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Water Quality in Georgia

Georgia's Agricultural Waste Regulations

Cooperative Extension Service • The University Georgia College of Agricultural and Environmental Sciences • Athens

The Clean Water Acts of 1970 and 1990 created legislation to help ensure that all of us help protect water. Today's environmental issues are gaining emphasis nationally and internationally. The environment belongs to all of us and we all need to protect it.

The quality of our food and water supplies has attracted attention and caused debate concerning risk, cost and benefits. More regulations and laws have an impact on water quality and waste utilization. This includes all aspects of waste handling, including livestock waste.

This increasing emphasis on a cleaner environment demands that agriculture give more attention to managing livestock and poultry manure. Land use patterns, size of livestock operations, soil type, rainfall run-off, land availability, crop scheduling and climate are some of the factors affecting the choice of waste management system. It must be both feasible and environmentally acceptable.

WASTE DEFINITION

Animal waste means different things to different people. Livestock manure consists of feces and urine from livestock and poultry. Waste refers to manure with added bedding, rain or other water (e.g., water from the milk house from washing the milking system which has no association with manure). The quantity, concentration and composition of waste may depend upon the degree of automation desired, as well as the holding period and disposal method, which all influence the design of livestock waste facilities.

Manure properties vary with animal species, ration, digestibility, fiber content and the animal's age and environment. The amount of nutrients in the waste available for crop production also varies considerably, depending on the waste handling method.

For example, consider the difference in the daily nitrogen production in the waste for 1,000 pounds of animal weight for broilers, swine and dairy.

	Daily Total Nitrogen per 1,000 Pounds of Animal
Broilers	1.16 pounds
Swine	0.45 pounds
Dairy	0.41 pounds

Handling methods greatly affect nutrient losses, thereby affecting plant nutrients available. Anaerobic lagoons, for example, destroy about 80 percent of the nitrogen in the waste over 12 months. The only way to know for certain what nutrients are being applied to the land is lab analysis. To complete the puzzle, use soil test results and calibrate application equipment.

Liquid manure containing up to 4 percent solids can normally be handled as a liquid using normal irrigation equipment. Liquid waste containing solids of 4 to 15 percent solids may be handled using slurry equipment to move the viscous, semi-solid material. Manure below 85 percent moisture content can be diluted with water so that it may be handled as a liquid; in some cases it can be handled as a solid.

PROBLEMS IN GEORGIA

Livestock and poultry are important to the economy of Georgia. In 1989, more than 38 percent of production agriculture's dollar came from poultry. In addition, 6.8 percent of farm income came from cattle and calves, 6.9 percent from eggs, 4.5 percent from hogs and pigs and 4.8 percent from dairy products. More than 50 percent of the farm dollar comes from livestock and poultry production.

Many livestock and poultry enterprises are concentrated in certain regions of the state near processing and packing plants. This concentration of animal units on limited land has potential impact on certain critical drainage basins, streams and rivers.

To protect water quality and get the best return from animal waste, it should be land applied to balance crop needs with the nutrients applied. The waste from one dairy cow, for example, is worth about 25 to 30 cents per day when fully used and applied immediately to crop land with the proper nutrient balance to the crops. By using best management practices, commonly called BMP's, we can collect the waste to apply to crops while protecting water quality.

Stackhouses (waste storage under a roof) are a convenient means to store poultry litter during periods when fields are wet or cropping does not allow land application. Another BMP coming into use is composting dead chickens and land application instead of

using deep pits or incineration, which are less environmentally friendly. Poultry mortality composting requires a permit from the Georgia Department of Agriculture, Animal Industry Division.

Large numbers of animals on limited land area, such as in holding lots, concentrate waste and mud. Mud can be controlled in these heavy use areas, but rain falling on these lots produces run-off, which can pollute streams if not collected and properly land applied.

Groundwater may also be adversely affected. Large numbers of animals held in total confinement, on the other hand, may produce no pollution outside the system. Handling methods and management can make a considerable difference. However, total confinement systems with liquid manure handling can pollute streams if the lagoons are not managed to prevent overflow. Dairy freestalls increase production and allow closed loop handling of waste.

Liquid manure systems are easily automated, with more being installed every year. Labor and equipment savings for liquid manure flush systems compared to scraping cost can in some instances return the installation cost of flush systems in two to five years. The concrete surface in flush systems is much cleaner and more durable than scrape systems. However, nutrients are lost in the lagoons.

Some systems use solid separators, settling basins or mechanical separators to keep solids out of the lagoon. If solids are removed, the lagoon contents are much easier to pump onto land. Sand and foreign material are much less likely to fill the lagoon over time and management is much easier. However, solids that are removed must be land applied. Because of this, many operators still prefer to put all the waste into the lagoon. This requires chopper pumps to agitate and mix lagoons before pumping on the land.

If wastes applied to land exceed plant nutrient needs, then the soil cannot retain the nutrients. They can wash into streams or contaminate groundwater. The best approach is to apply the amount of nutrients based on the crop's needs when they need it. Double or triple cropping will allow you to apply more waste on the land.

LIQUID MANURE HANDLING EQUIPMENT

The viscosity and consistency of liquid manure and slurries requires special consideration of pumping equipment. Figure 1 shows typical equipment needed to handle manure as a liquid.

Vacuum tanks can pull waste material containing high levels of solids into a mobile tank for land application. Solids separators can effectively remove solids from animal waste to make it more fluid and to reduce solids buildup in anaerobic lagoons. Mechanical screens and various settling basins have been used. For fly control, the solids collection and storage area at dairies should be several hundred feet away from the milking parlor. Settling basins that are flooded daily generally do not provide a suitable environment for fly larvae.

Another helpful method to prevent solids buildup in dairy lagoons is to use fabric to retain freestall bedding in the freestalls and to keep it out of the flush gutters and out of the lagoon. Mats also greatly reduce bedding costs and labor.

ANAEROBIC LAGOONS

Anaerobic lagoons have become popular over the state because of labor savings. Anaerobic lagoons can be enlarged to make the waste more fluid and reduce odors. Table 1 shows the design requirements for anaerobic lagoons in Georgia. Adding a second stage lagoon improves wastewater quality for flushing and reduces odor. Adding a second stage to a lagoon can reduce the wastewater pollution level by a factor of three to five (Sweenten-Texas). This makes pumping easier and helps with odor.

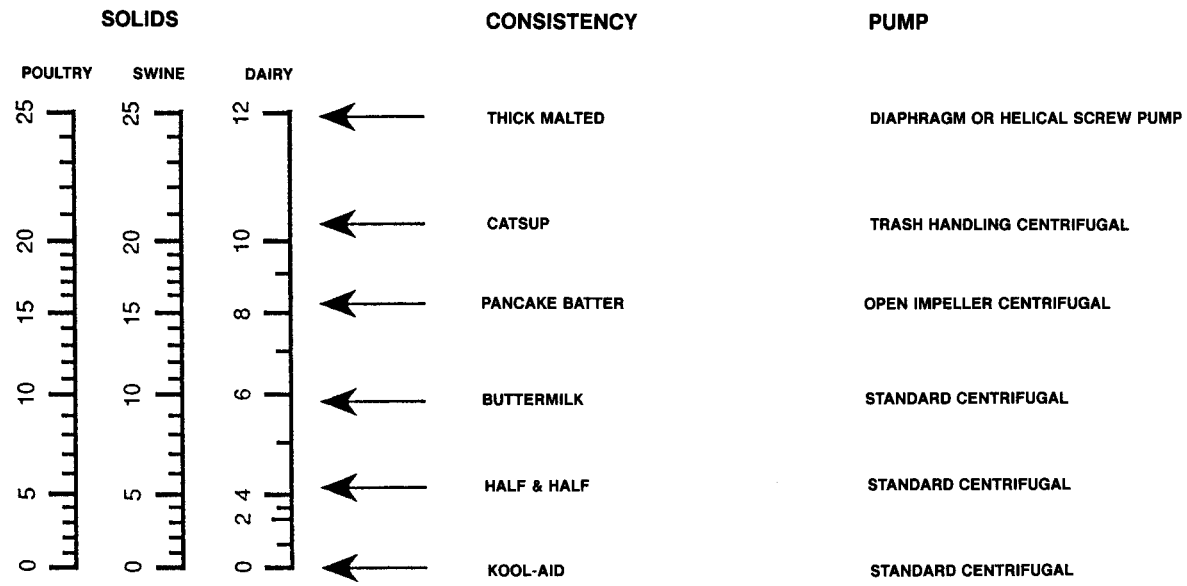

Figure 1. Solids content, consistency, and type of pump required for liquid handling of animal and poultry wastes

Table 1: Anaerobic Lagoon Requirements

Waste from	Cu. ft. per* Animal	Odor Control C.F./Animal
Animals		
Dairy Cattle ** (1,200 lbs.)	1,380	1885
Beef Cattle (800 lbs.)	920	1200
Hogs (150 lbs.)	250	450
Chickens (4 lbs.)	15	20
Hogs		
1 animal = 150 lb. feeder		
1 sow = 300 lbs.—2 feeders		
1 sow and litter—4 feeders		
1 weaned pig—0.25 feeder		

Note: Multiply appropriate values by the minimum number of chickens, cows, and/or hogs to ever be served at any one time and sum to determine the minimum total volume needed.

* These are minimum design requirements. Additional capacity should be provided for solids accumulation and where odors must be minimized.

** Where a dairy operation consists of a wash down area and/or a flush system for cleaning the holding area, the storage area of the lagoon will be increased to accommodate this additional volume of water. The equipment wash room water must also be properly disposed of either in the lagoon or a separate system.

REGULATIONS

The proliferation of livestock waste regulations began when agriculture was blamed for the pollution of Chesapeake Bay. Wastes on farms in the Chesapeake Bay watershed got into surface waters that eventually flowed into the Bay. Farmers in the Chesapeake Bay area have shown that when best management practices are applied, water pollution problems may be significantly reduced.

For agriculture to comply with the laws and regulations in Georgia, we must know what the regulations are, who enforces the regulations and where to get help to comply.

The Environmental Protection Division (EPD) of the Georgia Department of Natural Resources is authorized by the Federal EPA to carry out the Federal Clean Water Act as amended in 1974. EPD and the USDA Soil Conservation Service entered into a memorandum of understanding in 1974 which established the responsibilities of each agency. This memorandum was further expanded in 1990. In some counties, ASCS (Agricultural Stabilization and Conservation Service) has helped finance waste handling facilities on a cost share basis, paying up to 75 percent for certain practices.

The guidelines and regulations are directed at *small* and *large* concentrated livestock feedlots and poultry operations. The definition of a small and large operation may change over time. Check with your county Extension agent for the latest data. Here is the current definition of a large operation:

* 1,000 or more slaughter steers and heifers
* 700 or more mature dairy cows (milkers or dry cows)
* 2,500 or more swine weighing more than 55 pounds
* 10,000 or more sheep
* 55,000 or more turkeys
* 100,000 or more laying hens or broilers when the facility has a continuous flow watering system
* 30,000 or more laying hens or broilers when the facility has a liquid manure handling system
* 500 or more horses
* 5,000 or more ducks

Large operations must meet requirements for land application permits. These permits are not currently required for small operators. In either case, the regulations prohibit the pollution of the waters of the state.

The current guidelines for *small operations* are:

(1) There shall be no discharge of pollutants from the feedlot operation into surface waters of Georgia (i.e. creeks, streams, lakes with outlet structures).

(2) The design of the wastewater disposal system shall be handled entirely by SCS. The system shall be designed in accordance with the appropriate practice standards and specifications contained in Section IV of the SCS Field Office Technical Guide.

(3) EPD is not involved in the review, approval or permitting of small feedlot operations, and has no requirements with regard to buffer zones or groundwater monitoring for these systems.

(4) The system must be designed to handle the runoff from a 24-hour, 25-year storm event without an overflow from the treatment/storage lagoon(s).

(5) The treatment/storage lagoon(s) must be constructed to ensure that seepage is limited to a maximum of ⅛ inch per day (3.67×10^{-6} cm/sec). For new feedlot lagoon(s) located within significant groundwater recharge areas which fall within the categories defined in the Georgia Department of Natural Resources Rules for Environmental Planning Criteria, Chapter 391-3-15-.02, Paragraph (3)(e), the waste impoundment(s) must be provided with either a compacted clay or a synthetic liner such that the vertical hydraulic conductivity does not exceed 5×10^{-7} cm/sec or other criteria established by SCS.

(6) A minimum of 2 feet of freeboard should be maintained in the lagoon(s) at all times.

(7) The wastewater disposal system shall not be located within a flood plain unless it is protected from inundation or damage from a 25-year, 24-hour storm event.

(8) The irrigation of feedlot wastewater on crops that are intended for direct human consumption is not recommended.

The guidelines for *large operations* are the same, with these exceptions.

(1) The wastewater disposal system shall either be designed by SCS, or reviewed and approved by SCS.

(2) A Land Application System (LAS) Permit must be obtained from EPD prior to commencing operation

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by W. Cecil Hammond, Extension Engineer

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of a new feedlot.

(3) An application for a LAS Permit must be submitted to EPD by the feedlot or dairy owner. A letter from SCS concurring with the design of the wastewater disposal system and a copy of the approved plans and specifications should be included with the LAS Permit application.

(4) Prior to issuing the LAS Permit, EPD requires that a 30-day public comment period be provided on the proposed permit issuance.

(5) The wastewater disposal system shall be designed and operated such that nitrates in the groundwater at the feedlot owner's property line do not exceed 10 mg/l. EPD will require feedlot operations to implement corrective actions if the nitrates exceed 10 mg/l.

(6) The wastewater disposal system shall be designed and operated so that nearby private and public water supply wells are protected from adverse effects.

(7) EPD requires a minimum buffer zone of 150 feet between the treatment/storage lagoon(s) and property lines, between the spray irrigation field(s) and property lines, and between the spray irrigation field(s) and public roads. A minimum buffer zone of 300 feet between the edge of the wetted field and any habitable structure (outside of the feedlot owner's property lines) is also required. EPD may allow for reduced buffer zones under certain conditions. Such conditions include the presence of a healthy stand of trees in a multi-storied canopy throughout the buffer zone area, along with the written consent of all property owners affected by the reduced buffer zone requirements. Requests for such reductions will be evaluated on a case-by-case basis.

(8) EPD requires that at least one up-gradient and at least two down-gradient groundwater monitoring wells be installed for each drainage basin intersected by the spray irrigation field(s). The number, location, design and construction specifications of the monitoring wells shall be reviewed and approved by EPD.

(9) The LAS Permit will contain specific requirements for monitoring the pond effluent and the groundwater monitoring wells. This will usually consist of quarterly monitoring of the pond effluent for BOD_5, TSS, TKN, NH_3, NO_3 and pH, as well as quarterly monitoring of the wells for specific conductivity, NO_3, pH and depth of the groundwater.

(10) The LAS Permit may require periodic monitoring of any wet weather ditches or perennial streams which are in close proximity to the spray irrigation field(s).

Certain streams located in agricultural areas of Georgia have been listed as targeted waters. These include Gladys and Rooty Creeks in Putnam County, Murder Creek in Putnam and Jasper counties, Mossy Creek in Hall and White counties, White Creek in White County, Gum Branch Creek in Crisp County, Hard Labor Creek in Walton and Morgan counties, Little River in Morgan and Putnam counties and Upper Chattahoochee River and tributaries in White, Habersham, Lumpkin, Hall, Dawson and Forsyth counties. Most of these watersheds are located in counties with high animal densities and the potential to generate waste.

Animal waste is a resource that can be used for nutrients to grow crops and forage. Proper handling and application to land allows the plant roots to act like a sponge or living filter using this resource while protecting the environment.

HANDLING AND STORAGE METHODS

From an environmental standpoint, the ideal arrangement is a confinement livestock or poultry operation that has adequate land areas nearby to properly land apply the waste. The waste can be handled using a liquid system such as a lagoon or it can be handled as a solid or slurry. But the key is to apply the waste at the appropriate time and in proper amounts to be used by a growing crop.

Waste lagoons are becoming increasingly popular and allow for timely application of waste to the land when designed and operated correctly. New regulations will not allow any overflow from livestock waste lagoons or appreciable seepage from the lagoon into the soil. Lagoons that are to be built on soils which allow appreciable seepage to the groundwater must have a clay layer or other acceptable liner to control seepage. The lagoon must be designed, sized and operated to allow land application.

Essentially, all lagoons fill and will eventually overflow if not pumped onto the land. Also, sludge and solids collect in lagoons and can eventually destroy the effectiveness of lagoons. Several methods can separate the solids from the liquid to keep the solids out.

Mechanical separators and pumps can pull out some of the solid material that would eventually choke the lagoon. Another method of solids removal is to use settling basins, which allow the solids to be confined in the basin to be removed at a convenient time with a loader and spreader for land application.

Another way to remove some of the solids and sludge from lagoons and preserve their longevity and effectiveness is to agitate the lagoon, putting solids in suspension before pumping onto the land. However, the process does require high capacity pumps and energy to power the pump.

A common source of pollution is the runoff of water from muddy animal lots. The water moving across the lots is polluted by contact with the waste and carries the pollution to the waterways. Liquid and small particles move into streams. One effective means to control this pollution is to use a diversion above the lot to keep clean water off the lot. Adding special fabrics under crusher-run gravel prevents mud in heavy use areas. A diversion below the lot can channel the water into an impoundment, then pump it onto pasture or

cropland after the storm has passed.

Another means that reduces pollution, but doesn't prevent it, is to divert the runoff water through a settling basin that empties slowly onto a grass filter strip. Up to 90 percent of the solids and much of the potential pollution in the liquid can be removed in this way. A terrace or diversion above the open lot is helpful to reduce the amount of water washing across the open lot.

A new procedure that holds some promise involves wetlands. After solids are removed, the liquid possibly can be cleaned up by the wetlands. This process is still experimental and somewhat costly. However, it has been successful in treating domestic sewage in Europe.

Public policy and regulations will continue to reduce the pollution potential and dictate that runoff from the land not contaminate our water. Livestock waste can no longer be allowed to run into road ditches and waterways. Excess wastes applied on limited land areas can wash into streams and move downward through the soil and pollute the groundwater.

The best technology currently is to contain and store the waste until it can be applied to the land at the proper time and rate to be used as crop nutrients. For example, poultry stackhouses can store poultry litter. This can contaminate streams and wells and degrade the environment.

We must all work for a cleaner environment for the good of everyone. If we can voluntarily do a good job, fewer regulations may be required in the future.

Waste can be used to reduce fertilizer cost and help offset some of the cost for improving handling methods that reduce pollution. Dairy freestalls are one example. They generally pay for themselves in three to five years with increased milk production and allow the waste to be contained. We must learn to adapt practices that use the waste as a resource and control pollution.