ALABAMA A&M AND AUBURN UNIVERSITIES

ALABAMA COOPERATIVE Extension SYSTEM

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Animal Waste Management Planning

Alabama farmers have always valued good land and clean water. When they are informed, responsible citizen farmers take the necessary steps within their economic means to care for these important natural resources. This is true with today's situation concerning water quality and animal waste management. As farmers understand how to protect Alabama's waters from animal waste, they will do so. They will also appreciate the benefits of applying animal waste to improve cropland.

This publication will describe the basic elements of a complete animal waste management program. Today, every operator needs to plan for the appropriate use of animal waste. By carrying out an effective waste management plan, the farmer will continue to be seen as one who cares about the land, environment, and people of Alabama.

The Alabama Cooperative Extension Service (ACES) is responsible for helping farmers understand the importance of animal waste management, the components of an animal waste management plan, and the procedures for putting an animal waste management plan in action. At the end of this publication is a list of Auburn University Extension Specialists who can be contacted for more information. These individuals are serving on a team dedicated to helping all livestock and poultry farmers in Alabama to plan and carry out a waste management program. An effective waste management program includes the following:

- A well-thought-out plan, which considers individual farming operations.
- Financial resources needed to put this plan into action.
- Time and labor for continuous attention and maintenance.

Producers should not avoid environmental issues or ignore the value of animal waste. Animal waste management addresses all aspects of production. An animal waste management plan considers the amount of waste generated, the storage facilities needed, and the nutrient content and available uses of manure. A critical phase of management is nutrient management which involves land application or conversion to feed.

Producers should not ignore public reaction to animal production. By carefully planning and successfully carrying out a complete animal waste management program, producers can continue operating successfully without complaints from neighboring landowners.

Site Evaluation

Facility location is the single most important consideration of an animal waste management plan. The producer who is aware of possible effects on surrounding neighbors is more likely to create a plan that will reduce pollution and nuisance complaints. Locating a livestock or poultry operation near residential developments, commercial enterprises, recreational facilities, or other non-agricultural areas requires expensive and detailed waste management measures. New producers or those wanting to expand should thoroughly check out land use zoning ordinances and proposed development nearby before committing to any production location.

A waste management plan should consider sights and smells that are part of any animal operation. Animal production units can be shielded from direct sight by planting hedgerows and tree barriers or by locating the facility away from main roads. Odor problems can be lessened by accounting for the direction of prevailing winds. Planting trees between the operation and downwind neighbors will reduce wind speed and allow time for odors to disperse.

Before locating waste storage facilities, the operator should investigate soil properties, including water intake rate, holding capacity, sealing characteristics, water table level, and depth to bedrock. High clay and silt content soils have negligible seepage and are desirable for earthen lagoon or storage pond construction. Sands should be modified with a clay or bentonite liner. Waste storage ponds and lagoons should be built above the water table. Lagoons or storage ponds in karst topography (sinkhole areas) should be sited by qualified geologists.

Distance of animals and waste storage structures from wells, streams, drainage canals, or natural wetlands is critical. The farther away from these water sources, the easier waste management will be. Locating storage facilities on high ground will promote good surface drainage away from buildings and will favor gravity flow systems. On the other hand, dramatic elevation changes may create more complex problems for waste transport and land application.

Type And Size Of Operation

Manure management practices depend on the kind of animals, number of head, and type of operation. To estimate amount of manure that will be generated on farm, the operator must calculate total live weight expected in a year. Manure production will be influenced by type of production whether poultry (breeder flock, broiler, layer); dairy (lactating cow, dry cow, heifer, calf); or swine (farrow to weaning, farrow to feeder, nursery, finishing, farrow to finish). In the initial planning, the operator should consider possible future increases in animal numbers to insure long-term, successful animal waste management.

Type Of Production Facilities

Partial confinement or total confinement production facilities require different manure management practices. Chicken broiler production units may be concerned primarily with litter cleanout and temporary storage. Dairy, beef, or swine pasture production systems may require stock trails, fences to keep animals from streams, improved stream crossings, and alternative watering sources with shade. For animals kept on unpaved dry lots with no vegetation or those in partly enclosed facilities with open slabs, conservation practices to collect and store runoff and manure will be necessary. Total animal confinement affects not only production performance but potential odor generation as well, depending on floor surface, ventilation, and manure management. In-house manure collection methods, such as flushing, pit recharge, and mechanical scraping greatly reduce gas and odor levels inside the facility.

Manure Storage And Treatment Facilities

Each producer must decide whether to conserve manure nutrients for maximum fertilization or to reduce manure nutrient content. Conserving manure nutrients requires more manual labor (more than three times as much with liquid waste handling systems) and more land application area than does reducing manure nutrients.

Broiler operators would prefer land application at cleanout because it eliminates the need for storage and treatment. However, land application may not be possible if cleanout occurs when soils are saturated or when crops are dormant. During these times, storage will be necessary. Until it can be safely spread, the material may be stored in a building called a dry stack barn. Field storage is acceptable if the manure is covered and is placed on a clay or concrete pad, preventing groundwater contamination. With liquid manure handling or flushing systems, conserving nutrients means moving manure to outdoor holding tanks or basins for short periods of storage (less than 180 days). Liquid manure spreaders or slurry irrigation systems move the manure nutrients to large fields for land application and incorporation.

If nutrient reduction and treatment of manure waste is the goal, then anaerobic lagoons with or without solids separation become the heart of the overall waste management system. Lagoons should be large enough not only to store manure for long periods (greater than 180 days) but also to accumulate solids for extended periods (10 to 20 years). Depending on solids separation, a typical lagoon will be three to eight times the volume of storage basins or holding ponds. Storage and treatment facilities should be sized according to specifications of the American Society of Agricultural Engineers or USDA Natural Resources Conservation Service (NRCS, formerly SCS). Their procedures for approved construction, start-up, and management will produce a successful system. Well-planned and well-managed lagoons can reduce nutrient content up to 85 percent and lower overall odor levels around a production facility. Lagoon treatment allows greater flexibility for land application scheduling and lowers the risk of environmental impact on shallow groundwater.

Nutrient Management

Estimating Manure Production

To properly manage waste from a livestock operation, producers must estimate or determine the quantity and nutrient content of manure. Estimates of both quantity and nutrient content of different animal manures

and broiler litter are available from ACES and NRCS. The estimated figures are based on nationally recognized Auburn University research and data from the American Society of Agricultural Engineers. This information should be used when planning new waste management facilities to insure appropriate land application for maximum nutrient uptake and minimum nutrient loss.

If it is available, information about the operation of an existing facility should be used. For new operations or where historical data is not available, operators must estimate volume of manure, litter, runoff, or lagoon liquid that is to be stored for land application.

For liquid based systems, using water meters or periodically recording lagoon level will help in determining volumes generated. Samples of manure and wastewater should be analyzed at least twice a year for nutrient content. The Soils Testing Lab at Auburn University can provide this service for a nominal fee.

Determining Application Rate

Soil characteristics, field slope, and erosion control systems are critical factors in proper application of manure. Clay soils have more capacity for holding nutrients than do coarse, sandy soils. Applying more nutrients or wastewater than the vegetative cover can use and the soil can hold will contribute to leaching and groundwater contamination. Runoff also becomes a major concern when excessive animal waste is applied to the land.

For liquid systems, infiltration rate and water holding capacity determine the maximum application rate and amount. Liquid waste should not be applied to saturated soil. Field slope affects runoff which, if not controlled, can result in nutrient losses and environmental pollution. Well-maintained terraces, waterways, field borders, and other water disposal systems help prevent excessive runoff.

Determining Cropping Systems

Target crops should be chosen for their nutrient requirements, and the manure application should be managed to meet that need. Crop nutrient requirements range from as low as 50 pounds of available nitrogen per acre on pine tree stands up to 600 pounds of available nitrogen on intensely managed bermudagrass hay land. Manure, litter, or wastewater should be applied to supply the timely nutrient needs of the crop involved. Different crops have different requirements for major plant food nutrients of nitrogen, phosphorus, and potassium. Since these three nutrients are also the most common ones found in animal manure, cropland application is a wise end use in an animal waste management plan. However, while manufactured fertilizer can be blended to match the exact nutrient requirements of a specific crop, typical nutrient content of animal wastes matches those of no crop. This is a manure nutrient management dilemma. Only a single nutrient need can be targeted as the waste-management-controlling nutrient; the remaining nutrients will be either over- or underapplied.

Overapplication of phosphorus (P) and potassium (K) can be tolerated in many instances since these nutrients are not highly susceptible to leaching. This is not the case with nitrogen which is highly water soluble and most likely to pollute surface and groundwater. Under no circumstances should available nitrogen be overapplied: it is highly susceptible to leaching and groundwater contamination. **Because of this difference in pollution potential, nitrogen is now and usually has been the controlling element in nutrient management programs.** This may change in the future.

Using any other nutrient as the controlling ingredient for waste planning would mean increasing the land area necessary for the proper application of the manure and would require the application of additional commercial nitrogen. For instance if P and K requirements of a crop were being considered, the area needed for land application would increase two to five times above that needed on the basis of nitrogen. Plant-available nitrogen amounts to about half of the total nitrogen applied in irrigated lagoon liquid and around 70 percent of total N in manure slurries that are soil incorporated. Percentages are less for sprinkler irrigation not incorporated. Work sheets are available from ACES to help calculate available nutrients and application rates.

Timing Of Waste Application

Timing of manure or wastewater application should coincide as nearly as possible to the time when plants can use the nutrients—that is, during the normal growing season. Manure should not be applied in a field when a crop cannot use the applied nutrients. Overseeding a summer grass or planting viable cool season crops may allow winter application. But even then, there will be periods when the ground is frozen or saturated and the cool season grass is dormant. At times when land application is not possible, adequate storage must be available until manure can be applied to a growing crop.

Lagoon wastewater irrigation is more effective when applied in several applications throughout the growing season. Slurry irrigation with high nutrient content or poultry litter may be applied only once or twice a year depending on crop type. Applying manure nutrients on dormant crops or fallow land can lead to groundwater contamination from leaching or surface water contamination from runoff.

Nutrient removal from the land application site is an important goal of any manure nutrient management plan. Regular harvest and removal of crops must take place regardless of the particular crop selected for land application. Where crop removal does not occur, manure nutrients cycle back into the soil, eventually increasing soil nutrient levels which increase pollution potential. Intensive grazing programs or haying procedures are necessary for bermudagrass hay land application sites. Before selecting a crop for manure application, the operator should consider marketing strategies for the particular crop used.

Application Equipment

Manure application equipment must be available, calibrated, and in good working order. The type of equipment used for waste application depends upon the type and consistency of the waste. Most broiler litter is applied with a truck-mounted bulk fertilizer applicator. Dairy waste from loafing areas is often handled in a solid form. Settled solids in sediment basins and scraped waste are usually handled with a box spreader or flail spreader.

Lagoon wastewater is often handled in two forms—wastewater, which contains less than 2 percent solids, and a slurry mixture of agitated sludge and wastewater. To avoid the high cost of hauling, many farmers apply wastewater on land using their regular irrigation systems. Slurries, however, require special pumping equipment and sprinklers that have a large nozzle. Alternatively, lagoons may be renovated by agitating once every 2 to 15 years, depending upon solids accumulation. The resulting slurries contain concentrated nutrients, often requiring many acres of cropland for application. When liquid wastes are irrigated, odor is a potential problem.

Portable agricultural irrigation equipment is available, or custom irrigators can be hired. In some locations Soil and Water Conservation Districts or Resource Conservation and Development offices have lagoon renovation equipment available for farm use. Farmers with many acres in field crops may use traveling sprinkler guns or center pivots for land application. Where only small acreages of grass are irrigated with no need to move the system, small solid-set, medium pressure irrigation systems can be used. These systems are convenient, require little labor, and provide uniform distribution of wastewater. Manure application equipment should be inspected and adjusted for uniform application rate. Because of water quality concerns, uniform application of manure and wastewater is as critical as the uniform application of chemical fertilizers.

The amount and type of labor needed for the animal manure management program must merge with the overall farm workload. Moving and handling application equipment must not interfere with other chores around the confined animal feeding operation. A wastewater irrigation system that has to be moved every 2 hours to prevent overapplication may conflict with other time demands on farm labor. Not being able to meet the time demands of equipment may also contribute to over- or underapplication of nutrients. Failing to use the irrigation system may result in overflowing lagoons or waste storage ponds. Operators should carefully consider which irrigation design will best meet their needs.

Animal Mortality Management

Every livestock operation should have a plan for the proper disposal of dead animals. Disposal must take place within 24 hours of death. Choices for on farm disposal include burial, incineration, and composting (particularly in the chicken broiler industry). Collection for rendering is another alternative. Current research is exploring methods for long-term storage before removal from farm to rendering plant.

Soil And Water Conservation

Erosion control, runoff, and drainage management normally included in a soil and water conservation plan are doubly important for sites where manure is land applied. Phosphorus adheres to soil particles and is particularly susceptible to moving off the field in eroded sediment. This is a problem because phosphorus is one of the main nutrients in animal manure and one that is typically overapplied. Conservation tillage and terraces with contour form strip cropping help control erosion and, therefore, limit loss

of phosphorus. Field borders, buffer strips, grassed waterways, sediment basins, and vegetated filters can also reduce runoff and sediment transport of manure-based nutrients.

Fields with artificial drainage systems can release soluble nitrates. This impact can be reduced if proper nutrient management is followed. Cover crops increase infiltration and denitrification but also help hold soil in place and remove additional unused nutrients when major crops are not being grown.

Farmstead Appearance

Because of public concern about the environment, an animal farmstead that is clean and well kept may be as important as one that operates efficiently. The animal production facility, its buildings, and surrounding land reflect the attitude of the operator. The good impression the public receives of a visually pleasing animal production facility is worth the effort. Alabama farmers who adopt a workable waste management plan will be seen as people who care about animals, land, and people.

The best animal waste management program for a particular animal production facility is one which the owner or operator chooses after evaluating various alternatives. It should be a program that can be carried out with appropriate investment of capital, attention, and management. Once implemented, the program must be continuously evaluated. No waste management program works without proper attention to all elements. Animal waste management should be a part of the total production scheme. A well-planned and well-executed animal waste management program will protect water quality and the environment for use and enjoyment by future generations.

Planning Assistance

Producers who wish to begin a waste management program can turn to several sources for professional advice. Before making any decisions, operators should obtain as much information as possible about managing the animal wastes produced. This includes details on different methods of collection, storage, treatment, and use of the by-product. Determining which alternative best fits into a particular overall production scheme means comparing costs and requirements of installation and operation.

The Natural Resources Conservation Service (NRCS) provides planning, design, and construction aid for waste treatment lagoons, manure dry stack facilities, composter units, incinerators, dead animal disposal pits, and waste disposal based upon soils, crops, and equipment needs. NRCS serves as technical representative for cost-share programs to carry out waste management and dead bird disposal systems. NCRS also provides financial assistance.

The Auburn University Extension Specialists listed below are members of a Waste Management Education Team which can provide information on animal and animal by-product production and how to incorporate various animal waste handling options into individual farm production plans.

Dairy—Pete Moss, Extension Animal Scientist.

Swine—Frank Owsley, Extension Animal Scientist.

Poultry—John Blake, Extension Poultry Scientist.

Beef cattle—B.G. Ruffin, Extension Animal Scientist.

Nutrient usability of target crops and application rate—Charles Mitchell, Extension Agronomist.

Waste management handling facilities, components, operation, and management— Ted W. Tyson, Extension Agricultural Engineer; and James Donald, Extension Agricultural Engineer.

Every livestock and poultry producer will be dealing with waste in some way. Planning before taking action is an important first step in preventing problems. Having an effective operating plan reduces the possibility of complaints that damage the image of agriculture and cause needless bother to everyone involved. The same animal wastes that sometimes pollute Alabama's waters can instead provide nutrients to reduce the need for manufactured fertilizer and commercial feed. Proper animal waste management will benefit the land, livestock, producers, and people of Alabama.

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This publication was prepared by Ted W. Tyson, *Extension Agricultural Engineer,* Associate Professor, Agricultural Engineering; and James O. Donald, *Extension Agricultural Engineer,* Professor, Agricultural Engineering.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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