K

S

U

Waste Disposal by Aerobic Oxidation

B. A. Koch

Waste disposal and odor control are two important problems in pork production. The odor formerly was called the "money smell" has suddenly become "Environmental Pollution." Concentrating many animals in small areas compounds the problem.

The Kansas State University swine unit was designed to use "aerobic oxidation" to control wastes and odors. Aerobic bacteria (those using oxygen) digest the organic portion of swine manure and break it down to water and carbon dioxide. If oxygen is not present in the manure mass, aerobic bacteria are depressed and anaerobic bacteria take over. The anaerobes digest organic material but the end products they produce include undesirable odorous gases, slime, and foam that, in some cases, are toxic.

At the K.S.U. swine barns, all pigs closely confined are on slotted floors, so all liquid and solid wastes drop through slots into a circular pit under the building. The pit is four feet deep but it contains only' 12 inches of liquid (manure and water mixed to a slurry). Excess liquid spills over into a holding tank. Liquid from the holding tank is hauled to the field and spread, using a tank wagon that is filled and emptied by a tractor-powered pump.

Material in the under-floor pit is mixed and circulated by an "air-wheel" that stirs oxygen into the moisture. The aerobic bacteria grow and reproduce using organic waste as nutrients. They rather quickly break down about 50% of the organic material to water and carbon dioxide. No odor is produced in the process. Little or no inorganic material (salts) is digested, so salts and less-easily digested organic material concentrate in the pit. That is the reason water must be added to dilute the material.

The K.S.U. system is operating satisfactorily. The original aeration wheels have been replaced by a more satisfactory model that rests on the floor. Wheels now are away from the corner of the pit to circulate the fluid more efficiently. The slurry now is maintained in a more fluid condition (at least 2,000 gallons of liquid is spilled into the holding tank each week). Amounts of detergent and disinfectant draining into the pits is held to a minimum. When excessive foaming becomes a problem, a commerical foam suppressant (Liqui-Lass) is used.

Problems that have occurred in the past:

1. Foam.

   Certain anaerobic bacteria create foam. Also, anytime a liquid containing protein is stirred or agitated, a viscous foam is formed. During the first year foam was a serious problem. Various materials were added to the slurry to suppress or control the foam; they adversely affected the bacteria. The Ferma-Gro corporation's bacterial fermentation product apparently helps to develop a desirable reaction in the slurry. We have used many commercial foam depressant solutions experimentally. All were of some value, but most are expensive. However, Liqui-Lass (Feed Flavors Inc., Chicago, Ill.) seems to give good results at low cost. Others equally as good or better may be developed and marketed.

2. Mechanical problems.

   We are using a commercially-produced "aeration wheel" (Fairfield). The original model was suspended in the pit. Current models sit on the floor of the pit. They vibrate less and all material in the pit must pass under the wheel. Bearings were short-lived on the early model. Present bearings last much longer. The rotor or fan on two of the units broke; however, that has not been a problem for many months.

3. Fluctuating pit load.

   Amount of waste in each pit fluctuates. Each is without pigs a certain period every two or three months, which seems to affect bacterial fermentation. A constant load likely would be better. None of the pits has been completely emptied and cleaned since being put in operation two years ago.

4. Odor.

   Odor becomes quite obvious when the wheel is shut down even a short time. However, there is no odor when the pit is properly diluted and the "air wheel" is turning.

5. Cost.

   Original cost of such a unit is about $100 per foot of wheel width. The daily operating cost (about 35 or 40 KWH for a 2-horse motor on a four-foot wheel or 45 to 50 KWH for a three-horse motor on a six-foot wheel) is approximately $1 per wheel.

Summary

1. The aerobic oxidation system controls flies, odor, and waste in a swine production system.

2. It adds some continuous maintenance and power costs.

3. It satisfactorily handles swine waste.

4. The system will freeze in Kansas winters unless it is in a well protected area.