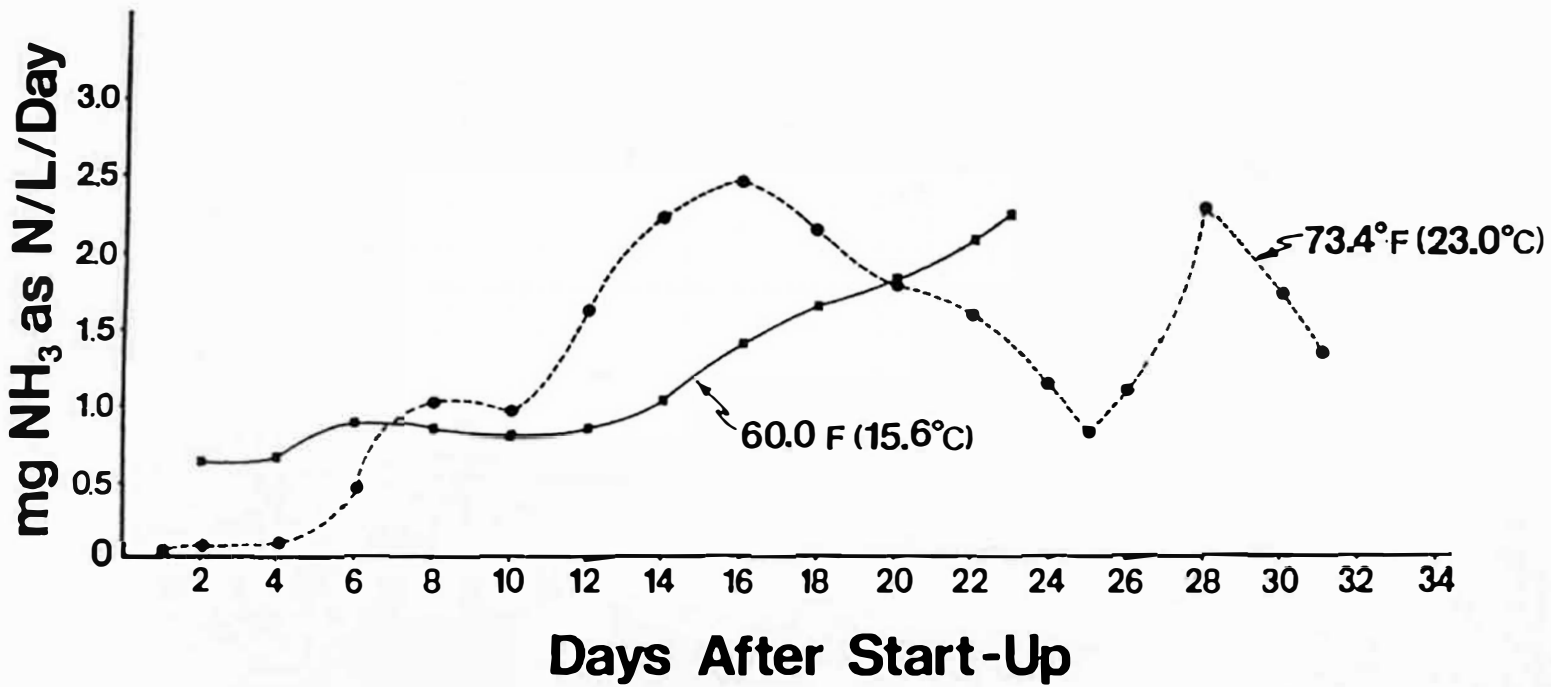


Figure 2. Ammonia Production vs Storage Time

give off the higher rates of noxious gases. For minimum ventilation rates in a nursery building, the maximum storage time in a below-floor gutter is approximately seven days while the above-floor gutter is five days. For longer storage times, the ventilation rates must be higher for the above-floor gravity gutters than the below-floor gravity gutters.

INCREASE DRAFTINESS IN THE ENVIRONMENT

The general method to reduce the noxious gas problem in swine confinement production systems is to increase the ventilation rate or utilize pit ventilation. This results in increased draftiness and temperature fluctuations in the building. For pit ventilation there is air movement through the slotted floor into the pit. Baby and nursery pigs are the most susceptible to this draftiness. This is the case, particularly, when they are forced to lie down on the slotted floor and then are chilled by the air moving into the pit.

Reduced ventilation and reduced under-floor pit ventilation can be achieved by frequent removal of the manure from the facility. This can be achieved by hydraulic flushing of manure from open gutters or from under-slotted floor with an adequate frequency each day. This can also be accomplished using shallow pits or gravity drained Y- or V-gutters that are emptied after, at most, seven days. Scrappers under a slotted floor required more ventilation than the above systems and may require as high of a rate as under-slotted floor pit storage if the gutters are not adequately cleaned.

Reduced ventilation also decreases the total energy required for the building heating load.

REFRIGERATION EFFECT UNDER PIGS

There is a health risk to pigs that accompanies the use of hydraulic flushing during the winter when the flush water is very cold. As the flush water travels through the gutter, the air is refrigerated. Any pig lying on the slotted-floor above the gutter during a flush, will be chilled. Again small pigs will be most affected by chilling, thus, increasing their potential health risks as well as their productivity.

DISEASE SPREAD IN THE CONFINED PIG POPULATION

Four swine diseases are common in swine production units: swine dysentery, salmonellosis, colibacillosis and coccidiosis. Swine dysentery is difficult to control and to eradicate from a given swine production facility because of carrier pigs and a contaminated environment. Swine dysentery affects weaned pigs, growing pigs, and adults. The causative organism of swine dysentery, Treponema hyodysenteriae can survive from 1 to 48 days in swine manure and has been found to survive for several weeks in anaerobic lagoons and pits. Salmonellosis caused by salmonella microorganisms are also hardy pathogens. These pathogenic organisms have also been found to survive for several weeks in anaerobic pits and up to 32 days in anaerobic lagoons. The second stage of a two-stage anaerobic lagoon was found to have a lower population of salmonella organisms

than the first stage of the lagoon suggesting that a single stage lagoon may have a higher potential for disease transmittance.

The waste handling system that allows the highest exposure to transmitting dysentery and salmonellosis is an open gutter flush system that utilizes recycled anaerobic lagoon water. Hogs are found to drink and to lay in the gutter as the flush water passes. Further, a carrier hog at the upper end of the open gutter thus can potentially infect all hogs that are downstream. Eradication of these diseases on the farm is almost impossible and disease control utilizing antibiotics can be expensive. Therefore, removing the pig from contact with the lagoon water is required. This can be achieved by covering the gutters with a slotted floor or utilizing fresh water for flushing.

Colibacillosis caused by E.coli and coccidiosis caused by a protozoa are two diseases that affect unweaned piglets. These diseases are transmitted from a carrier sow's feces to the piglets. Separation of the piglets from the sow, good sanitation, and removal of manure every five days should minimize the effects of these diseases in the farrowing house.

FEED ADDITIVES

Feed additives such as antibiotics, drugs, and growth promotant chemicals can accumulate in the tissues of hogs that are exposed to recycled lagoon water in an open gutter or manure on a concrete lot. Hogs will drink flush water during a flushing event or will ingest solid manure. Accumulation of these additives in excess of the legal limits have been found in carcass tissues. In the case of sulfa drugs, hogs fed sulfa drugs and exposed to recycled lagoon water in open gutters have been found to have accumulated sulfa drugs above the legal limits in carcass tissues. It has been suggested that hogs be separated from the flush water with a slotted floor to reduce the concentration of this drug in the animal's tissue.

SUMMARY

This paper has suggested potential disease and health problems in raising hogs in intensive confinement facilities as a function of the waste management system. Research has only scratched the surface of these problems and the suggested alternatives have not been fully tested.

Manure management and disease control for swine. 1981. C. B. Gilbertson and A. Hogg. ASAE Paper No. 81-4510, 1981 ASAE Winter Mtg., Chicago, IL, Dec. 15-18, 1981.

Gas production vs. storage time on swine nursery manure. 1981. D. J. Meyer and J. C. Converse. ASAE Paper No. 81-4512, 1981 ASAE Winter Mtg., Chicago, IL, Dec. 15-18, 1981.

Influence of waste management on animal health and welfare. 1982. A. L. Sutton and J. C. Nye. ASAE Paper No. 82-4036, 1982 ASAE Summer Mtg., Madison, WI, June 27-30, 1982.

Manure handling systems and their relationship to herd health. 1981. R. A. Vinson. ASAE Paper No. 81-4514, 1981 ASAE Winter Mtg., Chicago, IL, Dec. 15-18, 1981.