SITE SELECTION

For new producers or those anticipating significant expansion, site selection is probably the most important single consideration associated with the entire operation. Adjacent land use should remove from consideration those sites near residential developments, commercial enterprises, recreational areas, or other prime areas for non-agricultural uses. Wind direction probability diagrams will help to locate facilities downwind of warm season prevailing winds. The strategic planting of hedge rows or tree barriers at property boundaries serves to shield the production and manure management facilities from direct sight and to reduce wind speed across the facilities allowing any emitted gases more opportunity to rise vertically and dissipate into the atmosphere.
A site may seem ideal with respect to transportation, feed supply, accessibility or land ownership, but may be inappropriate because of existing or proposed development.

Soil properties and limitations should be investigated. Soil types with limited permeability which will rapidly seal are desirable for lagoon construction. Coarse sands will probably need to be amended to speed up the sealing process. An erosion control plan to stabilize and maintain a site during construction should be considered. When possible, locate production facilities near the center of a tract of land large enough to allow manure to be applied at agronomic rates. Pollution control and manure management facilities should be located as remotely as possible from areas of high environmental sensitivity such as drainage canals, streams, or natural wetlands. Buildings in flat, high water table areas should be built on pads of earth excavated from the lagoon. Elevating these buildings several feet above ground routes surface drainage away from them and allows flushed manure to flow by gravity to a lagoon built above the water table. Upland facilities should be built on high ground and as far away from water sources as possible to allow wastewater management options.

**TYPE OF OPERATION AND ANIMAL INVENTORY**

The type of operation (dairy - lactating cow, dry cow, heifer, calf; swine - farrow-to-weanling, farrow-to-feeder, nursery, finishing, farrow-to-finish; turkey - brooder flock, grower, breeder; etc.) affects most manure management practices. The maximum number of animals and corresponding total live weight expected on the farm on any given day is also necessary for most manure management calculations.

**TYPE OF PRODUCTION FACILITIES**

Different environmental management practices are required for different production facilities and systems. Stock trails and improved stream crossings may be required in vulnerable pasture areas. Fencing of animals from streams in intensively used areas where animals tend to congregate or along highly erodible reaches may be required. Animals maintained on unpaved lounging areas or drylots not supporting vegetation will in some instances require conservation practices to minimize the effects of lot runoff. These animals will most likely be denied direct access to surface waters or wetlands. Partially enclosed facilities with animals on open slabs will also be subject to runoff control. Totally enclosed facilities can affect the production performance as well as potential odors emitted depending on floor surface, ventilation, and manure management. In-house manure collection methods and frequency affect gas and odor levels. Modern manure removal methods such as flushing, pit recharge, and mechanical scraping have drastically reduced the gas and odor levels inside production facilities.

**MANURE STORAGE / TREATMENT FACILITIES**

Producers must decide whether their objective is manure nutrient conservation for maximum fertilization or nutrient reduction for ease of management. If nutrient conservation is desired, then scrapers moving manure to outdoor holding tanks or basins, or settling basins prior to lagoons for flushed waste will be needed. Liquid manure spreaders or slurry irrigation systems
will move the manure nutrients to large field crop acreages for spreading. If, on the other hand, nutrient reduction prior to land application is desired, then solids separation and/or anaerobic lagoons become very important parts of the overall treatment system. Lagoons, storage basins and holding ponds must be properly sized according to USDA-Soil Conservation Service specifications using correct construction, start-up, and management procedures. When properly planned and managed, lagoons can reduce overall odor levels around a production facility, reduce nutrients to be land applied by up to 85%, provide flexibility for land application scheduling, and have minimal impact on shallow groundwater.

**AGRONOMIC PLAN**

**Manure Characterization**

Summaries and estimates of manure quantities and nutrient content are available from the N.C. Cooperative Extension Service, USDA-Soil Conservation Service, N.C. Dept. of Agriculture, N.C. Agricultural Chemicals Manual, [http://ipm.ncsu.edu/agchem/agchem.html](http://ipm.ncsu.edu/agchem/agchem.html), as well as other sources. When no other information is available, such as when planning a new operation, these averages provide "ball park" figures and should be utilized. Existing operations are encouraged to develop individual estimates of the volume of manure, litter, feedlot runoff or lagoon liquid to be land applied, e.g., using water meters to measure the amount of water used in a production facility or by recording the lagoon levels periodically and determining the accumulated volume. Representative samples of the material to be land applied should be analyzed twice annually for nutrient and mineral content. The N.C. Department of Agriculture provides this service with interpretations of results for a nominal fee.

**Crop / Soil Selection**

Soil types should be mapped for each field on the farm to receive manure. Soil infiltration rates will often determine maximum irrigation rates or how much lagoon liquid can be applied before runoff occurs. Soil types also determine the fate of unused nutrients. Well-drained sandy soils provide more potential for unused nitrogen to convert to nitrates and leach downward. Heavy soils or poorly-drained soils reduce infiltration rates and water-holding capacity but provide more potential for unused nitrogen to denitrify harmlessly. Clay soils have more capacity to tie-up and hold phosphorus in place than do coarse soils.

Soil types also influence the yield potential of selected crops. If a corn crop, e.g., only has a yield potential of 100 bu/A on a given soil type, then it should only be fertilized for 100 bu/A, since any more nutrients would be wasted and become potential pollutants. Crop types should be selected for their nutrient requirements. A range of fertilization rates from 50 lbs of available nitrogen per acre on stands of pine trees to 400 lbs of available N on bermudagrass hayland allow flexibility depending on land availability and farm objectives.
Application Rates

Application rates of manure, litter or wastewater should only supply the fertilizer needs of the crops. Since the manure nutrients are not a balanced blend for most crops, some nutrients will either be under- or over-applied. Some over application of phosphorus and potassium may be tolerated, however significant and prolonged over application of P and K should be avoided. Supplemental fertilizer will be needed if rates supply only the P and K requirements of the crop. Under no circumstances should available nitrogen be over applied. Plant available nitrogen is currently estimated to be half of the total nitrogen in irrigated lagoon liquid and 70% of the total N in manure slurries that are soil incorporated. Worksheets are available from the Cooperative Extension Service to help calculate available nutrients and application rates.

Scheduling of Manure Application

Manure nutrients should be applied as near to the period of plant uptake as possible. Nutrients that are readily available, such as in lagoon liquid, are more efficiently utilized by the crop in several small applications throughout the growing season. Nutrients should only be applied to crops during their normal growing season. For example, bermudagrass normally thrives from May to September and should not receive manure at other times of year except when overseeded with a cool season grass such as rye. Cool season crops are necessary to allow application to proceed during the cool season, or enough storage is necessary to avoid having to spread. Land application of manure nutrients on fallow soil or onto dormant crops will only lead to nitrate leaching downward toward ground water.

Manure Application Equipment

Most manures will either be hauled with farm liquid manure spreaders, spread with irrigation systems, or applied by a custom applicator. Costs and time required for hauling, additional acreages required for concentrated slurries, soil compaction, odor considerations, and availability of custom applicators need to be considered for slurry management. It is not cost effective to haul wastewater. Most farms with lagoons will use simple farm irrigation systems, use portable company irrigation equipment, or hire custom irrigators. Those farms with field crops or tree stands will probably find portable systems such as travellers or center pivots most advantageous. Also, if portability to several different fields or large acreages are to be irrigated, travellers will be selected. On the other hand, if small acreages of grass are to be irrigated and equipment portability is not necessary, small-nozzle, moderate-pressure, permanent irrigation systems provide low-labor and more uniform distribution of lagoon liquids. All manure equipment should be calibrated periodically for application rate and uniformity. Appropriate equipment or contractual arrangements must be available whenever manure or lagoon liquid needs to be land applied.

Crop Management Utilization

It is important to remember that regardless of what crops are grown on land application sites, they all must be regularly harvested and removed from the site. Otherwise, nutrients will simply recycle back into the soil system and eventually become pollutants. For most field crops, readily
established markets are available for the products. For grass crops, markets for hay may not be readily available and may need to be developed. Consideration should be given to marketing a particular crop before selecting that crop for land application.

**Labor Availability / Accessibility**

The availability of labor and the ability to use that labor in the most efficient manner for manure management and farming chores outside of the production facilities should be considered. An irrigation system, e.g., that requires sprinklers to be moved or changed every two hours might require a laborer to shower out/in of the production complex for biosecurity reasons each time attention is given to the system. Would different irrigation equipment or management plans allow the labor to be used more efficiently? The same applies to crop establishment, maintenance, and harvest.

**ANIMAL MORTALITY MANAGEMENT**

Dead animals are required to be properly disposed of within 24 hours. On-farm mortality management options have consisted of below ground disposal or incineration. Below ground burial or pit disposal of animal and bird mortality may contribute nutrients to ground water in areas with coarse textured soils or high water tables. Mortality management alternatives currently being explored are collection for rendering or on-site composting. These alternatives would reduce below-ground point-sources of nutrients and produce a safe and marketable end product.

**CONSERVATION PLAN**

Erosion Control Soil as well as manure nutrients should be kept on the field where they are applied. Some nutrients such as phosphorus adhere to soil particles and only move when the soil particles move. Fields where manure is to be applied should have sound conservation practices where appropriate such as terraces, strip cropping, and conservation tillage.

**Runoff and Drainage Management**

It is difficult to avoid occasional applications of manure that are immediately followed by a rainfall event. When this happens, conservation practices such as field borders, grassed waterways, sediment basins, and vegetative filters help to minimize the transport of nutrients and organics off-site. Fields receiving manure that have artificial drainage systems should have a water management plan in action. Some nitrates that have formed in the upper soil layers will be collected in the tile drainage and will be delivered to the drainage ditches or canals. Management of the water levels in these ditches and canals by water control structures can accelerate the denitrification of these nitrates harmlessly.
Cover Crops

Double cropping or cover crops after harvest can help hold soil in place and remove some of the unused nutrients left in the upper soil layers. Crop rotation also tends to use certain nutrients or elements that otherwise would remain in the soil or be lost.

PUBLIC RELATIONS

Planning a group of buildings and their surroundings to present a wholesome image is as important as planning for productive efficiency. When the public sees a livestock or poultry farm, they see much more than buildings and grounds. They see an attitude -- an attitude of pride in the business or an attitude of indifference. They see an environmental protector or an environmental polluter. Farm operators who take pride in maintaining the farmstead are generally better managers than those who practice poor housekeeping. Employees take more pride in their jobs and work output improves (Morris et al., 1973).

After weighing the important points of alternative manure management systems, a producer must decide which system appears best, and then commit to it providing the attention and management necessary to make the system function. No production or manure management system will take care of itself. An ounce of prevention is worth a pound of cure. The appearance of buildings and grounds on farms constantly generates images of the product, good or bad. A good farm image helps sell the product. Portraying an attitude of success is contagious -- to employees, to neighbors, to consumers and to the general public (Morris et al., 1973).

REFERENCE


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EBAE 185-93
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