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Waste Stabilization Pond, Ambient Temperature Anaerobic Bioreactor …. No Matter What You Call It, It's Still a Lagoon

Doug Hamilton (Oklahoma State University) and Ed Buckner (University of Arkansas, Pine Bluff)

Unless you have been lost at sea or living in a cave for the last decade, you are probably aware of the controversy surrounding animal waste treatment lagoons. The North Carolina Attorney General reached an agreement with Smithfield to investigate systems that substantially improve manure handling in that state, with the stated purpose of eliminating "lagoon and sprayfield" technology. Similar action has taken place in the state of Missouri. This would lead the public to believe that the problem with hogs are the lagoons that store and treat hog manure.

Although lagoons do have problems, the general distrust of lagoons is unfounded. First of all, the term "lagoon" is often misused. Farmers, the press, and the public tend to call any earthen manure storage basin found on a farm a "lagoon." The title "lagoon", however, has a specific meaning. Lagoons are biological treatment components of liquid manure handling systems that also provide storage. Many of the problems associated liquid manure handling systems: liner seepage, accidental overflows, catastrophic embankment failure, pathogen release, odor emissions, and closure of earthen basins are not unique to systems that have lagoons. These problems are shared by all liquid systems.

Lagoons rely on physical, chemical, and biological processes to degrade manure. Biological processes play the greatest role in degradation. Growth and maintenance of biological communities depend on temperature, food, the absence of toxic elements, and the ability of organisms to remain in the lagoon long enough to reproduce.

The microbiological communities degrading manure are layered in lagoons, with each layer performing a separate function in the overall process. Lagoons located in temperate climates undergo annual cycles of storage, heating, and organic matter accumulation. The heating and organic matter accumulation cycles are problematic in that there is a tendency for lagoon layers to become unstable in the spring and fall, increasing the likelihood of odor emissions during these periods. Most of the southeast United States is far enough south that the problem of organic matter accumulation can be overcome by good lagoon design and maintenance.

Photosynthetic organisms, which occupy the upper most layer of the lagoon, play a major role in the degradation of compounds that contain sulfur and nitrogen, as well as many volatile organic chemicals that cause odor. It is important that at least one cell of a lagoon system is open to the atmosphere to allow sunlight to penetrate the surface. Unfortunately, the open surface also allows volatile compounds to escape the lagoon. Ammonia gas produced during anaerobic degradation of proteins and urea is particularly problematic. Controlling atmospheric emissions from lagoons is an area of active research.

Lagoons function best when operated as flow-through systems with yearly effluent removal. The most common method of effluent removal is irrigation. Local patterns of rainfall and evaporation -- and the amount of rain produced by isolated storm events – determine the annual effluent storage capacity of lagoons. In the eastern edge of the southeast region, liquid levels must be closely monitored to prevent lagoons from over-flowing. However, just west of the Oklahoma-Texas border, producers must add water in order to avoid reducing the treatment capacity of the lagoon and to have sufficient effluent for irrigation.

Lagoon maintenance is relatively simple. Producers need to maintain prescribed liquid levels, monitor the accumulation of sludge, and irrigate excess effluent. But, nutrient recycling efficiency is lost in the simple operation. Up to 80% of all nitrogen entering lagoons is lost to the atmosphere before it leaves the lagoon as effluent, and nitrogen and other plant nutrients are less concentrated in lagoon effluent than in material removed from other types of manure storage components. To fully recycle crop nutrients, lagoon effluent must be irrigated in multiple applications throughout the growing season. Managing effluent in this manner requires expensive, permanent irrigation equipment to apply what is essentially a low quality fertilizer. On a more positive note, lagoon effluent has a better balance of nitrogen to soluble phosphorus than most sources of manure nutrients. Lagoon effluent can be used in crop production on a nitrogen basis with less concern for phosphorus accumulation.

A great portion of manure phosphorus is retained in the sludge stored in the bottom of the lagoon. This stored phosphorus is only recovered when solids are removed at the end of the sludge storage cycle – which may last as long as 10 to 20 years. Lagoon sludge is an excellent organic fertilizer, but should be applied on a phosphorus rather than a nitrogen basis.

So, lagoons are viable treatment alternatives with a few short comings. Despite repeated calls for their elimination, lagoons are probably here to stay for small to medium sized hog farms – frankly, because lagoons are the most error-proof, low-labor treatment components available to handle liquid manure streams. However, they will not function properly unless operated properly.

To help Extension personnel better understand lagoon operation, and to pass this knowledge on to producers, a workshop entitled, "Animal Waste Lagoon Management" will be offered at the Southern Region Water Quality Conference in Lexington, Kentucky. The workshop will be held on Sunday Morning, October 23, 2005 – the first day of the conference. Participants in this workshop will learn how to distinguish between lagoons and other liquid manure handling components, how engineers use standards to design lagoons, how microorganisms interact to degrade manure in lagoons, how effluent quality determines irrigation scheduling, how sludge accumulation determines lagoon operational life, and how to use the local climate to maintain lagoon liquids within the proper operating levels.

Poultry Litter Spreader Calibration Education and Demonstration

Thomas Bass, University of Georgia

A great amount of resources and time have been put into nationally recognized programs in nutrient and animal waste management conducted by University of Georgia (UGA) Extension specialists and county agents in the last 5 years. These programs were born from regulatory changes, increased public scrutiny

and a proactive industry. An integral component of nutrient management planning is the calibration of land application equipment. The Georgia Department of Agriculture now requires haulers and brokers of animal manures to apply for a permit and annually calibrate application equipment. Hence, spreader calibration is necessary for the continued use of animal waste resources in an environmentally responsible manner, particularly in Georgia, which produces 1.5 million tons of poultry litter annually.

In March 2004, Extension specialists and over 25 county agents field tested a variety of methods for poultry litter spreader calibration. The field day was promoted as an in-service training with an interactive component. It was cooperatively planned by five specialists as well as county agents from Greene, Morgan and Putnam Counties. During the training, five methods were each tested on four different spreaders at the University of Georgia Central Branch Experiment Station in Eatonton. The results of this exercise allowed specialists to continue recommending the UGA small tarp method (Figure 1) for litter spreader calibration (www.agp2/aware, search keyword "calibration"). A convenient calibration kit was assembled to facilitate quick and easy replications in the field.

Figure 1. University of Georgia personnel using the small tarp method for poultry litter spreader calibration

A curriculum on spreader calibration was also developed for county and regional workshops. Monroe County Extension worked with Poultry Science and Bio and Ag Engineering to plan the first course on animal feeding regulations and nutrient management planning that also incorporated calibration of a spreader. The program consisted of a 2½ hour classroom session covering poultry regulations, litter and soil testing, farm mapping, nutrient management planning software, and explanation of calibration. A hands-on demonstration and interpretation of the recommended "UGA small tarp method" for spreader calibration was also conducted.

Since the summer of 2004, over 10 successful workshops have been conducted around the state for producers, litter brokers, poultry company field men as well as technical service providers and other educators. The compiled curriculum, set of presentations and calibration kit make this training easy to replicate. Requests for additional trainings have been received and will be accommodated to provide this pertinent and timely training in convenient geographic regions throughout the state. These trainings

exemplify successful collaboration and cooperation between Extension specialists, county agents, local soil and water districts, NRCS and the poultry industry.

Please contact Paul Sumner or Tommy Bass for more information on spreader calibration. Visit www.agp2.org for more information on animal waste programming in Georgia.

Additional Acknowledgements: Dr. John Worley, Dr. Casey Ritz, Dr. Mark Risse and Georgia's County Agents.

Upcoming Events and Announcements

National - International

- 2005 Animal Waste Management Symposium, October 5-7, Raleigh, NC

Statewide – Regional

- Florida
  - UF/IFAS Certified Crop Advisor Fall Training, October 12, 2005, Fort Pierce, FL
    5 CEUs offered in Crop Management and 5 CEUs offered in Soil & Water Management. Cost is $100 and course will be available at multiple locations via electronic connections.
  - IFAS/NRCS Nutrient Management Training for Technical Service Providers, December 6-8, 2005, Gainesville, FL.
- Georgia
- North Carolina
  - Multiple trainings on animal waste systems offered throughout the year in Raleigh, NC
  - 10-Hour Initial Animal Waste Certification Courses - Duplin Co. Extension Office; contact Star Jackson to register: 910-296-2143
- Southern Region Extension Water Program Meeting, 4 Sessions and Workshops on Animal Waste Management, October 24-26, Lexington, KY

Animal Waste Management Program

The Animal Waste Management Program is one of 12 priority program areas identified by the Southern Region Water Program Planning Committee. The multi-disciplinary regional workgroup of animal waste management experts is improving animal waste management recommendations to enhance both economic and environmental outcomes in threatened and impaired watersheds. Through strengthened regional and multi-agency collaboration, the workgroup identifies gaps in knowledge and resources, defines significant research needs, and conducts strategic planning to develop appropriate educational and technology transfer tools. Questions or comments may be directed to the team leaders or the appropriate state contact.

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