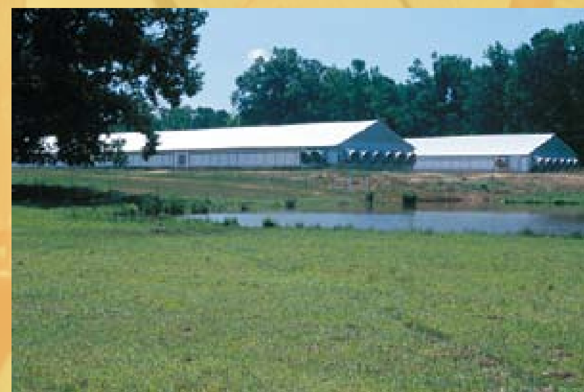

LSU AgCenter
Research & Extension



# Poultry Environmental BEST MANAGEMENT PRACTICES (BMPs)

endorsed by

Louisiana Department of Agriculture and Forestry

NRCS

FARM BUREAU LOUISIANA

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# Why BMPs Are Important to Louisiana

In Louisiana we are blessed with beautiful and abundant waters to enjoy fishing, hunting, boating or just relaxing on the shore of a lake, river or bayou. Most of the water in Louisiana's rivers and lakes comes from rainfall runoff. As this runoff travels across the soil surface, it carries with it soil particles, organic matter and nutrients, such as nitrogen and phosphorus. Agricultural activities contribute to the amount of these materials entering streams, lakes, estuaries and groundwater. In addition to assuring an abundant, affordable food supply, Louisiana farmers must strive to protect the environment.

Research and educational programs on environmental issues related to the use and management of natural resources have always been an important part of the LSU AgCenter's mission. Working with representatives from the agricultural commodity groups, the Natural Resources Conservation Service (NRCS), the Louisiana Department of Environmental Quality (LDEQ), the Louisiana Farm Bureau Federation (LFBF) and the Louisiana Department of Agriculture and Forestry (LDAF), the LSU AgCenter has taken the lead in assembling a group of best management practices (BMPs) for each agricultural commodity in Louisiana.

BMPs are practices used by agricultural producers to control the generation and delivery of pollutants from agricultural activities to water resources of the state and to thereby reduce the amount of agricultural pollutants entering surface water and groundwater. Each BMP is a culmination of years of research and demonstrations conducted by agricultural research scientists and soil engineers. A list of BMPs and accompanying standards and specifications are published by the NRCS in its Field Office Technical Guide.

# poultry BMPs

Poultry production is Louisiana's largest animal industry and its $1.5 billion contribution to the state's economy makes it the second-largest segment of Louisiana's agricultural industries. The Louisiana poultry industry consists of broiler producers and egg producers. Commercial broilers are produced by 350 growers in 11 parishes including Bienville, Claiborne, Jackson, Lincoln, Natchitoches, Ouachita, Sabine, Union, Vernon, Webster and Winn. There also are 580 commercial and small table egg producers in Louisiana housing more than 1 million egg-laying hens and producing more than 21 million dozen eggs. On-farm receipts from broiler production, breeder flocks and table egg production bring in nearly $812 million. Poultry processing and other value-added enterprises doubled this amount to nearly $1.9 billion. Poultry production represented the largest part of the $2.6 billion in economic contributions by animal agricultural industries in Louisiana for 2010. It ranks second only to forestry in its overall economic contribution to the state. Poultry production, by its nature, requires specific practices to conserve and protect soil and water resources.

Best management practices (BMPs) have been determined to be an effective and practical means of reducing point and nonpoint-source water pollutants at levels compatible with environmental quality goals. The primary purpose for implementation of BMPs is to conserve and protect soil, water and air resources. BMPs for poultry farms are a specific set of practices used by farmers to reduce the amount of soil, nutrients, pesticides and microbial contaminants entering surface water and groundwater while maintaining or improving the productivity of agricultural land. This BMPs manual is a guide for the selection, implementation and management of those practices that will help poultry farmers conserve soil and protect water and air resources.

# Whole Farm Nutrient Planning

Both the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Agriculture (USDA) are encouraging a voluntary approach to handling nonpoint-source pollution issues related to animal agriculture. The implementation of comprehensive nutrient management plans (CNMPs) by all poultry producers will ensure the nutrient value of litter is managed in an environmentally friendly fashion by either (1) properly using litter on the land based on its nutrient value or (2) transferring the litter to an alternative use program.

Litter is an excellent source of organic nutrients that can be incorporated into most farming operations when properly managed. For poultry producers, the proper management of litter is a major consideration in daily operations. Whether the material is used as a nutrient source on land controlled by the producer, provided as a nutrient source on other lands or offered as a material in an alternative use process, the proper management of the litter is essential. Storage, transportation, application, disease prevention and proper documentation are just a few of the items that need to be included in the nutrient management plan.

Whole farm nutrient planning is a strategy for making wise use of plant nutrients to enhance farm profits while protecting water resources. Such a plan looks at every part of your farming operation and helps you make the best use of manures, fertilizers and other nutrient sources. Successful nutrient management requires thorough planning and recognizes that every farm is different. The type of farming you do and the specifics of your operation will affect your plan – your CNMP. The best plan is one that is matched to the farming operation and the needs of the person implementing the plan.

A CNMP takes into account how nutrients are used and managed throughout the farm. It is more than a nutrient management plan that looks only at nutrient supply and needs for a particular field. Nutrients are brought to the farm through feeds, fertilizers, manure, litter and other off-farm inputs. These inputs are used, and some are recycled by plants and animals on the farm. Nutrients then leave the farm in harvested crops and animal products. These are nutrient removals. Ideally, the amounts of nutrient inputs and nutrient removals should be roughly the same. When nutrient inputs to the farm greatly exceed nutrient removals from the farm, the risk of nutrient losses to groundwater and surface water is increased. When you compare nutrient inputs and nutrient removals, you are creating a mass balance. This nutrient mass balance is an important part of a CNMP and important to understand for your individual farming operation.

## Whole Farm Nutrient Balance

Nutrients are transported along multiple pathways and in a variety of forms on a poultry operation. Our tendency is to focus on a small part of the total picture, such as the nutrients in litter and their losses into the environment. An understanding of the big picture is necessary, however, to identifying the underlying cause of nutrient concentration concerns as well as the solutions.

A picture of the flow of nutrients is presented in Figure 1. Nutrients arrive on a poultry operation as purchased products (fertilizer, animal feed and purchased animals), in rain and irrigation water and nitrogen fixed by legume crops. These "inputs" are the origin of all nutrients required for crop and poultry production and are the nutrients that accumulate in soils as well as those that escape into the environment.

Within the boundaries of the farm, there is "recycling" of nutrients between the poultry and crops. Manure nutrients are recycled, at least in part, for crop production. Feed crop nutrients are, in turn, recycled as animal feed for livestock or poultry production.

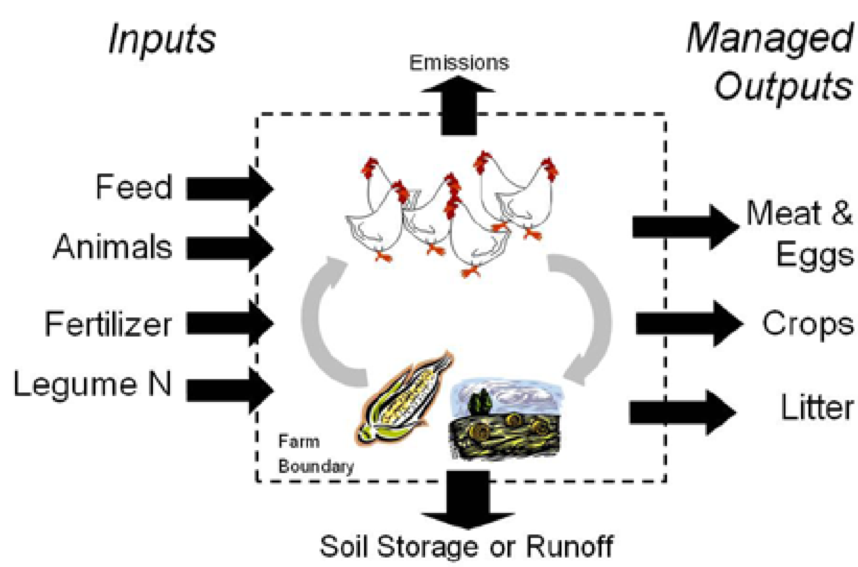



**Figure 1. A whole farm nutrient balance considers all nutrient inputs and managed outputs. The difference or imbalance drives the farm's air and water quality risks.**

Nutrients preferably exit a poultry operation as "managed outputs," including animals and crops sold and possibly other products moved off the farm (for example, litter sold or given to a neighboring crop producer). Some nutrients exit the farm as losses to the environment (nitrates in groundwater, ammonia volatilized into the atmosphere and nitrogen and phosphorus into surface water). Nutrients (especially phosphorus and potassium) also accumulate in large quantities in the soil. Although not a direct loss to the environment, a growing accumulation of nutrients in the soil adds to the risk of future environmental losses.

The "imbalance" is the difference between the inputs and the managed outputs. This imbalance accounts for both the direct environmental loss and the accumulation of nutrients in the soil. Poultry operations with a significant imbalance are concentrating nutrients, resulting in increased risk to water quality. In contrast, poultry operations that have achieved a balance represent a potentially sustainable production system. An analogy can be drawn between the whole farm nutrient balance for a poultry operation and water flow in a farm pond (Figure 2). The farm pond is the equivalent of a poultry and cropping operation (whole farm). The "water in" and "water out" (of the pipe) are respectively comparable to nutrient inputs and managed outputs. If the flow of water into the pond exceeds the outflow, the pond level rises. Similarly, if the nutrients entering a poultry operation exceed the nutrients leaving as managed products, the nutrients concentrate within the farm (for example, rising soil phosphorus levels).

If that imbalance is sustained, water eventually flows over the top of the dam with potentially catastrophic results. Similarly, with nutrients, the imbalance eventually is corrected by losses to the environment (for example, nitrates leaching to groundwater or phosphorus exiting with runoff and erosion) of similar magnitude as with the imbalance of water. A sustained nutrient imbalance leads to the nutrient contamination of water.

Sandbags provide a temporary solution to this problem. If the water imbalance is not corrected, however, the water level eventually exceeds what the sandbags can hold back. Many current best management practices (BMPs) for manure handling focus on plugging leaks without correcting the origin of the imbalance. BMPs such as grass filter strips, no applications on frozen soil or soil erosion control do not correct the imbalance and provide only short-term benefits.

Ultimately, the imbalance of water flows must be corrected to save the dam and the property downstream. To achieve a balance, the quantity of water entering the pond needs to be reduced and/or the water exiting the outlet pipe must be increased. Similarly, nutrient management planning must ensure a whole farm nutrient balance. The nutrients arriving on farm must roughly balance with those exiting the farm in managed products. After a balance is achieved, then BMPs designed to plug the leaks will provide additional long-term benefits.

For the purpose of this discussion, nutrient imbalance will be expressed as a ratio of inputs to managed outputs. A ratio of 3-to-1 suggests that for every 3 pounds of nutrient entering a farm, 1 pound leaves as a managed product and the remaining 2 pounds are lost to the environment or accumulate in soil.

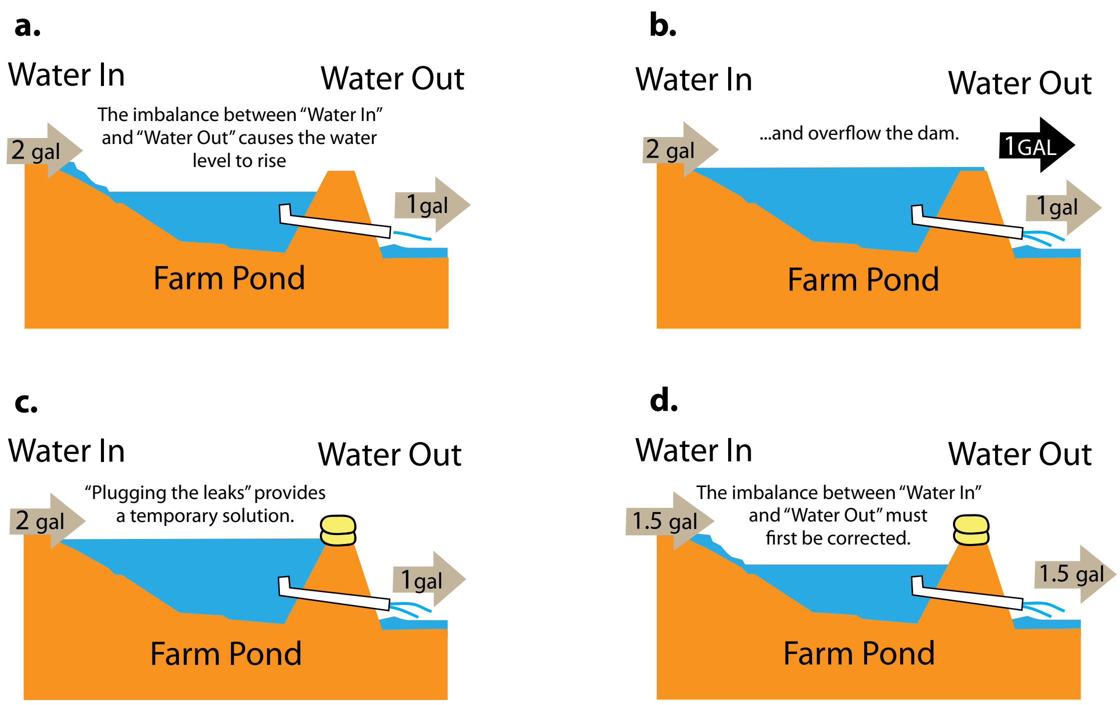



**Figure 2. A farm pond as a sustainability tool.**

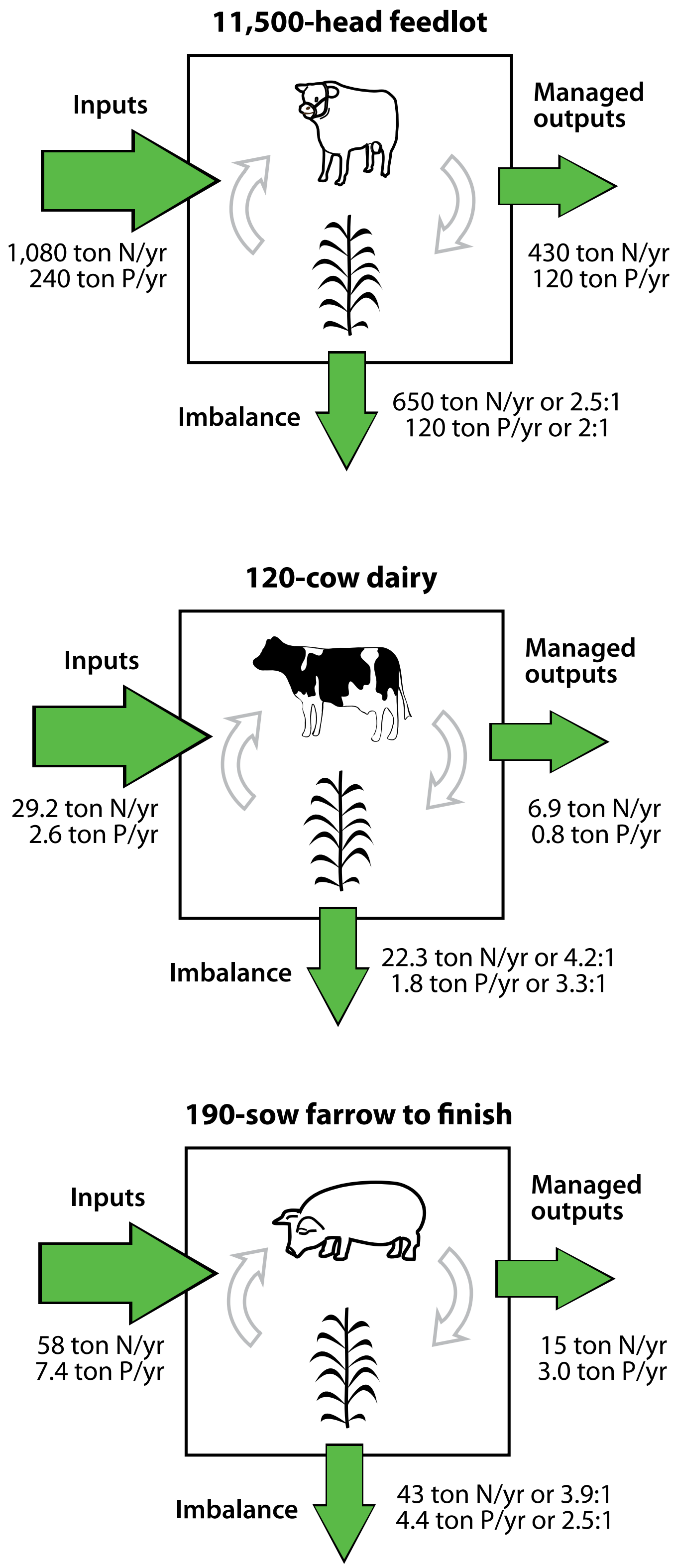



**Figure 3. Typical nutrient imbalance observed for several different livestock systems.**

# Typical Nutrient Balances

The nutrient balance is illustrated for a feedlot, dairy, and swine operation in Figure 3. For this feedlot, the input to output ratio was 2.5-to-1 for nitrogen (imbalance of 650 tons/year) and 2-to-1 for phosphorus (imbalance of 120 tons/year). The magnitude of the imbalance is smaller for the dairy and swine operation. But the ratio of inputs to outputs ranges from 2.5-to-1 to more than 4-to-1. Input-to-output ratios of 2-to-1 up to 4-to-1 are common for many poultry operations.

An 80,000-bird broiler farm in Louisiana annually imports feed representing approximately 87 tons of nitrogen and 22 tons on phosphorus onto the farm (Figure 4). Harvested broilers account for 32 tons of nitrogen and 6 tons of phosphorus. Without shipping manure off the farm, the input-to-output ratio is 2.7-to-1 for nitrogen and 3.3-to-1 for phosphorus. Exporting cake and litter off the farm will greatly reduce these ratios and will increase the long-term sustainability of the farm.

Size generally is a poor indicator of the nutrient imbalance in poultry operations. A review of the whole farm nutrient balance for 33 Nebraska swine confinements and beef feedlots did not observe a trend between an increasing imbalance and larger operations (Figure 5). Many of the operations involved in this study experienced a phosphorus balance near the ideal 1-to-1 ratio, while some exceeded ratios of 4-to-1. Several of the worst imbalances were observed for operations with less than 1,000 animal units.

A phosphorus balance provides a preferred indicator of the risk to water quality. An imbalance in nitrogen does not distinguish between the relatively benign losses (for example, , denitrification of nitrate to nitrogen gas) and the relatively harmful environmental losses (for example, nitrate loss to water or ammonia volatilization). In contrast, phosphorus losses affect water quality through increased soil phosphorus levels and greater concentration of phosphorus in surface runoff water.

Farms with a phosphorus input-to-output ratio near 1-to-1 ("low risk" group in Figure 5) have the potential to be environmentally sustainable. Since soil is the primary reservoir for phosphorus, average soil phosphorus should not increase for an input-to-output ratio near 1-to-1. If litter is managed appropriately within the available land base, the nutrient-related water quality risk should not increase.

Poultry operations with a large imbalance (1.5-to-1 and greater) can expect steadily increasing soil phosphorus levels. Runoff and erosion from lands of these operations carry an increasing phosphorus load as soil phosphorus levels increase. Measures to reduce runoff and erosion will partially reduce this risk and provide temporary solutions. But eventually the phosphorus imbalance must

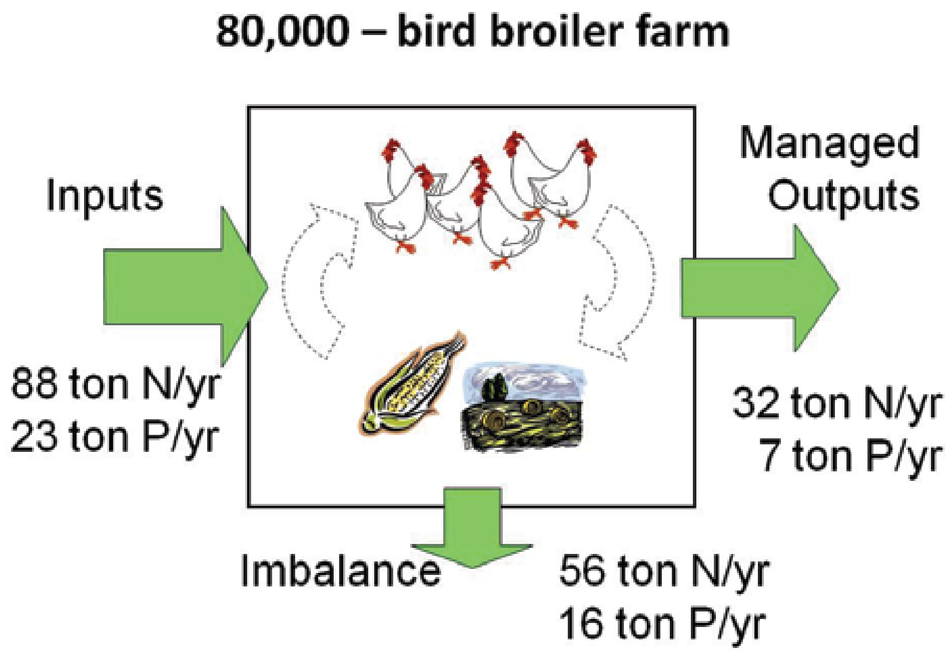



**Figure 4. Nutrient balance for an 80,000—bird broiler farm.**

be corrected before this growing pollution potential will stabilize. These "high risk" operations are not environmentally sustainable.

Best management practices also are important to a successful comprehensive nutrient management plan and help manage the imbalances on poultry farms. BMPs, such as soil testing and litter analysis, help you select the right nutrient rate and application strategy so that crops use nutrients efficiently. This not only reduces nutrient losses and protects the environment but also increases farm profitability. BMPs may include managing the farm to reduce soil erosion and improve soil tilth through conservation tillage, planting cover crops to use excess nutrients or using filter strips and buffers to protect water quality. Preventive maintenance, record keeping and emergency response plans also must be included in a comprehensive nutrient management plan for poultry farms.

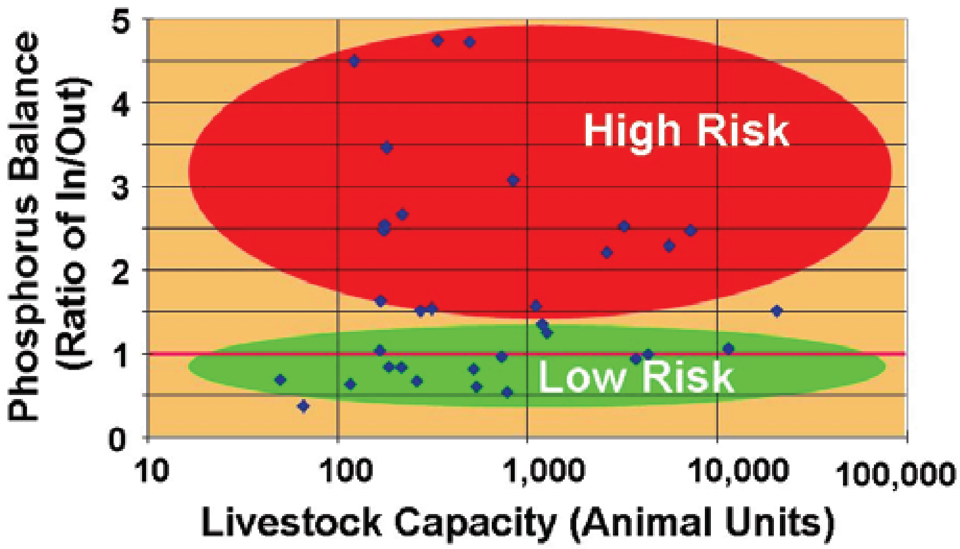



**Figure 5. Phosphorus balance versus size for 33 Nebraska livestock operations.**

# Importance of BMPs to Reduce Losses

By implementing or using best management practices (BMPs), Louisiana poultry producers are minimizing pollution of water resources of the state, as well as saving money in some cases. **Sediment** runoff reduction is one of the most important practices a producer can strive for, both from economic and environmental perspectives. Sediment is the largest pollutant by volume of surface water in the nation. Sediment pollution comes from several sources including agricultural operations that leave bare soil exposed to rainfall.

From an economic perspective, allowing nutrient-laden soil to run off the farm and into rivers and streams is a financial loss to the operation. Soil lost in this manner from land where poultry litter was applied can never be used again to produce forage or grazing pastures to support production. Retaining as much soil as possible can reduce the amount of fertilizers and other soil amendments needed to maintain adequate forage and grazing acreage.

Negative environmental effects that are increasingly noticed and can cause much concern to the public and environmental regulatory agencies include increases in the turbidity of water, thereby reducing light penetration, impairment of photosynthesis and the altering of oxygen relationships that can reduce the available food supply for certain aquatic organisms. It can adversely affect fish populations in areas where sediment deposits cover spawning beds and also partially fill lakes and reservoirs in some situations if given a long enough period of time.

In addition, sediment is often rich in organic matter. Nutrients such as nitrogen and phosphorus and certain pesticides may enter streams with sediment. The potentially harmful effects of these substances accompanying the sediment may include rapid algae growth, oxygen depletion as organic matter and algae decompose, fish kills from oxygen depletion, toxic effects of pesticides on aquatic life and unsafe drinking water caused by nitrate or pesticide content.

**Manure** runoff reduction is of paramount importance to poultry growers. They should practice all cost-effective methods to ensure litter is handled and treated properly. One of the greatest concerns of the regulatory agencies and the public is the escape of manure runoff and the accompanying bacteria and nutrients that can enter the streams and tributaries of Louisiana's surface waters. Many of the water bodies in Louisiana that are listed as impaired and require attention by the U.S. Environmental Protection Agency and the Louisiana Department of Environmental Quality are polluted with fecal coliform bacteria and do not meet their designated standards for swimming, water contact or fishing. Not all of this pollution can be attributed to poultry operations or other agricultural operations, but in the public's mind, poultry is always at least part of the

source. Fecal coliform is a term used to describe bacteria found in the intestinal tract of warm-blooded animals. Surface waters are monitored for the presence and concentration of fecal coliforms. Not all coliforms are harmful to human health. Some fecal coliforms are normal and essential for human digestion. Without them, our digestive system would not function properly.

If fecal material is present in stream segments in excessive concentrations, experts with the Louisiana Department of Health and Hospitals believe there is the potential for other harmful pathogens to also be present. Some forms of coliforms, such as a few strains of E. Coli, can be transmitted from livestock or poultry to humans or from person to person and may be harmful to human health. When excessive concentrations of fecal coliforms are found in monitored rivers and streams, the Department of Health and Hospitals may issue advisories or closures of affected surface waters. In addition, manure runoff also contains nitrogen and phosphorus and can result in nutrient over-enrichment of water bodies, which can cause algae blooms and oxygen depletion in surface waters – resulting in fish and other aquatic animal kills.

**Nutrient** management is another profoundly important aspect of a poultry operation, and much attention is given to this aspect of poultry management in this manual. Excessive nutrient runoff can cost the farm significant amounts of money. Often, without a sound comprehensive nutrient management plan, poultry producers may apply too much of these essential elements. When this occurs, it's just money down the river. Excessive nutrients cost the operation money and ultimately run off the farm and pose environmental problems in nearby surface waters.

Nutrients such as nitrogen and phosphorus can become pollutants. Both are essential for all plant growth and therefore essential for the proper function of ecosystems and necessary for all agricultural operations. Excessive nitrogen and phosphorus concentrations in water can accelerate algae and plant growth in streams and lakes, however, resulting in oxygen depletion or critically low dissolved oxygen levels. Often referred to as nutrient over-enrichment or hypoxia, it is a major concern in many water bodies of Louisiana and the Gulf of Mexico.

# Litter Management

## House management to improve litter quality

Poultry houses need to be managed in a way that will minimize litter moisture and improve litter quality. Litter storage conditions (prior to use), bird nutrition, environmental conditions (humidity and condensation), and equipment (drinkers, foggers and evaporative cooling pads) in houses all can contribute to problems with litter moisture – if not managed properly.

Litter quality is important to achieve optimum bird performance. Wet litter will increase the incidence of breast blisters, skin burns, scabs, bruising, condemnations and downgrades. Wet litter promotes the growth of pathogens. Furthermore, wet litter is the primary cause of ammonia emissions from litter. Chickens are sensitive to ammonia, and ammonia can cause blindness, decreased growth rate, reduced feed conversion rate and condemnations.

To keep litter dry, circulation fans should be used to move air within the house while moving warm air off of the ceiling and down to the floor. When air inlets are used, proper static pressure and air velocity should be maintained to promote a good mixing of air and to keep cold air from going to the floor when it enters the house. In addition, heating and ventilating a house will remove moisture, since warmed air holds moisture and can be ventilated from a house.

The management of watering systems is critical in maintaining good litter quality. Watering systems need to be checked often for leaks, and drinker height and water pressure need to be adjusted according to bird growth. When leaks or wet spots occur in the litter, the wet litter needs to be removed and replaced with dry bedding. Between flocks, caked litter should be removed to get excessive moisture out of the house. Growers also should make sure seepage is not an issue in poultry houses. The grading and drainage around houses should not allow stormwater to enter houses.

## Re-using Poultry Litter

Re-using litter can be beneficial and economical, if managed properly, and has become a standard in the poultry industry. As poultry litter is re-used, there is less to dispose of or apply to the land over a specified period of time. Thus, the chance of nutrient or pathogen contamination to waterways is reduced, which benefits the environment. In addition, it means poultry growers can reduce their operating costs by not having to handle and dispose of litter after each flock. The availability of bedding also has become an issue for poultry growers. Therefore, re-using litter has benefits to production and costs.

In-house pasteurization/composting of litter between flocks of broilers has become a popular management practice in the broiler industry. Pasteurizing (composting) broiler litter between flocks is a good management procedure to reduce microbial load in broiler houses, to extend the life of the litter and to allow clean-out to extend to times when it is favorable for the grower or market. Through in-house pasteurization, bird performance is improved, and the chance of spreading disease is decreased. Bacterial and viral loads in litter can be reduced by in-house composting of the litter. In-house pasteurization of broiler litter provides a means for poultry producers to confidently re-use litter from previous flocks. Broiler litter that has undergone in-house pasteurization has reduced pathogen content and reduced moisture content. It appears that the percentage of plant available nutrients decrease in the built-up litter over time.

In times when disease challenges may be present, in-house composting can reduce the risk of spreading disease to the next flock and reduce the risk of spreading disease when litter is removed from the house. When the loads of harmful bacteria and viruses are reduced, birds can grow and perform better since they will not have to fight disease challenges (some of these may be mild or unseen).

**Procedures:** After flocks of broilers are harvested, remove the caked litter, pressure wash the interior of the houses to remove excessive dust buildup and form two litter windrows in each poultry house (a tractor with an extended width blade can be used). The windrows should run the full length of the houses. The litter should remain in the windrows for seven to 10 days before being redistributed over the floor of the houses.

In field trials conducted by LSU AgCenter specialists, the windrows were approximately 2 feet high and 4 feet wide. Windrows should be at least 2 to 3 feet high. If there is not enough litter in the house to make two windrows, one windrow can be used.

If litter is very dry, the cake can be left in the litter. The windrowing procedure can work with litter moisture in the lower 30 percent range.

**Results:** When managed properly, windrowed litter will reach 131 degrees F (the temperature necessary to kill most pathogens) within one day of windrowing and will remain at that temperature for several days. It is important to keep the litter in windrows for a longer period of time to help ensure that as much of the windrow as possible reaches 131 degrees F.

LSU AgCenter field trials have shown an average reduction in litter moisture of 9 percent as a result of the windrowing/pasteurization process. Also, the pasteurization process reduced total anaerobic microorganism populations by more than 78 percent.

# Manure Storage

Manure storage is critical since it affects both the quantity and quality of nutrients that will need to be land applied or exported from the farm. The storage structures and design capacities need to be identified as part of a comprehensive nutrient management plan. These structures also need to be managed to prevent nutrient losses and to protect water quality.

At the time a litter/manure clean-out operation is conducted, the litter/manure often is required to be placed in storage. Although litter storage does present an additional expense, it is a useful tool in a comprehensive litter/manure management plan. Litter/manure storage facilities can be divided into two basic categories: temporary structures and permanent structures. It is desirable to have a permanent structure for litter/manure storage. Whether the structure is temporary or permanent, the site of the facility is important.

The following general guidelines should be implemented in selecting a site and the construction of a litter storage facility:

- Select a site with easy access and terrain that keeps site grading to a minimum.
- A 100-foot buffer strip should be maintained from wet areas, drainage ditches, streams, rivers, ponds, lakes or other surface water bodies.
- Permanent structures should have a base or floor of concrete or impermeable clay.
- Permanent structures should be designed in accordance with the USDA NRCS guidelines or the equivalent
- Temporary storage should be covered with plastic or similar material to prevent runoff.

Litter stored for three months or longer should be kept in a permanent storage facility. Litter that is used in a land application program and is applied directly from a poultry production house during a clean-out operation does not need a storage facility but should be handled in an environmentally sound manner.

# Sampling Poultry Litter

Litter sampling is one of the foundations of a sound nutrient management program. Poultry litter testing is an important best management practice and is an essential component of a comprehensive nutrient management plan. Poultry litter testing is necessary to determine the nutrient balance between supply and needs of your farm.

A poultry litter test should be performed before the litter is applied to the land. For application of litter directly from the house to the land, the litter should be sampled before clean-out. Poultry litter stored in piles should be sampled before land application. Since poultry litter tests should be performed as close to the time of litter application as possible, the timing of taking poultry litter samples and conducting poultry litter tests will depend on the time it will take the laboratory to run the test and return the results to you. Your LSU AgCenter county agent can help you determine when you need to have your poultry litter sample analyzed and the results returned to you.

### *In-house Poultry Litter Sampling Using the ZIGZAG METHOD*

Representative poultry litter samples from within a poultry house can be collected by the zigzag method. For this, you will need a clean 5-gallon plastic bucket; a narrow, square-ended spade or soil probe; and a 1-quart, zipper-closing plastic bag.

Procedures:

- Visually divide the house into three sections that run lengthwise of the house.
- In the first section, walk the length of the house in a zigzag pattern(See Figure 1), taking subsamples with the spade from at least 10 random points along your path.
- Take at least 12 subsamples.

The accuracy of poultry litter tests and the value of the results obtained from them are only as good as the samples sent to the lab. Proper collection of poultry litter samples that represent the entire poultry house must be taken to ensure the accuracy and worth of the poultry litter test. Tests performed on poorly taken samples can be misleading.

If you use a soil probe, be sure to include subsamples from litter under feeders and waterers. At each subsampling point, clear a small trench the width of the spade and to the depth of the litter. Remove a 1-inch segment of litter from the top of the litter down to the floor of the house. If you use a soil probe, insert the probe the entire depth of the litter but not into the dirt floor below the litter.

- Place each subsample into the clean 5-gallon plastic bucket.
- Repeat the entire subsample collection process in the other two sections of the house.
- After the subsamples have been collected from all three sections, crumble and mix the litter thoroughly in the bucket – or it may be easier to mix the litter subsamples on a piece of clean plastic or in a clean wheelbarrow.

- After thorough mixing, fill the zippered plastic bag with a sample of the litter.
- Label the sample with the name of the operation, name of the house and the date the sample was taken.
- **Secure a sample submittal form**, fill it out and enclose the proper payment for the requested analyses. See below for suggested analysis.

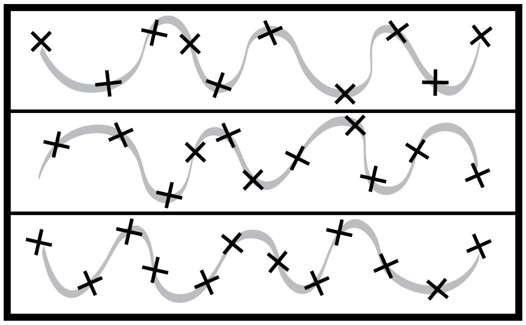



**Figure 1. Sampling using ZIG-ZAG Method**

### *Sampling Poultry Litter in Piles*

Equipment needed:

- Shovel
- Clean 5-gallon plastic bucket
- 1-quart, zipper-closing plastic bag

Procedures:

- Select 10 to 12 widely dispersed points on the pile.
- At each point, remove five shovelfuls of litter and set them aside.
- Mix the five shovelfuls of litter and place one shovelful into the clean bucket.
- Repeat this for all of the 10 to 12 selected points on the pile.
- After collecting samples from each selected point, crumble and mix the samples thoroughly in the bucket.
- Fill the zippered plastic bag with a sample of litter.
- Label the sample with the name of the operation, pile identification and the date the sample was taken.
- Secure a sample submittal form, fill it out and enclose the proper payment for the requested analyses.

The key to sampling litter piles is to collect multiple samples (as described above) at the time the nutrient content of the pile is stable. The nutrient content of the pile should stabilize about two weeks after forming the pile or turning an existing pile.

### *Handling and Testing Poultry Litter Samples*

- Poultry litter samples should be sent to the lab on the same day they are collected.
- If poultry litter samples cannot be sent to the lab on the same day, refrigerate the samples until they can be sent to the lab.
- If samples are mailed, mail them early in the week so they do not sit over the weekend waiting for delivery.
- Do not put the poultry litter samples in a hot spot.

Regardless of the method of sampling, when requesting laboratory tests for each sample, request at least:

- Percent moisture or percent dry matter
- Phosphorous, expressed as percentage of phosphate ($P_2O_5$)
- Potassium, expressed as percentage of potash ($K_2O$)
- Ammonium ($NH_4$) or ammonia ($NH_3$) nitrogen
- Nitrogen, expressed at percentage

Your LSU AgCenter county agent can help you interpret the results of your poultry litter test.

# Mortality Management

Dead broilers from normal mortality alone result in more than 200,000 pounds of carcasses to be disposed of weekly. A satisfactory system for disposal of dead birds and farm animals is necessary for sanitation, disease and odor prevention, as well as for environmental protection. Moreover, the Louisiana Livestock Sanitary Board requires that poultry producers have an approved method for disposing of dead birds. Poultry carcasses cannot be legally fed to hogs or alligators in Louisiana unless they are first cooked or rendered. A complaint to the Livestock Sanitary Board, the Department of Health and Hospitals (DHH) or the Department of Environmental Quality (DEQ) concerning noncompliance with these regulations will result in an inspection by the enforcement staff and possible fines and/or penalties.

**Louisiana Department of Agriculture and Forestry (LDAF) regulations, specifically LAC 7:11771, state that dead poultry shall be disposed in the following manner:**

- All commercial poultry producers are required to obtain a certification of approval for disposing of dead poultry from the State Veterinarian's Office in the Louisiana Department of Agriculture and Forestry. Failure to obtain a certificate shall be considered a violation of the regulations. Certificates of approval are continuous but subject to review and cancellation should the poultry producer fail to dispose of dead poultry in accordance with the regulations. The LDAF will be responsible for follow-up to ensure that all conditions and requirements are met.

- Dead poultry must be removed from the presence of the live poultry without delay. The carcasses, parts of carcasses and offal must be held in covered containment until disposal is made by one of the approved methods. In no instance, however, will the storage of dead poultry be allowed to create sanitary problems.

**Commercial poultry producers shall be required to dispose of dead poultry by one of the following methods:**

## Composting

The design, construction and use of compost units must be approved by an authorized representative of the Livestock Sanitary Board. Design criteria for composting structures shall meet or exceed standards and specifications for composting structures contained in the USDA Natural Resources Conservation Service Field Office Technical Guide. Composting of dead poultry and litter will be completed in accordance with management practices contained in that technical guide.

## Incinerators

Incinerators shall be constructed in a manner and design capable of providing a method of disposal of dead poultry that prevents the spread of diseases. The design and construction must be approved by an authorized representative of the Livestock Sanitary Board and shall meet state and federal air emission standards. Incinerators are subject to LAC33:III.2521 and LAC33:III.2531

discharge regulations. An air emission permit is required from DEQ for all incinerators. Prior to placing an incinerator into operation or using an existing incinerator, a permit must be on file with the DEQ Permit Division. For questions about permitting of incinerators, contact Dick Lehr at (225) 765-2723 or Annette Sharp at (225) 765-0288 with the DEQ Small Business Assistance Program.

## Rendering Plant

Dead poultry, parts of carcasses and poultry offal may be transported in covered containers to approved rendering plants. Poultry carcasses may be held on the premises of commercial poultry producers as long as the storage does not create a sanitary problem. All such methods of storage, modes of transportation and location of rendering plants shall be submitted to and approved by an authorized representative of the Livestock Sanitary Board.

## Digesters

Poultry digesters may be used if the following conditions are met:

- The design, construction, location and use of digesters must be approved by an authorized representative of the Livestock Sanitary Board.
- The bacteria being used in the digester must be approved by an authorized representative of the Livestock Sanitary Board.
- The digester must be maintained according to recommendations of an authorized representative of the Livestock Sanitary Board.

For more information about the disposal of dead poultry, contact the LDAF's Livestock Sanitary Board.

## Management

From a management standpoint, the disposal method needs to meet several criteria. It should be convenient, sanitary, economical, practical, legal and socially acceptable. Place tightly covered containers for carcass accumulation at the entrance of each production house. Dead animals and birds should be removed from production facilities at least once each day, preferably more frequently, especially when disease conditions are present and/or temperatures are high. Empty these containers into disposal facilities at least every 24 hours to prevent dead birds from becoming a problem.

Improper methods of disposal include dumping carcasses in the woods or a creek or feeding them to other livestock on the farm. These unacceptable practices cannot be permitted and are illegal.

Modern farm businessmen recognize the importance of having a sanitary means for disposal of dead birds and animals. They know convenient, sanitary and fast disposal is imperative if they are to prevent diseases from spreading. Good waste management practices are essential if the poultry industry is to grow and thrive under today's environmental conditions.

Properly used poultry wastes are a resource with minimal environmental effects. Improperly handled or used poultry wastes can degrade the environment, spread diseases and damage the favorable image developed by poultry producers.

## Incineration

Incineration of dead birds and animals may be the quickest and most sanitary method of disposal. Wastes can be disposed of as fast as they accumulate, and the resulting stabilized residue does not attract scavengers or insects. Commercial units are available with oil or gas burners and usually are equipped with automatic timers. Barrels, stoves or homemade incinerators seldom meet air pollution control standards.

Incineration may be a problem with larger animals, depending on the size and availability of DEQ-approved incinerators.

Management recommendations include:

- Purchase only approved incinerators.
- Locate incinerators downwind from poultry houses and populated areas.
- Remove ashes before each firing to ensure proper performance, reduce maintenance and maximize incinerator life.
- Clean grates, check burner jets and adjust the timer regularly to get a complete burn.
- Protect the unit from the weather when it's not in use, particularly if it's mobile, or construct a simple open metal structure over it to extend its life.
- Maintain a distance of at least 4 feet or provide heat protection between smokestacks and wooden structures or trees because of the intense heat generated.

Incinerator manufacturers specify capacities of their equipment, which usually is stated in pounds per day to be incinerated. Refer to Table I below to determine the incinerator size to meet your specific needs.

When the equipment is properly adjusted and operated, the cost of incineration will vary with weight, moisture content, loading density and fat content. It is important not to overload the incinerator, because this will lead to incomplete incineration of the carcasses. An incinerator can be expected to last from five to seven years.

## Rendering

Growers who live near a rendering plant could use this method. There are only a few rendering plants in Louisiana, and they generally are not available to growers. Some out-of-state firms also pick up carcasses for rendering. Rendering cost is estimated to be from 3.5 to 5 cents per pound. Assuming the plant is reasonably close, this method may be the most cost-effective. Besides the cost of fuel for delivery, there is a risk of picking up disease organisms on the vehicle at or near the plant and transporting them back to the flock. This disease risk is of great concern to the poultry industry.

Central drop-off facilities for rendering are being tried in other states. The central facility approach may have real promise if the disease transmission and sanitation problems can be overcome. Between pickups, dead birds must be secured in a closed area or container to prevent animals such as dogs or coyotes from removing them. Depending on frequency of pickup, they may need to be frozen to prevent decomposition and odors. Researchers and integrators are working to develop systems for the safe storage and transport of poultry carcasses for rendering.

## Digesting

The Louisiana Department of Agriculture and Forestry regulates the construction and operation of digesters in Louisiana through the Livestock Sanitary Board. To use this method of mortality management, a permit is required. Contact the Livestock Sanitary Board for current regulations on the construction and operation of digesters.

## Composting

Composting converts organic matter, such as dry poultry waste or dead chickens, into a more uniform and relatively odorless substance called humus or compost. Active composting is the controlled version of natural decay. By creating the right conditions, organic breakdown is accelerated, producing high temperatures that kill pathogens. It is receiving increased attention as more people search for less expensive alternatives to solid waste management.

**Table I.**
**Expected Disposal Requirements For Poultry Flocks**

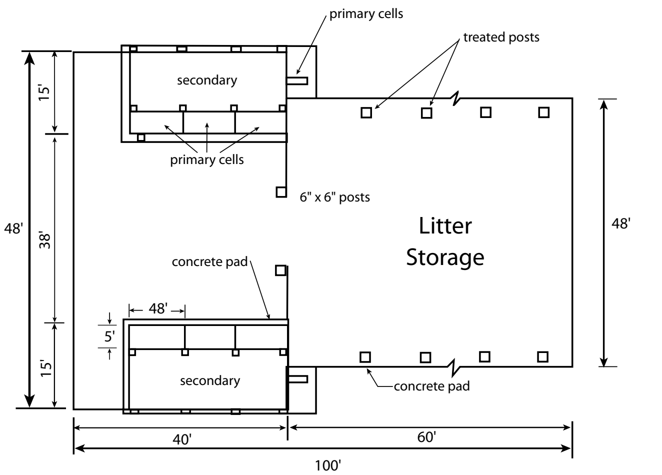
| Type of Poultry | Average Mortality Rate | Carcass Weight (Pounds) | Flock Size for 100 pounds/day |
|---|---|---|---|
| Egg Production-type Layers | 1% per month | 3-3.5 | 100,000 |
| Egg Production-type Breeders | 1% per month | 3-3.5 | 100,000 |
| Broilers | 3% per cycle | 1 | 200,000 |
| Broiler Breeders | 1% per month 3-3.5 | 6 | 50,000 |

Composting is a natural process in which beneficial microorganisms (bacteria and fungi) reduce and transform or change organic wastes into a useful end product — compost. Composting is considered an aerobic (oxygen-requiring) process. It normally will reduce the volume by 50 percent or more.

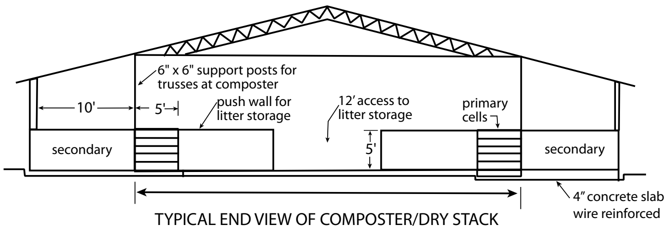
Dead poultry management is one example of an appropriate use of composting for preparation of a waste material for land application. The universities of Maryland and Delaware have been conducting research on dead bird composting since 1987. Their studies have shown that properly constructed and operated two-stage composters can destroy both heat-resistant and heat-sensitive poultry pathogens in less than two weeks. They have assisted in the construction and operation of dead bird composters on broiler farms in Delaware, Maryland and Virginia without disease or performance problems. Other states such as Alabama, Arkansas and Mississippi have had good results with composting. Louisiana has recommended and approved composting of dead birds since 1994.

In dead bird composting operations, a prescribed mixture of dead chickens, manure, litter, straw, hay or rice hulls and water provide the necessary ingredients for speeding the process and changing the mixture to compost. The key factors for successful aerobic composting are a proper carbon to nitrogen ratio (about 23-to-1), the proper moisture content (about 55 percent) and an adequate supply of oxygen for the bacteria. Acceptable carbon to nitrogen ratios (C to N) are between 15-to-1 and 35-to-1. Acceptable moisture content ranges are between 40 percent and 60 percent. The carbon source may be rice hulls, wood shavings, straw, litter or similar material.

The microorganisms in the composting process are heat-generating. They may cause the temperature of the mixture to rise as high as 170 degrees F. Typical temperatures are between 140 and 160 degrees F. Temperatures higher than 160 degrees F pose the risk of fire and should be avoided by turning the compost pile. The producer




FLOOR PLAN




TYPICAL END VIEW OF COMPOSTER/DRY STACK
LEFT ELEVATION

should monitor the temperature daily to make sure the composting process is proceeding properly.

The nitrogen content and the crude protein value of the material can be reduced as much as 40 percent through composting. This can be an advantage if the owner has a limited land area for spreading wastes and needs a way to reduce nitrogen application rates.

Composting reduces the weight, volume and moisture content of the original material. If the material is properly managed during the composting process, the final product will be a rich, uniform mixture suitable for pasture/field application or use in gardening and nurseries.

Composter size is based on broiler farm capacity, overall bird size at the end of the production cycle and mortality. The USDA NRCS has recommended design specifications for dead bird composters.

A simple mixture of straw or hay, dead chickens, poultry litter, water and oxygen will produce the beneficial bacteria and fungi needed to convert these materials into an inoffensive, useful compost. Odors and insects have not been a problem in research studies when composters are properly operated. Tests on certain pathogens (such as E. coli) and on Gumboro and New Castle disease viruses prove that these pathogens do not survive the pasteurizing effects of composting. Once the weight and volume relationships of one day's dead poultry are determined, the other elements can be weighed according to the formula in Table 2. Weigh the elements in buckets on scales the first day. On subsequent days, a loader can be used once the weight of a full loader/bucket is determined for each element except water. One gallon of water weighs about 8 pounds. Or use a hose to deliver the correct amount of water based on a percolation test (the time necessary to deliver the required gallons through the hose). Some growers in Mississippi have found that no additional water is needed when litter is wet.

**Table 2.**
**Formula for dead poultry composting**

| Materials | Parts by weight |
|---|---|
| Poultry carcasses | 1.0 |
| chicken manure, litter cake | 1.2 |
| straw (hay) or litter | 0.1 |
| Water (add sparingly | 0.75 |

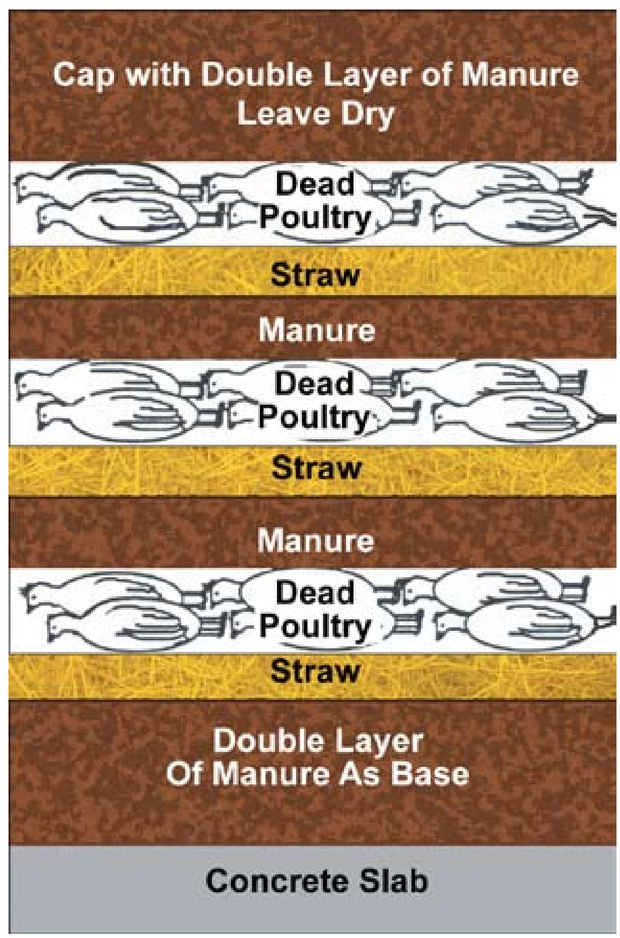



**Figure 1. Dead poultry composter bin layering**

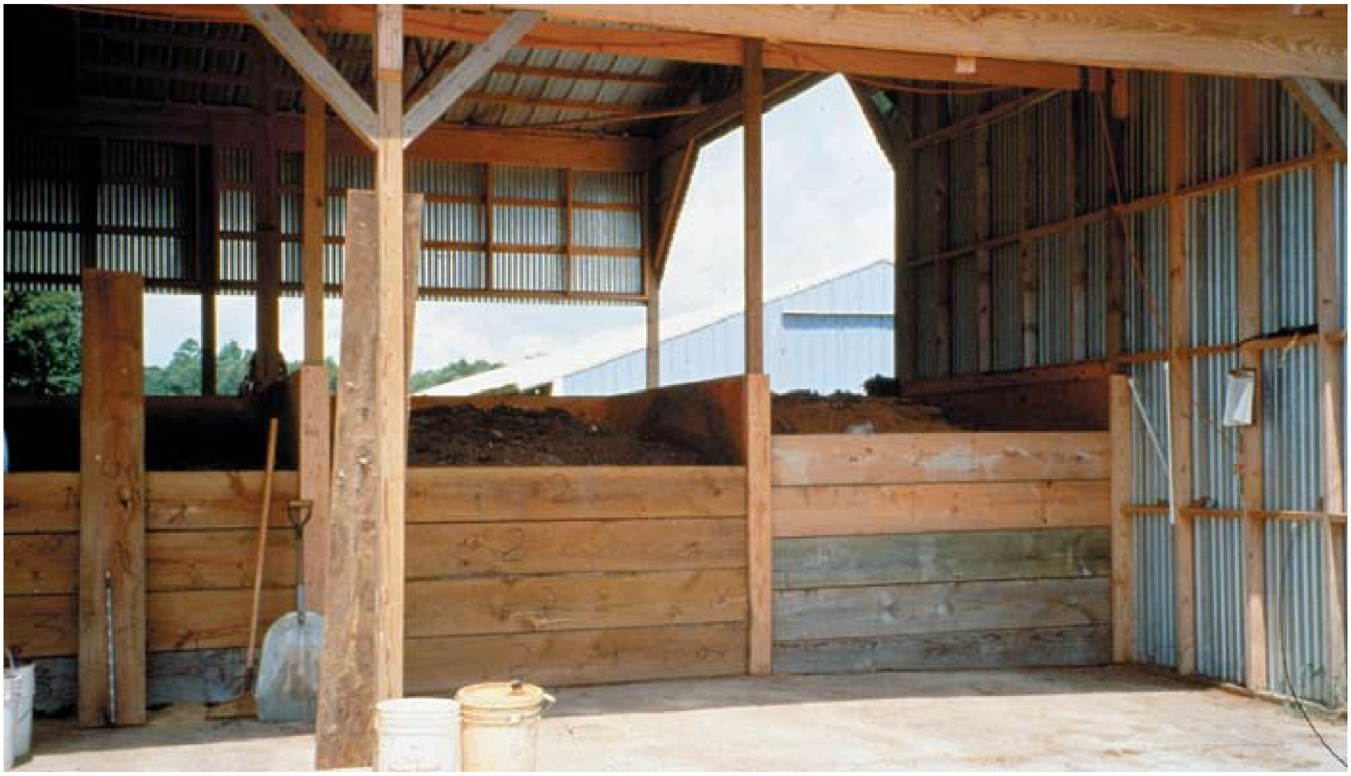
| Table 3.<br>Number of first stage composter bins required based on number of broilers on hand (NRCS Specifications). | | | |
|---|---|---|---|
| **Farm capacity** | **Required cubic feet for first stage bins** | **No. of first stage bins (5' x 6' x 8')** | **Required cubic feet for second stage bins** |
| 20,000 | 480 | 2 | 480 |
| 40,000 | 720 | 3 | 720 |
| 60,000 | 960 | 4 | 960 |
| 80,000 | 1200 | 5 | 1200 |
| 100,000 | 1440 | 6 | 1440 |
| 120,000 | 1680 | 7 | 1680 |

The mixture is placed in a primary bin in layers. A 1-foot layer of manure cake (litter) is first placed on the concrete floor of the bin. Then a 6-inch layer of straw/hay is added to aid in aeration and to provide a source of carbon. After these two layers, ingredients are added according to the formula, beginning with a layer of carcasses, a layer of litter, a layer of straw and then water (typically 1 pound of water to 2 pounds of carcasses). This completes one batch. The second and all subsequent batches begin with a layer of carcasses, litter, straw and water, in that order. After the last batch is added, the final cover cap is a double layer of litter. Do not add water to this final cap. A small amount of fly bait may be added to each layer daily if flies become a problem. See Figure 1 for details on layering the ingredients.

During the composting process, the volume of the mass will reduce 25 percent to 30 percent, enabling the operator to add more material to the top of the bin.

Ideally, the composter will be a size such that the average day's mortality will equal one layer of dead chickens in the primary bin. Each subsequent day, layer the dead chickens and the other elements in the bin (manure, chickens, straw; manure, chickens, straw. See Figure 1). If the bin is too large to make a full layer in one day (when chicks are young, for example), a half or quarter layer can be formed, using extra litter to cover the exposed edge of the partial layer. Use only one layer of dead birds (over 1/2 pound per carcass) per layer.

Monitor the temperature in the compost pile with a 36-inch, metal-probe thermometer. The pile should reach 140 to 160 degrees F within a day or so, which pasteurizes the compost. After a week or so, when the temperature starts to drop, move the material to the second-stage bin or secondary alley for aeration and reheating. A skid loader both mixes and aerates the compost as additional compost from primary bins is added to the older compost



in the secondary bin or alley. The temperature in the secondary bin will start to rise as beneficial bacterial activity begins and will peak in five to 10 days. Monitor the temperature in the secondary stage just as in the primary stage. Be sure to check the moisture content of the pile if temperatures fail to rise.

The final step is to store the pasteurized compost. Poultry carcass compost should be allowed to cure for approximately 30 days before applying to land. After removal from the secondary composting bin, stack or pile the compost no more than 7 feet high in a dry stack facility or pole barn or under a waterproof cover, and do not allow the compost to come into contact with any fresh manure, litter or drainage water. Curing allows further drying and aerobic decomposition. As a result, the pH of finished compost generally is around neutral, the carbon-to-nitrogen ratio decreases, the cation exchange capacity increases, the concentration of humus increases and nitrate-nitrogen formation takes place. The pile also is re-colonized by soil microorganisms. This gives the compost some disease-suppressing qualities. Curing may be considered complete when the pile temperature falls to near the temperature of surrounding air. At the appropriate time during the growing season, apply compost directly to the land. Work it into the soil, using the same guidelines as those for applying poultry manure.

Loading and managing a composter sized for a broiler farm with a 100,000- to 130,000-bird capacity takes about 20 minutes a day over and above the time necessary to pick up the dead chickens.

Composter design can vary considerably and still perform well, but experience teaches that all good composters have certain common features:

**Roof**: Although some materials may be composted in the open, this does not work well with dead bird composting. A roof ensures year-round operation and controls rainwater and percolation, which can be major problems. Stormwater regulations will probably require roofs in the future.

**Foundation:** An impervious, weight-bearing foundation (preferably concrete) is critical to all-weather operation, because the bottom of the compost pile may get wet and soggy and cause traction problems for equipment. A concrete foundation secures the composter against rodents, dogs, etc., and reduces contamination of the surrounding area.

**Building Materials:** Specify pressure-treated lumber or other rot-resistant materials because they resist rotting caused by alternative wet-dry cycles and will extend the life of the facility.

**Composter Size:** Capacity of the composter must be sufficient to handle average mortality. The USDA NRCS recommendations for composter size are shown in Table 2.

**Thermometer:** Monitoring the composting temperatures is very important in good management of a composting unit. A 36-inch probe thermometer is effective for monitoring temperature in typical composting bins.

The cost of materials for the composter, including the concrete pad, will range from $1,500 to $5,000 for a 40,000-bird operation. Total cost will depend on composter size, design and the cost of labor to construct the unit. Researchers in Alabama estimate the cost of composting dead birds at 2.1 cents per pound. The estimated useful life of a composting unit is 10 to 15 years. Detailed composter recommendations are available from the local USDA NRCS office, the parish Extension Service office or Soil and Water Conservation District offices.

The nutrient content of the compost will vary, depending on the amount and nutrient content of the manure and litter, the age of the compost and the method of storage. Table 4 shows the average analysis on an "as-sampled basis" for compost samples analyzed by the University of Delaware.

**Table 4. As-sampled moisture and nutrient composition of poultry litter compost.**

| Parameter | Percentage (%) |
|---|---|
| Moisture | 28.0 |
| Nitrogen | |
| Total Nitrogen (TN) | 1.85 |
| Ammonia Nitrogen ($NH_3$) | 0.15 |
| Organic Nitrogen (ON) | 1.70 |
| Total Phosphorus ($P_2O_5$) | 2.29 |
| Potassium ($K_2O$) | 1.56 |

A ton of compost with the above analysis would provide 37 pounds of nitrogen (N), 46 pounds of phosphate ($P_2O_5$) and 31 pounds of potash ($K_2O$). Because of variation in nutrient composition of composts, regular

analyses for nitrogen, phosphorus, potassium, sulfur and micronutrients are desirable.

The value of applying this compost to agricultural land as compared to commercial fertilizer is about $23.40 per ton. This figure is based on 37 pounds of N at 20 cents per pound, 46 pounds of $P_2O_5$ at 24 cents per pound and 31 pounds of $K_2O$ at 16 cents per pound.

As with any organic soil amendment, actual nitrogen availability to plants depends on method of application. If the compost is spread on the surface, most of the ammonia will volatize and pass off as a gas. If incorporated, most of the ammonia will be available for plant use. Phosphorus, potassium and micronutrients will remain for plant use.

Compost may be applied using conventional rear-delivery or side-delivery manure spreaders for covering large acreage. For application of compost as a top dressing, broadcast cyclone-type applicators are used. To obtain maximum uniformity of application and reduce handling problems, compost should contain less than 40 percent moisture.

Land application of compost or any poultry waste, like application of fertilizer, must balance nutrient content with the crop nutrient needs based on regular soil tests and realistic yield goals. The biggest problem is over-application. This is not only wasteful but also can result in excessive levels of salts, nitrogen and phosphorus. Nutrients not taken up by plants can be lost to groundwater by leaching or to surface water through runoff.

To avoid excessive nutrient application, apply compost based on the nitrogen or phosphorus need of the crop and soil test results. Nitrogen in compost is not as readily available as nitrogen in fresh poultry litter, because more is in the organic form and less in the ammonium and urea form. In general, 50 percent to 65 percent of the nitrogen will be available during the growing season in which it is applied. Assume 75 percent of the phosphate and potash is available. The rest will be available in following years.

Apply compost as close to planting as possible for row crops and annual crops, and incorporate with normal soil tillage operations. For perennial summer grass pastures and hayfields (Bermuda grass and Bahia grass), apply in early spring and again in early summer if additional growth is needed. For cool-season perennial grass pastures and hayfields (fescue and ryegrass), make early fall and early spring applications. Contact your LSU AgCenter county agent for current recommendations on application rates.

## Abnormal Death Loss

If a large number of poultry carcasses need to be disposed of because of weather-induced death (heat stress, etc.), flooding or condemnation, normal disposal measures are likely to be inadequate. In the event of the death of more than 1 percent of broilers or 0.5 percent of pullets or breeders over four weeks of age on the same premises within a 24-hour period (the death of which is not known to be caused by a contagious or infectious disease), the dead poultry may be disposed of by on-site burial. The State Veterinarian's Office must be notified immediately by telephone or facsimile if excessive mortality requires on-site burial.

# Litter Application and Runoff Control

## The Value of Litter

Manure is recognized as an excellent source of the plant nutrients nitrogen (N), phosphorus (P) and potassium (K). In addition, manure returns organic matter and other nutrients such as calcium, magnesium and sulfur to the soil, building soil fertility and quality.

A nutrient analysis of your litter and cake is the best way to determine its nutrient content so you can match this with soil test recommendations and determine application rates. Samples should be taken of removed cake, litter and stockpiled litter, since nutrient concentrations will be substantially different in each. Recent samples from Lincoln and Union parishes showed no predictable relationship between the nutrient content of litter and the content of removed cake from the same farms. Lab results will help you determine how much of the nutrients in the manure will be available to your crops. The amount credited to the nutrient budget should be based on plant-available nutrient levels, which may be substantially different from the total nutrient content. Your parish LSU AgCenter Extension Service office has information on manure and litter testing.

The nutrient content of manure will vary depending on animal type and diet, type and amount of bedding, manure moisture content and storage method. Average concentrations can be found in Table 1.

## Selecting Appropriate Application Equipment

The land application of litter is facing growing scrutiny because of potential surface water and groundwater contamination, as well as odor nuisances. As a result, when selecting and operating manure application equipment, producers must consider environmental issues along with materials handling and economic factors (Table 2).

**Manure spreader as a fertilizer applicator.** The fundamental principle underlying both best management practices and future regulatory requirements for manure application will be efficient crop use of applied nutrients. Litter spreaders will need to be managed like any other fertilizer or chemical applicator. Spreaders need to apply manure uniformly, provide a consistent application rate between loads and offer a simple means of calibration. Appropriate equipment selection and careful operator management will contribute to the efficient use of manure nutrients.

**Nitrogen conservation.** The availability of the nitrogen and phosphorus in applied manure is usually out of balance with crop needs. Typically, high soil phosphorus levels result from long-term applications of litter. The ammonium fraction, originally representing roughly half of the potentially available nitrogen, is lost by the long-term, open-lot storage of manure, anaerobic lagoons and the surface spreading of manure. Systems that conserve ammonium nitrogen and provide nutrients more in balance with crop needs increase the manure's economic value.

**Odor nuisances.** Odor nuisances are the primary driving factor behind more restrictive local zoning laws for agriculture. Better management of manure nutrients through increased reliance on manure storage and land application of manure in narrow windows of time may add to or reduce odor complaints due to weather conditions or the location and your relationship with neighbors. Manure application systems that minimize odor, flies and dust deserve consideration and preference when neighbors live near application sites.

**Table 1. Average nutrient content of litter and nitrogen availability factors by production system and handling method.**

| | Total N (TN) | N Availability Factor: Broadcast Application | N Availability Factor: Incorporated Application | Total $P_2O_5$ | Total $K_2O$ |
|---|---|---|---|---|---|
| **Species** | lb/ton | (0.5 * lb TN/ton) | (0.6 * lb TN/ton) | lb/ton | lb/ton |
| Broiler | 72.3 | 36.15 | 43.38 | 78.5 | 45.8 |
| Roaster | 73.3 | 36.65 | 43.98 | 74.8 | 44.9 |
| Breeder | 31.2 | 15.60 | 18.72 | 54.0 | 31.0 |
| Stockpiled litter | 35.6 | 17.80 | 21.36 | 79.6 | 34.5 |

**Table 2. Environmental ratings of litter application equipment.**

| Type of System | Uniformity of Application | Nitrogen Conservation | Odor Nuisances | Soil Compaction | Timeliness of Manure Application |
|---|---|---|---|---|---|
| **Solid System** | | | | | |
| Box spreader, tractor pulled | **poor** | **very poor** | **fair** | **fair** | **poor** |
| Box spreader, truck mounted | **poor** | **very poor** | **fair** | **fair** | **fair** |
| Flail-type spreader | **fair** | **very poor** | **fair** | **fair** | **poor** |
| Side-discharge spreader | **fair** | **very poor** | **fair** | **fair** | **poor** |
| Dump truck | **very poor** | **very poor** | **fair** | **very poor** | **fair** |

**Soil compaction.** Manure spreaders are heavy. In addition, manure often is applied during the late fall and early spring when high soil moisture levels and the potential for soil compaction are common. The effect of manure application on potential soil compaction requires consideration.

**Timeliness of manure nutrient applications.** The ability to move large quantities of manure during short periods of time is critical. Limited opportunities exist for the application of litter to meet crop nutrient needs and minimize nutrient loss. Investments and planning decisions that enhance the farm's capacity to move manure or to store manure in closer proximity to application sites will facilitate the improved timing of manure applications.

# Litter Application Equipment

Litter typically is handled by spinner, box or side-discharge spreaders. Spinner-type spreaders, used to apply dry poultry litter, are similar to the hopper-style spreaders used to apply dry commercial fertilizer or lime. Litter placed in the storage hopper is moved toward an adjustable gate via a chain drive. Litter then falls out of the spreader onto two spinning discs that propel the litter away from the spreader. Uniform application easily can be achieved with spinner spreaders by either varying the spinner speed or angle.

Box-type spreaders range in size from under 3 tons (100 cubic feet) to 20 tons (725 cubic feet). Box spreaders provide either a feed apron or a moving gate for delivering manure to the rear of the spreader. A spreader mechanism at the rear of the spreader (paddles, flails or augers) distributes the manure. Both truck-mounted and tractor-towed spreaders are common.

Flail-type spreaders provide an alternative for handling drier manure. They have a partially open top tank with chain flails for throwing manure out the spreader's side. Flail units have the capability of handling a wider range of manure moisture levels – ranging from dry to thick slurries. Side-discharge spreaders are open-top spreaders that use augers within the hopper to move wet manure toward a discharge gate. Manure is then discharged from the spreader by either a rotating paddle or set of spinning hammers. Side-discharge spreaders provide a uniform application of manure for many types of manure with the exception of dry poultry litter.

Application rates can be adjusted by changing the travel speed and opening or closing the spreader gate. With the growing concern about manure contamination of water and air resources, spreaders must be capable of performing as fertilizer spreaders. Typically, such equipment has been designed as disposal equipment with limited ability to calibrate application rates or maintain consistently uniform application rates. Several considerations specific to solids application equipment are:

- The operator must control the application rate. Feed aprons or moving push gates, hydraulically driven or power takeoff (PTO) powered, affect the application rate. Does the equipment allow the operator to adjust the application rate and return to the same setting with succeeding loads?
- Uniformity of manure application is critical for fertilizer applicators. Variations in application rate are common both perpendicular and parallel to the direction of travel. Uniformity can be checked by laying out several equally sized plastic sheets and weighing the manure falling on each sheet. The variation in net litter weights represents a similar variation in crop-available nutrients.
- Transport speed and box or tank capacity affect timely delivery of manure. Often 50 percent or more of the time spent hauling manure is for transit between the feedlot or animal housing and field. Truck-mounted spreaders can provide substantial time savings over tractor-pulled units for medium- and long-distance hauls. Trucks used for manure application also must be designed to travel in agricultural fields. Available four-wheel drive and dual tires or flotation-type tires should be considered for trucks that will apply manure. Increased box or tank capacities

speed delivery. Spreaders must be selected to move and apply manure quickly.

- Substantial ammonia is lost from solid manure that is not incorporated. Most of the ammonia nitrogen, representing between 20 percent and 65 percent of the total available nitrogen in manure, will be lost if not incorporated within a few days. Practices that encourage the incorporation of manure into the soil on the same day that it is applied will reduce ammonia losses but may increase soil-erosion.

**Table 3. Nitrogen losses during land application. Percentage of total nitrogen lost within 4 days of application.**

| Application Method | Type of Manure | Nitrogen Lost, % |
|---|---|---|
| Broadcast | Solid | 15-30% |
| Broadcast with immediate incorporation | Solid | 1-5% |

Source: Livestock Waste Facilities Handbook, MWPS-18.

# Equipment calibration

You can avoid the potentially adverse effects of over-fertilization on groundwater and surface water by applying only the amount of manure, effluent or wastewater necessary to maintain soil fertility for crop production. The calibration or combination of settings and travel speed needed to uniformly apply litter or manure at a desired rate by manure-spreading equipment is important because it tells you the amount of manure and wastewater that you are applying to an area. Knowledge of the application rate and nutrient concentration of litter nutrients lets you apply at an agronomic rate.

# Why calibrate?

- Verify actual application rates
- Troubleshoot equipment operation
- Determine appropriate overlaps
- Evaluate application uniformity
- Identify "hot spots" or areas of deficient application
- Monitor changes in equipment operation that result from use and "wear and tear"
- Determine changes in manure consistency or "thickness"

Simply put, calibration enables producers to know how much litter they are applying. Knowing the actual application rate allows them to apply manure and nutrients at specific rates that meet the needs of growing crops. If required, calibration also ensures rates do not exceed any state or federal regulatory limits that may exist.

# Controlling runoff

No matter how well you manage your operation; there will be times when runoff occurs. Since all water flows downhill, the total amount of surface runoff going past a given point will increase as you move downhill. As the runoff concentrates in rills and gullies, its erosive force and its ability to transport pollutants will continue to increase. Often, however, structural practices such as terraces, diversions, grassed waterways, sediment basins, subsurface drainage or even farm ponds can be used to control the flow of water and to protect water quality. While these practices often are costly to install, they usually have production and aesthetic benefits in addition to their environmental benefits.

Steep slopes and irregularities on the land's surface contribute to increased flow concentrations and to the formation of rills and gullies. Land smoothing and leveling can be used to improve drainage and reduce erosion by spreading the flow over a larger area. Terraces and diversions can be used on steep or long slopes. Both of these practices are effective because they slow the runoff by encouraging flow across the hillside rather than down the steeper hill slope. A grassed waterway is a natural or constructed channel, usually broad and shallow, planted with perennial grasses to reduce the erosion caused by the concentrated flow. These waterways serve as conduits for transporting excess rainfall and diverted runoff from fields or pastures without initiating excessive soil erosion. The vegetation also acts as a filter to remove suspended sediment and some nutrients. Grassed waterways require careful maintenance and periodic reshaping, however, especially after large or intense storms.

Using sediment basins or small farm ponds is one final method of preventing off-farm pollution. A sediment basin is a barrier or dam constructed across a waterway to reduce the velocity of the runoff water, so much of the sediment and associated nutrients settle to the basin bottom. Small sediment basins require regular sediment removal, while larger basins almost appear to be a pond and may support fish and wildlife. A well-placed pond can collect the runoff from a farm and have a positive effect on water quality. It acts as a detention basin by removing sediment and nutrients from the flow and by reducing the volume of flow during storms. If aquatic vegetation or fish are added, it also can filter many nutrients. Finally, the pond can act as a buffer between the farm and the external environment.

# Pasture Management and Establishment

Broilers, cattle and pastures seem to go together. To achieve your goals, however, all of them must have a good start. These steps will help:

1. **Soil Test** – A test is the best guide for correcting soil pH and soil fertility needs. LSU AgCenter Extension Service Offices in every parish have soil sample kits and instructions (or instructions also are online at www.LSUAgCenter.com/soiltest). Soil pH should be between 5.8 and 6.5. Lime reacts slowly with soil and is best applied several months before seeding; therefore, test soil early. Lime applied in the right amount, according to your soil test, can raise the pH level of the soil. That also has the added benefit of allowing the applied fertilizer to be more effective.
2. **Apply Lime and Fertilizer** – Apply according to soil test. If large lime applications are needed, plow some down and disc some in. Disc the fertilizer into the soil after plowing. If using nutrient sources such as manure, apply before plowing or other soil preparation. To start a vigorous crop, correct lime and nutrient needs before seeding. Annual fertilizer applications are required for maintenance. Soil testing is recommended about every two to three years.
3. **Prepare a Good Seedbed** – Most forage seeds and seedlings are small and require a fine, firm seedbed. Finely worked soil allows close seed-to-soil contact for germination, and close root-to-soil contact for early growth. A firm seedbed allows close depth control for shallow seed placement. Loose and cloddy seedbeds waste seed and do not sustain early growth well.
4. **Buy High-Quality Seed** – Use species and varieties that are adapted to the area. Your LSU AgCenter county agent/agricultural agent can supply appropriate information. Avoid shopping for "bargain" seed. The cost difference between bargain and high-quality seed is very small when the entire expense is considered.
5. **Forage Crop Adaptation** – It is extremely important to plant a forage crop only where it is adapted to being grown. Failure to adhere to this concept results in many disappointments each year. Some forage crops that make excellent pastures or hay crops in some parts of the United States simply are not well adapted to Louisiana. Examples include Timothy, Kentucky bluegrass, alfalfa and smooth bromegrass. Adaptation is determined primarily by soil moisture availability throughout the growing season and by temperatures, particularly temperature extremes. Thus, many factors, including soil type, topography and area of the state, greatly influence adaptation.

**Categories of Forage Crops** – More than 40 species of forage crops are commonly grown in Louisiana. Each is normally distinguished as being (1) a grass or a legume, (2) an annual or a perennial and (3) a warm-season or cool-season plant.

**Use the Most-Suitable Species** – Most Louisiana cattle enterprises use a warm-season perennial grass for grazing during the spring and summer months, and then a cool-season winter annual is planted in the fall for grazing during the winter and early spring months. The most common warm-season perennial grasses used are Bermuda grass, Bahia grass and Dallis grass. The most popular winter annual grass used is annual ryegrass. Clovers such as white, crimson and berseem are sometimes planted in combination with annual ryegrass for winter grazing. Clovers are beneficial because they are high in quality, they are able to "fix" their own nitrogen and they can extend the grazing season of cool- and warm-season grasses. Clovers, however, are more site-specific than are most grasses. Individuals may have to experiment with several species of clover to determine which one(s) perform well on their own particular farms or ranches.

## Warm-Season Perennial Grasses to Choose From

**Bermuda grass** can be grown throughout Louisiana and is one of the most widely used forage species in the state. It can be used for hay or pasture. Bermuda grass can be planted with seed or vegetatively propagated. For cattle pasture, it is probably best to plant a seeded variety, such as common Bermuda grass. This grass produces a resilient sod that "heals" well when cut by cattle's hooves. Vegetative varieties such as Alicia, Russell and Jiggs are more suited for hay production.

**Bahia grass** is planted with seed and is adapted to many soil types in Louisiana. Individuals must be patient when attempting to establish Bahia grass because it contains a large percentage of dormant seed that germinate over a period of months. Once established, however, Bahia grass provides a very good sod for grazing. Bahia grass is more adapted to sites of low soil fertility than Bermuda grass is.

**Dallis grass** is an adapted grass that is very productive on alluvial soils and more fertile upland soils in Louisiana. It has good drought tolerance but does not do well on deep, sandy, upland soils of northern Louisiana or soils with low fertility in other areas. It is noted for having good to excellent forage quality. Dallis grass also suffers from ergot problems in the seed head, which can be harmful to cattle. This problem can be controlled in pastures by clipping to remove the seed heads

**Table 1. Suggested seeding rates for pasture grasses and legumes.**

| Species | Growth Type | Pounds / Acre | Seeding Dates |
|---|---|---|---|
| Bermuda grass | Warm-season | 5 | March 1-June 1 |
| Bahia grass | Warm-season | 15 | March 1-June 1 |
| Dallis grass | Warm-season | 5 | March 1-June 1 |
| Annual ryegrass | Cool-season | 30 | Sept. 20-Oct. 15 |
| White clover | Cool-season | 5 | Oct. 1-Nov. 15 |
| Crimson clover | Cool-season | 15 | Oct. 1-Nov. 15 |
| Berseem clover | Cool-season | 20 | Oct. 1-Nov. 15 |

## Cool-season Annual Grasses to Choose From

**Annual ryegrass** is by far the most popular winter annual species for forage. Its high yielding ability, ease of establishment, high forage quality and tendency to form a dense sod make it a good choice. Its peak growth is in the spring, but it has good fall growth if it is planted early and the weather is suitable. Ryegrass can be planted in mid-September on a prepared seedbed, or it can be seeded over the summer sod in mid-October.

**Small grains** include such species as wheat, oats or rye. They must be planted deeper than annual ryegrass and generally do not provide as much forage production as annual ryegrass. Oats can be planted in early September to provide early grazing in the fall.

## Legumes to Choose From

- **White clover** is the most popular clover in Louisiana – more popular than any of the other forage legumes. It is best suited for use as a companion species to annual ryegrass. It is particularly well suited to be grown in pastures because it is quite tolerant of close defoliation.
- **Crimson clover** is an upright-growing annual clover. It produces some fall and winter growth but produces most of its growth in early spring. Crimson clover is a very good re-seeder.
- **Berseem clover** is best suited to be grown on heavy soils. It has an erect growth habit and can be damaged by close, continuous grazing. Berseem clover is classified as a nonbloating clover.
- **Other clovers** that can be grown in Louisiana include arrowleaf clover, red clover, subterranean clover and ball clover. These clovers act as annuals and will need to be seeded every fall.

## Establishment

The establishment process is critical, because mistakes made here will have long-lasting effects. Establishment is not a good time to cut corners or take shortcuts. In some situations where there is little or no competing vegetation, it is possible to use no-tillage drills to establish forage crops. Control or suppression of existing vegetation, planting at the proper depth and controlling harmful insects are keys to successful no-tillage establishment. In many other cases, however, some amount of tillage is used to prepare a good seedbed for establishing the new forage stand. Most forage seeds are small and therefore only need to be planted at a depth of ¼ to ½ inch. Seeds can be broadcast on the top of the soil and then a cultipacker or roller can be used to press the seeds into the soil. Early weed growth can ruin a pasture. Either use herbicides or clip closely as often as needed. If using herbicides, read and follow all label instructions.

## Grazing Management

Cattle graze selectively, often eating one kind of plant and passing over others. This leaves uneaten areas that become unpalatable and that could eventually eliminate the most palatable species. Good management can reduce these problems and make the pasture more useful.

Do NOT begin grazing until there are 3 to 4 inches of growth. The root system must be well established, or cattle will pull the plants out while grazing.

**Delay Early Grazing** – A common cause of pasture failure is grazing too early. This can occur in early life of new pasture or any pasture in early spring. Keep animals out of a pasture until there is at least 3 to 4 inches of growth. Young plants are easily damaged by hooves earlier, and the root systems are not sufficiently developed to prevent the whole plant from being pulled out as cattle graze. Avoid use of the pasture in early spring when soil is soft. Sod will be cut by hooves, and compacting of the soil will cause additional damage. Wait until soil is dry and firm before beginning spring grazing. Better yet, wait for 3 to 4 inches of growth.

**Fertilize Annually** – To keep a pasture productive, fertilize it annually. Again, start with a soil test. LSU AgCenter Extension Service Offices in every parish across Louisiana have soil test kits and instructions. Base fertility applications on test results and retest every two to three years. Lime also may be needed. The soil test will provide this information. Take cattle out of the pasture when liming or fertilizing, and keep them out for several days or until after a rain. The most appropriate times for making these applications are in the spring before grazing begins. In pastures with only grasses, nitrogen can be applied just after a grazing period in a rotational system or in continuously grazed pastures to stimulate growth for the next five to six weeks.

**Manage Grazing** – Many pastures are over-grazed, but few are under-grazed. Either situation is undesirable. Unfortunately, seasonal growth variations also contribute to these problems. Over-grazing probably is the most common problem. As a guideline, it takes about 2 acres of pasture to support each head of cattle for an entire grazing season. Frequently, there are two or more cows on less than 1 acre. The available forage gets "eaten into the ground," and these areas become exercise lots. Not much can be done except to provide more space. Under-grazing results from having too few animals in a pasture. Parts of the pasture are not eaten, and the grass becomes coarse, develops too much tough stem and is wasted. The solution is to force the animals to consume the feed while it is palatable. Confine the animals to a portion of the pasture. Over-graze it for a short time. When the forage is consumed in that area, let the cattle graze the rest of the pasture. This is a good time to clip the first area, spread the manure droppings so they will dry, apply fertilizer and allow the area to recover. This is called rotational grazing and is one of the most efficient ways to manage a pasture. A series of small pastures or paddocks also may be used. In effect, each area is over-grazed for a short time and then allowed several weeks to recover. The last areas to be grazed may need early clipping to keep them palatable. The time for grazing any one paddock is determined by the amount of forage available, the size of the area and the number of cattle.

Figure 1 shows a system for rotational grazing. Put the animals in paddock A and allow them to graze until the forage is consumed to about 1 to 2 inches. Leave the gate to paddock A open so cattle have access to shade and water. Some areas may not be eaten well, particularly around droppings. When Area A is grazed down, move cattle to Area B, repeating the procedure as in Area A. While the cattle are in Area B, clip and fertilize Area A, spread droppings and let Area A recover. When Area B is grazed down, move all cattle to Area C. Continue to rotate the cows from one area to another throughout the grazing season. This system is much more efficient than constantly grazing the entire pasture for a whole season. This system does, however, require more labor and management than a continuous grazing system.

**Clip The Pasture** – Regular clipping is one of the least expensive (but most useful) practices in pasture management. Clipping an entire pasture after a period of grazing removes the unused forage and allows all of the plants to start new palatable growth. Previously under-grazed areas will be grazed after clipping. Many weeds will be controlled, and droppings can be spread to dry. Clip several times during the grazing season.

**Weed Control** – Clipping will help to control weeds that appear in pastures, but it will not remove all weeds. Those that persist in spite of clipping may need to be controlled by using herbicides. LSU AgCenter Extension Service county agents/agricultural agents have information about herbicides to be used in these cases. Remove animals from the pasture when herbicides are used and **keep them out** for the time specified on the herbicide label. Whenever using any pesticide, **read and follow instructions on the label.**

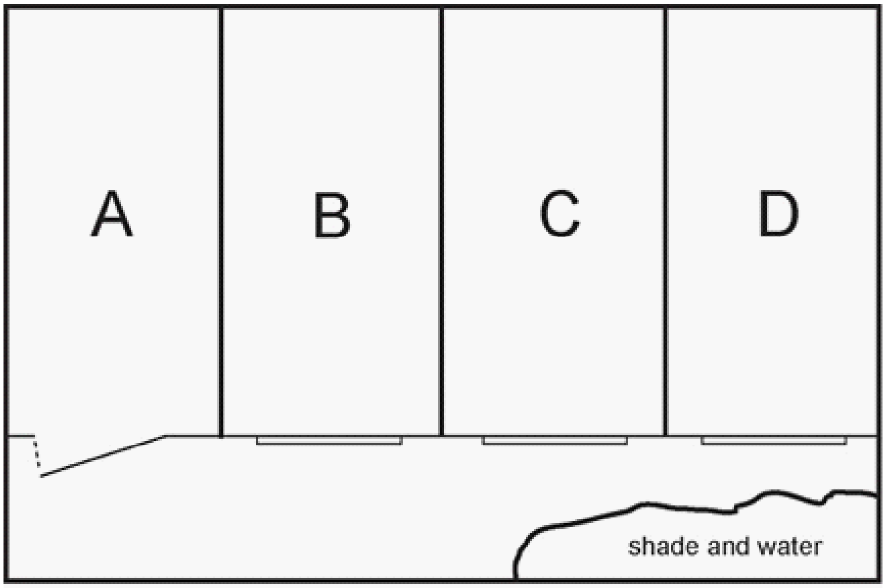



**Figure 1. Rotational grazing system.**

# Soil Testing

Soil testing is critical to the success of any nutrient management plan and can save you money. Testing can help poultry growers who also produce livestock select the right nutrient rate and application strategy so that forage crops or pasture lands use nutrients efficiently. This not only reduces nutrient loss to runoff but increase farm profitability.

Soil testing should be conducted at least every two to three years. County agents with the LSU AgCenter/ Louisiana Cooperative Extension Service can give you advice and assistance on how to take soil samples and where to have them analyzed, as well as help you interpret the results.

Generally, soil testing will be the most successful if you keep this in mind:

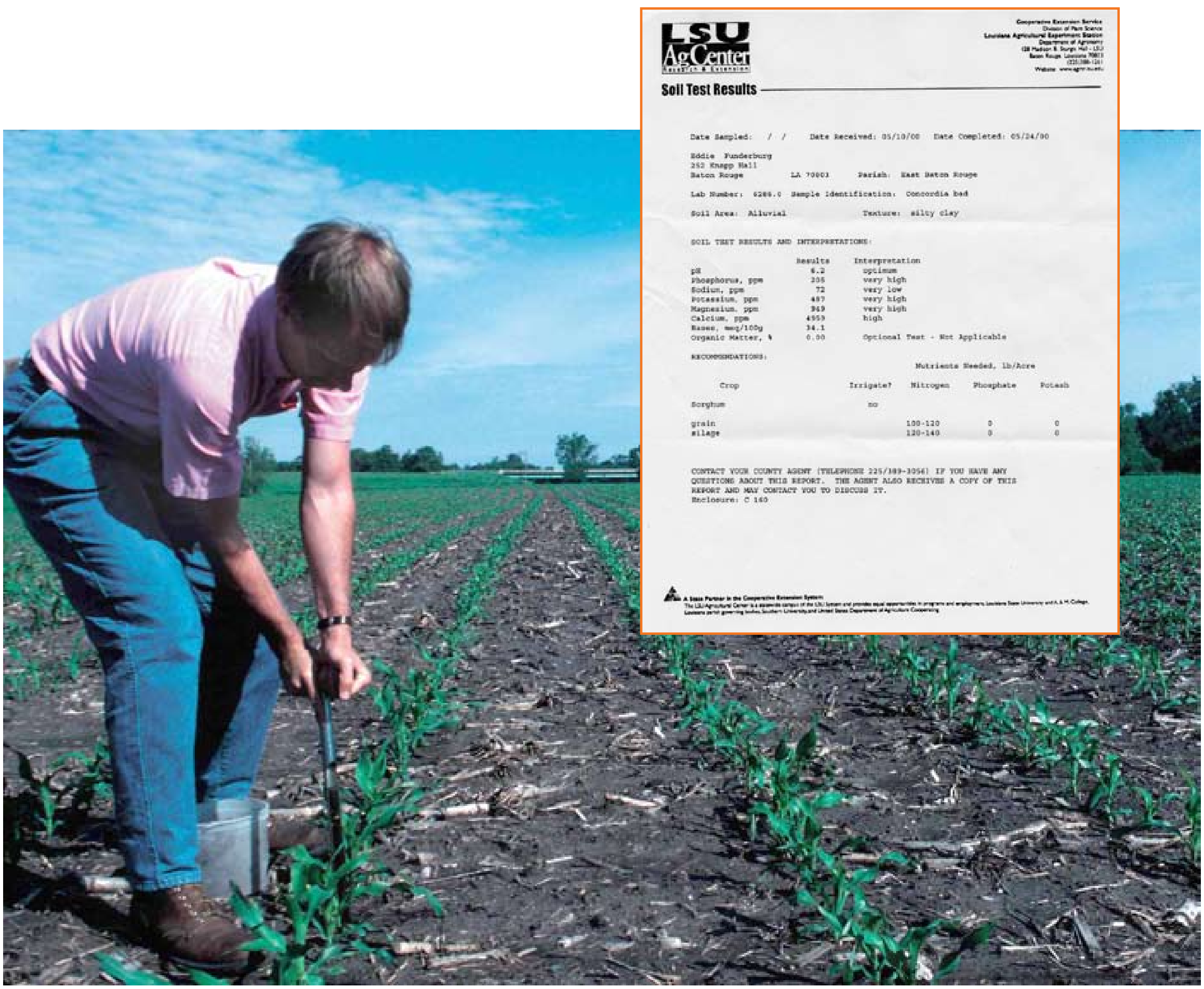
Soils that differ in appearance, crop growth or past treatment should be sampled separately, provided the area is of such size and nature that it can be fertilized separately. For each sample, collect subsamples of soil from 10 or more places in each sampling area in a zigzag fashion to take a truly representative sample.

Mix all random subsamples from one sampling area thoroughly before filling a sampling carton or container to be mailed to the soil testing laboratory. For each sampling area, the lab will need 1 pint of the mixture of all subsamples.

One soil sample should represent 10 acres or less. Avoid sampling directly in the fertilized band.

Proper sampling depth depends on the kind of crop or forage you plan to grow. For pastures, and for minimum tillage, take the top 2-3 inches of soil. For cultivated crops, collect the upper 5-6 inches of soil.

If possible, collect and submit samples three to five months before your projected planting date to ensure you have plenty time to plan your liming and fertilization program for the upcoming season.



Soil Test Results

Date Sampled: / / Date Received: 05/10/00 Date Completed: 05/24/00

Eddie Funderburg
252 Knapp Hall
Baton Rouge LA 70803 Parish: East Baton Rouge

Lab Number: 6286.0 Sample Identification: Concordia bed

Soil Area: Alluvial Texture: silty clay

SOIL TEST RESULTS AND INTERPRETATIONS:

| | Results | Interpretation |
|---|---|---|
| pH | 6.2 | optimum |
| Phosphorus, ppm | 205 | very high |
| Sodium, ppm | 72 | very low |
| Potassium, ppm | 487 | very high |
| Magnesium, ppm | 949 | very high |
| Calcium, ppm | 4959 | high |
| Bases, meq/100g | 34.1 | |
| Organic Matter, % | 0.00 | Optional Test - Not Applicable |

RECOMMENDATIONS:

| Crop | Irrigate? | Nitrogen | Phosphate | Potash |
|---|---|---|---|---|
| | | Nutrients Needed, lb/Acre | | |
| Sorghum | no | | | |
| grain | | 100-120 | 0 | 0 |
| silage | | 120-140 | 0 | 0 |

CONTACT YOUR COUNTY AGENT (TELEPHONE 225/388-3056) IF YOU HAVE ANY QUESTIONS ABOUT THIS REPORT. THE AGENT ALSO RECEIVES A COPY OF THIS REPORT AND MAY CONTACT YOU TO DISCUSS IT.
Enclosure: C 140

# Odor Prevention on Poultry Farms

Odors on poultry farms arise from many different sources. There are more than 160 odorous compounds that have been identified coming from manure. Some of these gases are even said to contribute to global warming and the production of acid rain. There are three primary sources of odor on poultry farms: production houses, manure storage sheds and land application fields.

There are many variables that can cause odor, and they are almost impossible to completely eliminate. A combination of manure, litter, dander, feathers and feed are the cause of the majority of the dust problems in poultry operations. Some larger factors are animal activity, temperature, relative humidity, stocking density and feeding methods. Dust also harbors gases and odors. So dust reduction can significantly reduce problem odors.

## Solid Manure Management

Odors from litter storage barns usually are considered to be less offensive than those from tunnel-ventilated production houses. The liquid is removed from the solid waste and can be stored using two different methods. The two types of systems are stacking and composting. Stacking is for storage only, while composting is treatment and storage. For the litter to break down, it must have the appropriate ratio of carbon, nitrogen and porosity, and the appropriate moisture level. By frequent mixing, noncomposted material is mixed with composted material – increasing the treatment efficiency and reducing the time in which the material is stabilized. Litter needs to be covered when stored. Roofed structures are best to prevent exposure to wind, blown soil and rain.

## Land Application

Typically, more than 50 percent of all odor complaints filed nationwide are a result of applying manure. When the litter is applied to land, it enlarges the surface area and allows a large odor plume to form. One way to solve this dilemma is to rapidly incorporate litter manure into the soil.

## Other Emission Sources

Dead birds have potential to be a source of odor, and their proper disposal is a must. Birds should never be disposed of in ditches, ponds or storage pits. Truck and tractor activity can cause large amounts of dust. Heavily traveled roads should be graveled or watered regularly to keep the dust down.

## What are your options?

***So what can you do if you have an odor problem?*** The following suggestions should not be used as a list of required practices for any or all farms. Any odor control strategies should be made while keeping the farm's production goals, regulatory requirements and nutrient management plan in mind.

- **Clean up your farm.** Clean up those random piles of manure and feed. Easy places to find them are at the end of barns where they're getting scraped, around storage sheds, around mortality composters and near litter that is stockpiled on remote areas of the farm. Any feed that spills should be cleaned up right away. This not only helps reduce odors but also cuts down on flies and dust.
- **Plant a windbreak (NRCS Code 380).** A cost-effective way to reduce odors from barns/houses is to plant a windbreak. Planting a row of evergreens and fast-growing hardwood trees near the structure will break wind flow and dilute smells. Plant trees far enough away so natural ventilation can still occur. They also make the farmstead more attractive.
- **Improve protein utilization.** Managing odors really starts with the feed the birds are eating. Poultry companies know overfeeding protein will result in large amounts of nitrogen in the manure, rather than it being converted into larger birds. If you mix your own feed, have a nutritionist review your rations to look into feed additives that may improve feed efficiency and nitrogen utilization.
- **Incorporate manure.** Incorporate broadcasted litter within 24 hours after spreading to prevent odors. Injecting manure is even better. This prevents gasses in manure from reacting with and escaping to the atmosphere.
- **Watch the dust during applications.** Dust and odor during application can be reduced by eliminating the time litter spends in the air. Calibrate your spreader and reduce the discharge spinner speed to reduce dust production. In addition, litter should not be applied when winds are more than 10 mile per hour.

## A word of caution . . .

It is important to evaluate your farming operation before making any changes on how you handle manure to cut down on odors. Critically evaluate your options. A practice that works on one farm is not guaranteed to be overly successful on another farm – just because of the differences in how you manage your manure and your land application system.

If you unfortunately have a problem, seek the help of technical experts with engineering and poultry management backgrounds who have seen the good and the bad of many manure systems. Work with them and take time and figure out what is going to work the best on your farm. Then design a plan, implement the strategy and monitor its success.

# Buffers and Borders

## Vegetative Buffers Around Poultry Houses

The use of vegetative buffers around poultry houses has become a "hot" topic in the commercial poultry industry. With a trend toward decreasing acres of farmland and increasing concentration of poultry houses per farm, the planting of trees for vegetative buffers makes good sense. These vegetative buffers can be beneficial to poultry producers.

Vegetative buffers can be used to maintain good relations with the neighbors. The "out-of-sight, out-of-mind" principle comes into play. The trees provide a visual screen, pleasing view and attractive landscaped appearance for poultry farms. In addition, the trees can serve as a noise barrier.

Tree and shrub buffers filter odor and dust particles expelled from poultry houses. Vegetation buffers also can absorb ammonia and carbon dioxide, as well as remove dust from the air. Today, researchers are conducting studies to calculate the poultry house emissions absorbed by vegetative buffers.

The roots of these trees and shrubs can filter and capture nutrients from runoff and groundwater. Nutrients are taken up by these plants instead of entering waterways. Thus, vegetative buffers can serve as a proactive environmental stewardship measure.

Furthermore, vegetative buffers may improve biosecurity by trapping airborne poultry diseases from air entering and exiting a farm.

There is even energy saving potential by planting trees around poultry houses (Windbreaks, NRCS Code 380). Strategically placed trees can protect houses from wind, as well as reduce the wind speed around the houses. Also, they can provide some roof shading and cooling of the air around houses.

Plant selection for vegetative buffers is extremely important. Fast-growing trees and shrubs are necessary. Species that do not produce large amounts of seeds and fruits need to be used to minimize the attraction of wild birds. In addition, plants with high leaf surface roughness and area will help to maximize the trapping of dust from the poultry houses.

There are benefits to planting trees around poultry houses. This practice can demonstrate good neighbor relations, reduce odor and dust particles in the air, benefit the environment and possibly reduce energy costs to the producer.

## Field Borders and Filter Strips

Field Borders (Code 386), Filter Strips (Code 393)

Field borders and filter strips are strips of grasses or other close-growing vegetation planted around fields and along drainage ways, streams and other bodies of water. They are designed to reduce sediment, organic material, nutrients and chemicals carried in runoff, as well as provide habitat.

Buffers:

- Protect water resources from nonpoint-source pollutants such as sediment and nutrients.
- Moderate fluctuations in stream temperature.
- Control light quantity and quality in the stream.
- Enhance habitat diversity.
- Stabilize stream banks and modify channel morphology.
- Enhance food webs and species richness.

In a properly designed filter strip, water flows evenly through the strip, slowing the runoff velocity and allowing contaminants to settle from the water. In addition, where filter strips are seeded, fertilizers and herbicides no longer need to be applied next to susceptible water sources. Filter strips also increase wildlife habitat.

Natural riparian buffers (Forested Buffers, NRCS Code 391, and Herbaceous Buffers, NRCS Code 390) are the grasses, trees, shrubs or other vegetation growing along streams. In Louisiana, natural riparian buffers are forested.

Many factors determine the effectiveness of riparian buffers in removing agriculturally derived pollutants. The most important factor, however, is hydrology – how the water moves through or over the buffer.

Sediment and sediment-associated pollutants, such phosphorus, bacteria and some pesticides, move to surface waters almost exclusively by surface runoff. When surface runoff is sufficiently slowed, sediment will settle out. If the runoff water does not spread over the buffer, it will move through the buffer in channels. Channels allow water to move almost as quickly through a buffer as it does from the field, thereby making the buffer ineffective at pollutant removal. Grass buffers should be used in the riparian buffer system because they are more effective than forests in spreading water and removing sediment and sediment-associated pollutants.

Most nitrogen from agricultural fields moves quickly into the soil as nitrate. Nitrate is very mobile in the soil. Any nitrate not used by the crop or the soil organisms continues to move through the soil and into the shallow groundwater below the soil surface. According to research from North Carolina State University, even when farmers follow best management practices, 20 to 40 pounds of nitrogen per acre per year routinely move into the shallow groundwater under agricultural fields.

To remove nitrate from groundwater before it reaches surface water, the groundwater must enter a zone where plant roots are or have been active. These plant roots may either absorb the nitrate for use in plant growth or, more importantly, provide an energy source for bacteria that convert nitrate-nitrogen to harmless nitrogen gas. This process, denitrification, occurs almost exclusively in water-saturated zones where abundant organic matter is present.

Riparian buffers reduce nitrogen under most conditions. Typically, denitrification rates measured in coastal plain forested riparian buffer areas are between 18 to 55 pounds of nitrogen per acre per year. There is little evidence the type of vegetation in the buffers has any influence on the ability of the buffers to reduce nitrogen. Grass buffers are more effective in reducing sediment, whereas tree buffers maintain stream-bank integrity and provide better habitat for macroinvertebrates (stream insects) and fish.

If the buffer is in an upland position or the stream next to the buffer is incised (the stream is very deep relative to the top of the buffer) and if conventional tillage is used in areas with moderate erosion potential, riparian buffers should consist of a 25-foot forested or shrub riparian buffer (from the edge of the stream outward) and enough grass buffer to control erosion (Figure 1). The width of the grass buffer probably will need to be at least 25 feet, but as erosion rates or slope become greater, grass buffers will need to be widened. Accumulated sediment in the grass buffer must be removed or it will fail over time. This maintenance often must also include reseeding.

Soil particles (sediment) settle from runoff water when flow is slowed by passing through a filter strip. The largest particles (sand and silt) settle within the shortest distance. Finer particles (clay) are carried the farthest before settling from runoff water, and they may remain suspended when runoff velocity is high. Farming practices upslope from filter strips affect the ability of strips to filter sediment. Fields with steep slopes or little crop residue will deliver more sediment to filter strips than more gently sloping fields and those with good residue cover. Large amounts of sediment entering the filter strip may overload the filtering capacity of the vegetation, and some may pass on through.

Filter strip effectiveness depends on five factors:

1. The amount of sediment reaching the filter strip. This is influenced by:
   - Type and frequency of tillage in cropland above the filter strip. The more aggressive and frequent tillage is above filter strips, the more likely soil is to erode.
   - Time between tillage and rain. The sooner it rains after a tillage operation, the more likely soil is to erode.
   - Rain intensity and duration. The longer it rains, and thus the more sediment is deposited, the less effective filter strips become as they fill with soil.
   - Steepness and length above the filter strip. Water flows faster down steeper slopes. Filter strips below steep slopes need to be wider to slow water and sediment movement adequately.

In general, a wider, uniformly shaped strip is more effective at stopping or slowing pollutants than a narrow strip. As a field's slope or watershed size increases, wider strips are required for effective filtering. Table 7 gives the suggested filter strip width based on slope. For a more accurate determination of the size of filter strip you will need for your individual fields, consult with someone in your local NRCS or Soil and Water Conservation District office.

**Table 7. Suggested vegetated filter strip widths based on land slope (%).**

| Land Slope, % | Strip Width, Feet |
|---|---|
| 0-5 | 20 |
| 5-6 | 30 |
| 6-9 | 40 |
| 9-13 | 50 |
| 13-18 | 60 |

*Widths are for grass and legume species only and are not intended for shrub and tree species. Adapted from the **NRCS Field Office Technical Guide, 1990**.

Where the majority of sediment and sediment-associated pollutants, such as phosphorus and pesticides, are controlled by no-till cultivation and the buffer is in an upland position or the stream next to the buffer is incised (Figure 2), a 50-foot buffer is needed – either 50 feet of tree buffer or 25 feet of trees next to the stream plus 25 feet of grass buffer. If the stream or ditch is in a low landscape position with hydric soils (very wet soils), then a 25-foot vegetated (trees, grass or shrubs) buffer is considered sufficient to reduce nitrogen, assuming erosion is minimal either because conservation tillage is used or the topography is very flat (Figure 3).

For well-maintained pastures, where the pollutant of concern is nitrogen, a fenced, 25-foot buffer is considered sufficient (Figure 4). Grass buffers can be used if the stream bank is stable. Otherwise, a tree buffer should be used. It is necessary to fence cattle out of streams to reduce stream bank degradation and nutrient deposition. Twenty-five feet of buffer is considered sufficient to reduce the low levels of nitrate moving into the stream.

2. The amount of time that water is retained in the filter strip. This is influenced by:

- Width of the filter area. Filter strips will vary in width, depending on the percentage of slope, length of slope and total drainage area above the strip.
- Type of vegetation and quality of stand. Tall, erect grass can trap more sediment than can short, flexible grass. The best species for filter strips are tall, perennial grasses. Filter strips may include more than one type of plant and may include parallel strips of trees and shrubs, as well as perennial grasses. In addition to potential for improving water quality, these strips increase diversity of wildlife habitat.

3. Infiltration rate of the soil

Soils with higher infiltration rates will absorb water and the accompanying dissolved nutrients and pesticides faster than soils with low infiltration rates. Parish soil

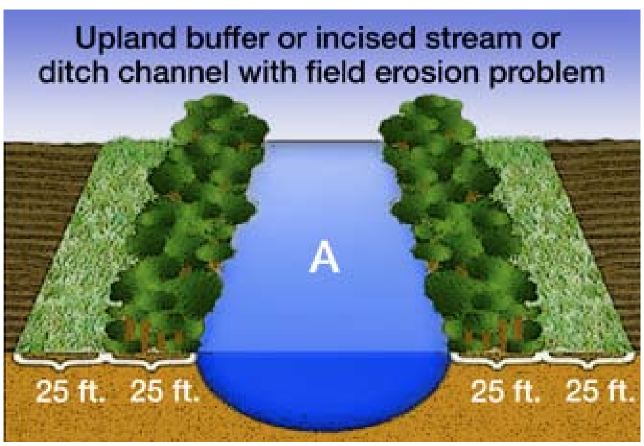



**Figure 1. Ideal buffer: 25 ft. forested on side of channel and 25 ft. grassed bottom next to field.**

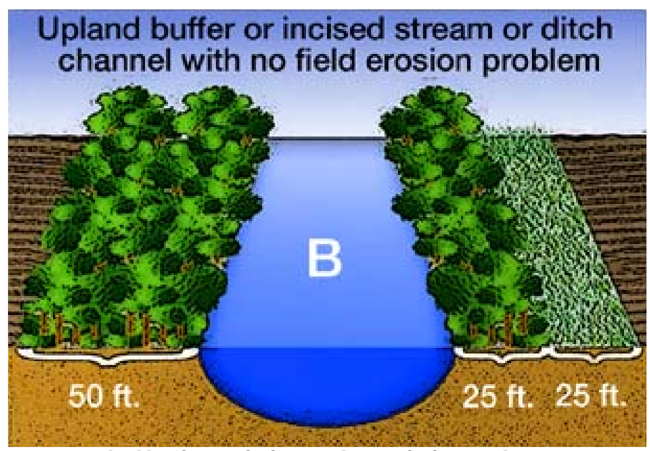



**Figure 2. Ideal buffer: 50 ft. forested or 25 ft. forested next to stream with no field erosion problem.**

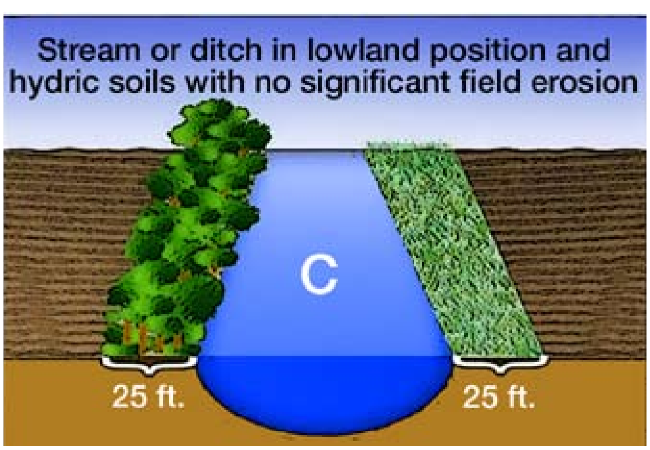



**Figure 3. Stream or ditch in lowland position and hydric soils with no significant field erosion.**

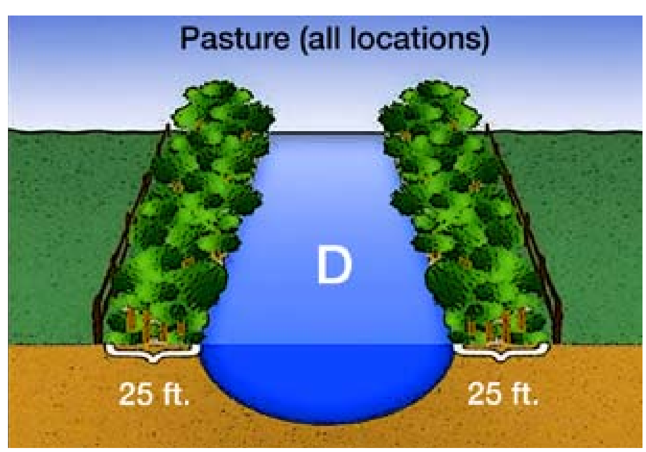



**Figure 4. Adequate buffer: 25 ft. forested each side of stream.**

survey reports include a table listing the infiltration rate group for the soils identified in each parish.

4. Uniformity of water flow through the filter strip

Shallow depressions or rills need to be graded to allow uniform flow of water into the filter strip along its length. Water concentrated in low points or rills will flow at high volume, so little filtering will take place.

5. Maintenance of the filter strip

When heavy sediment loads are deposited, soil tends to build up across the strip, forming a miniature terrace. If this becomes large enough to impound water, water will eventually break over the top and flow will become concentrated in that area. Strips should be inspected regularly for damage. Maintenance may include minor grading or re-seeding to keep filter strips effective.

**Grassed Waterways (Code 412)** are natural or constructed channels that are shaped or graded to required dimensions and planted in suitable vegetation to carry water runoff. They are designed to carry this runoff without causing erosion or flooding and to improve water quality by filtering out some of the suspended sediment.

**Riparian Forest Buffers (Code 391)** are areas of trees, shrubs and other vegetation located adjacent to and uphill from water bodies. This practice may be applied in a conservation management system to supplement one or more of the following:

- To create shade to lower water temperature, which would improve habitat for aquatic organisms.
- To remove, reduce or buffer the effects of nutrients, sediment, organic material and other pollutants before entry into surface water and groundwater recharge systems.

This practice applies on crop, hay, range, forest and pasture areas adjacent to permanent or intermittent streams, lakes, rivers, ponds, wetlands and areas with groundwater recharge where water quality is impaired or where there is a high potential of water quality impairment.

## In summary:

- Vegetative filter strips can reduce sediment effectively if water flow is even and shallow.
- Filter strips must be properly designed and constructed to be effective.
- Filter strips become less effective as sediment accumulates. With slow accumulation, grass regrowth between rains often restores the filtering capacity.
- Filter strips remove larger sediment particles of sand and silt first. Smaller clay-size particles settle most slowly and may be only partially removed, depending on the strip width and water flow rate.
- Because soil-bound nutrients and pesticides are largely bound to clay particles, filter strips may be only partially effective in removing them.
- Fewer dissolved nutrients and pesticides will be removed than those bound to soil particles.
- Filter strips are a complementary conservation practice that should be used with in-field conservation practices such as conservation tillage, contour buffer strips, strip cropping and waterways.

# Controlling Flies In and Around Poultry Houses

Adopted from: Hoelscher, C.E. 1997. Poultry Pest Management. Texas Agricultural Extension Service Bulletin B-1088.

One of the largest management problems facing poultry producers is filth fly control. The shift from many small farm flocks to fewer large poultry operations has greatly increased fly problems by creating concentrated breeding areas and large volumes of waste that cannot be removed frequently. As urbanization and rural nonfarm residences increase, poultry producers face increasing pressures to reduce fly populations. Fly populations (manure-breeding flies) may cause a public health nuisance, resulting in poor community relations and threats of litigation. A dedicated effort is necessary to achieve an acceptable level of fly control.

Several kinds of flies are common in and around caged layer houses in Louisiana. Probably the most common flies are the house fly and the little house fly. About 95 percent of problems involve the house fly. Both of these flies can move up to 20 miles from the site of development but normally don't go more than a mile or two from the initial source.

**House flies**, ***Musca domestica*** L. These flies are about 1/2 inch long and breed in moist, decaying plant material, including refuse, spilled grains, spilled feed and all kinds of manure. For this reason, house flies are more likely to be a problem around poultry houses where sanitation is poor.

These flies prefer sunlight and are very active, crawling over filth, people and food products. This fly is the most important species because it can carry and spread human and poultry diseases and cause fly-specking problems of the eggs. For example, house flies are the intermediate host for the common tapeworm in chickens, and they carry millions of bacteria.

The **little house fly**, ***Fannia canicularis*** (L), is about 3/16 inch long, somewhat smaller than the house fly. These flies prefer a less-moist medium than house flies for breeding and reproduction. The little house fly will choose poultry manure over most other media. This fly also prefers shade and cooler temperatures and is often seen circling aimlessly beneath hanging objects in the poultry house, egg room and feed room. This fly is less likely to crawl about on people and food, but it does cause people living near poultry establishments to complain about fly problems. The little house fly may hover in large numbers in nearby garages, breezeways and homes because it prefers shade.

The **black garbage fly**, ***Ophyra aenescens*** (Wiedemann), is slightly smaller than the house fly and shiny bronze-black in color. The wings are held straight back. This fly tends to stay on the food source at night rather than resting on the ceiling or on outdoor vegetation, as does the house fly. The female fly doesn't seem to fly great distances but has been found up to about 5 miles from its breeding area. Although black garbage fly larvae have been known to exterminate house fly populations, they should not be considered entirely beneficial because these flies can build large populations on the farm and disperse as adults to nearby communities. All stages are found throughout the year under suitable conditions, and they show rather good tolerance to cold weather. The life cycle is similar to that of the house fly.

**Blow flies**, sometimes known as green or blue bottle flies, are slightly larger than house flies and sometimes live in poultry houses. They prefer to breed and reproduce in decaying animal and bird carcasses, dog manure, broken eggs and wet garbage. Generally, a good sanitation program will hold these flies in check.

Other flies found on the poultry establishment include soldier flies, small dung flies, fruit flies, and rat-tailed maggots.

## Fly Biology

All flies develop through four life stages: egg, larva, pupa and adult (Figure 1). Adult flies lay small, white, oval eggs on the breeding medium, and creamy white larvae (maggots) develop in this moist (wet) material. Mature maggots crawl out of this material and move to a drier place for the pupal stage. The brown, seedlike pupae finally yield adult flies. Development from egg to adult fly may take just seven to 10 days under ideal conditions. Adult house flies live about three to four weeks, and females lay two to 20 batches of 75 to 200 eggs at three- to four-day intervals. At this rate, a pair of flies beginning operation in April, if all offspring were to live, would result in 191,010,000,000,000,000,000 (191 quintillion, 10 quadrillion) flies by August. Allowing 1/8 cubic inch to a fly, this number would cover the Earth 47 feet deep. Of course, this does not happen because beneficial predators and parasites keep the populations under control.

Flies can be present in poultry houses year-round if there are warm temperatures and no true diapause.

## Cultural Control

Manure management is the most effective way to control flies. As many as 1,000 house flies can complete development in 1 pound of breeding material. Fresh poultry manure contains 75 percent to 80 percent moisture, which makes it ideal for fly breeding. You can practically eliminate fly breeding in this material by reducing the

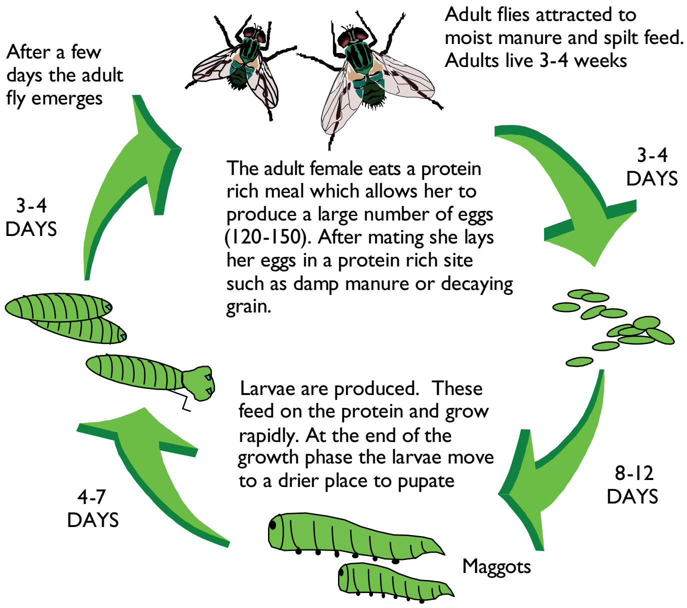



**Figure 1. Life cycle of a house fly (Adopted from R. Tucker, Today's Feedlotting, July 1992)**

moisture content to 30 percent or less or by adding moisture to liquefy it. Drying manure is preferred because the product occupies less space and usually has less odor.

## Dry Manure Management

Frequent removal of manure (at least once a week) prevents fly breeding because it breaks the breeding life cycle. It is important to scatter the manure lightly outdoors to kill the eggs and larvae by drying. Avoid piles or clumps of manure. You must have access to enough land so the manure can be spread thinly; this keeps excessive amounts of nutrients from building up in the soil. Spread at an agronomic rate for your area.

In-house storage of manure requires drying it to a 30-percent moisture level and maintaining this level where sufficient storage space is available. Dry manure can be held for several years. Any practice that limits moisture in the droppings or aids in rapid drying is important for fly control.

## Water Management

Managing the water content of manure is important in controlling flies. Following these steps can help minimize water content:

- Prevent leaks. Regulating water flow to an on/off cycle may help eliminate moisture problems.
- If the water table in your area is high, or if there is a danger of water running into the house from the outside, adjust the floor-grade relationship so that the house floor is higher than the outside surrounding ground. Have surface water run away from the building. Drain and fill all low areas around the houses.
- Prevent dysentery by keeping water clean. Use recommended antibiotics if dysentery develops.
- Prevent excessively high house temperatures, which encourage the chickens to drink abnormal amounts of water.
- Practice good husbandry by restricting excess water consumption.

## Sanitation

Sanitation is the most important aid in successful fly control. Often, certain conditions in and around the poultry operation will encourage fly outbreaks. These must be eliminated. Follow these steps to improve sanitation:

- Quickly remove and dispose of dead birds. Dispose of them far from the poultry premises by burning in an incinerator or other approved management method.
- Clean up and dispose of feed spills and manure spills, especially if wet, immediately.
- Install proper eave troughs and downspouts on poultry houses to carry rainwater far from buildings. Provide proper drainage in poultry yards.
- Minimize the migration of flies from other fly-infested animal operations that are near the poultry house.

## Biological Control

Entomologists encourage the use of biological control in poultry houses. If you are considering biological control for your operation, be sure to purchase beneficial insects (also called "beneficials") adapted to the climate in your area.

These fly parasites, actually very tiny wasps, are the naturally occurring enemies of manure-breeding flies.

They destroy flies in the pupal stage. These wasps, ***Spalangia nigroaenea***, are about the size of the head of a house fly (1/16 to 1/8 inch) and live in the manure, depositing eggs in fly pupae. Adult female wasps lay an egg on the fly pupa within the puparium (the hard case containing the pupa). Then the developing wasp larva consumes the pupa and emerges as an adult. These fly parasites are specific to flies and attack nothing else. They are biteless and stingless to people and usually go unnoticed by those living near poultry operations. They self-propagate in the process of controlling pest flies. Mass releases are needed, however, to produce results. In addition, the wasp lays fewer eggs than the fly over the same period, making it necessary to start with an initial wasp release and follow up with weekly supplemental releases. You should make these releases before and during the fly season.

Whenever you use beneficial insects, you must be extremely careful with insecticides. Chemical sprays must be discontinued in areas of the poultry house where these wasps are used, and you should never treat the entire manure surface with insecticides (with the exception of cyromazine or Larvadex®). Otherwise, beneficial insects, as well as the pest flies, will be killed.

To improve the chances of successful biological control with these wasps, you also should follow a strict sanitation program involving manure management, water management, weed mowing, etc. Keep the manure dry, since wet manure promotes fly breeding and inhibits beneficial insect breeding. Also, when you clean the poultry house, leave areas of old dry manure to provide a reservoir of beneficials to repopulate the house as new flies occur.

According to the Cornell and Penn State Cooperative Extension publication, "Pest Management Recommendations for Poultry," other beneficials in poultry manure include mites and beetles. Both are major predators in caged-layer operations. The macrochelid mite, ***Macrochelis muscaedomesticae***, is reddish-brown and less than 1/16 inch long. It feeds on house fly eggs and first-instar larvae. These mites, found on the outside layer of manure, can consume up to 20 house fly eggs per day. Another mite is the uropodid mite, Fuscuropoda vegetans, which feeds only on first-instar house fly larvae deeper in the manure.

A hister beetle, ***Carcinops pumilio***, is black and about 1/8 inch long and feeds on house fly eggs and first-instar larvae. This effective beetle predator, common in both broiler and layer houses, can consume 13 to 24 house fly eggs per day. Both adult and immature hister beetles live in the surface layers of manure. Another hister beetle, ***Gnathoncus nanus***, is present at lower numbers on poultry farms.

Using fly parasites for biological control in Louisiana would reduce chemical residues to people, birds, eggs and the environment. To date, however, claims that wasps will provide long-term fly control have not always been backed by scientific research results. When using biological control methods, remember to manage the habitat for biological control by keeping the manure dry. Accumulations of poultry manure left undisturbed over long periods of time will support large populations of native fly parasites (wasps and mites) and fly predators (beetles). Be sure to encourage the native strains of beneficials already present in the dry manure to populate. Remove manure only during the fly-free time of the year and eliminate insecticide sprays in manure pits.

## Mechanical Control

Many types and styles of fly traps appear on the market each year. These traps usually are electrical, employing a black light with an electrically charged grid to kill the insects. Some traps are baited with a fly attractant material.

Traps appear to be helpful in tight, enclosed areas such as egg rooms – where there is a breeding fly population, if good sanitation practices are followed. In areas of heavy fly populations, however, traps are not effective in reducing fly numbers to satisfactory levels. Use traps in the middle of the night away from doors and windows.

Traps should be judged by the population of flies remaining in the area and not by the number of flies caught in the trap. Most entomologists say fly traps used alone are not effective in controlling flies, especially in and around livestock and poultry operations.

Use a fan to blow air through a screened doorway from the egg room or other work area into the main poultry house. Flies will not move against the wind into the egg room or other work area. There are commercial, electric-powered, air-curtain fans. Keep in mind, however, that certain state health departments may require solid doors between the egg room or other main work area into the main poultry house.

Use sticky fly strips where appropriate.

## Surveillance

It is important to monitor fly populations to make wise control decisions. Visual observations alone can be misleading. Know the flies' behavior patterns and history. Documentation is very helpful in legal defense, if needed.

**Moving tape count.** This is the best surveillance method – taking about five minutes each day walking on a 1,000-foot walk to catch 25 to 75 flies. Walking down and back in each house is cheap and easy. Use the same walk pattern and the same time of day when carrying the sticky fly tape.

**Sticky fly tapes.** Tapes that hang often tell nothing. Tapes fill up fast during summer months within a chicken house. But you can determine the fly species. Some growers hang sticky fly ribbons along aisles. Captured flies are counted weekly and ribbons replaced. A weekly count of 100 flies per ribbon may indicate fly control is required. Ribbons may become ineffective after two to three days because of dust and fly covering. Tapes are messy to use, and location is important.

**Speck fly count.** A 3-by-5-inch white file card fastened flush against feed troughs, ceilings, braces or other fly resting areas, left for a period of several days to a week, will provide documented evidence as to the number of "fly specks" counted on a given date or over a period of time within a given house. Place cards on head rafters (three cards per house) and count fly specks on one side. Change cards once each day or week, depending on populations present. Fifty or more spots per card per week may indicate fly-control measures are required. Place cards in the same position each time. Fly species cannot be determined from the spots, but the spot card method is very economical.

**Baited jug trap.** This is more expensive than other sampling methods but offers greater sensitivity to fly population changes. A plastic milk jug, with four access holes (2 inches in diameter) around the upper part of the jug with a wire attached for hanging about 3 feet above the floor around the pit periphery, may indicate need for control. The jug is baited with a commercial fly bait (about 1 oz.) placed inside the jug bottom. Use fly pheromone muscalure (Muscamone) for effectiveness.

## Chemical Control

Insecticides should be considered supplemental to sanitation, and management measures must be directed to prevent fly breeding. Accurate records should be kept on insecticides and dosage rates used. Resistance to insecticides has developed at different levels in various poultry house locations, depending somewhat on prior exposure.

The use of a variety of different classes or families of insecticides can minimize the development of resistance. Rotate the use of organophosphate, carbamate, pyrethroid and other classes of insecticides when necessary.

## Residual Sprays

Residual sprays usually are the most effective and economical method for controlling potentially heavy populations of adult flies of any species present. These sprays should be applied in spring at the beginning of fly season. Application after manure removal will reduce fly buildup that usually follows house clean-out. A second application should be made five to six weeks later. (Two sprays are required.) Apply to surfaces on which flies locate, such as poultry house framework, the ceiling, walls, trusses, wires supporting cages, electric light cords and other areas marked by fly specking. Also, treat outside the poultry house around openings and on shrubs and other plants where flies rest.

Apply coarse, low-pressure sprays to the point of runoff at pressures of 80 to 100 pounds per square inch, using a power sprayer or good proportioned-type sprayer. Depending on the insecticide used and the type of surface sprayed, treated areas may remain toxic for two to 15 weeks.

Avoid contamination of feed, water and eggs during spraying. Do not spray birds.

## Resin Strips and Fly Belts

Ready-to-use dichlorvos (Vapona®) 20 percent resin strips can be used at the rate of one strip per 1,000 cubic feet of enclosed area. Strips will need to be replaced as they lose their effectiveness, which is about every three months. Methomyl (Golden Malrin®) fly belts can be attached to surfaces out of the reach of food-producing animals. The belts may be cut to any desired length and attached to surfaces such as walls and ceilings. Follow label directions. Both resin strips and fly belts may become dusty and dirty if used for long periods.

# Controlling Rodents

Adopted from: Hoelscher, C.E. 1997. Poultry Pest Management. Texas Agricultural Extension Service Bulletin B-1088.

It is unusual to find a poultry farm that does not have at least a few rats or mice, and, more often than not, the population is much larger than suspected. In addition to eating and contaminating a great deal of food, rodents do considerable damage to buildings. They undermine foundations, destroy curtains and insulation, damage equipment and cause fires by gnawing electrical wiring. In rare cases, rats have been known to kill poults and young chickens. Finally, since they are able to carry a variety of diseases and ectoparasites, rodents can affect flock health and performance.

## Identification

Two species of rodents, the Norway rat and the house mouse, are common pests on most poultry farms (Figure 1). The following descriptions provide information on their biology and behavior that is useful in managing these pests:

Norway Rat *(Rattus norvegicus)*

Adults are up to 46 centimeters (18 inches) long from head to tail. The tail is hairless and shorter than the body; the fur is reddish- or grayish-brown or black with the underside gray or yellowish-white. (Varicolored forms may occur.) Common names are brown rat, house rat, barn rat, sewer rat and wharf rat.

- Rats burrow under and along foundations and feed bins and in secluded spots near poultry houses (fields, trash piles and banks of ditches and lagoons). They may also burrow into manure under slats or cages. Their burrows are large, often with conspicuous piles of dirt nearby.
- They are active at night. If they are seen above ground during the daytime, it indicates a large population.
- Capsule-shaped droppings about 13 millimeters (1/2 inch) long may be seen along walls and areas where rats move or congregate.
- Rats prefer fresh food, when available.
- They are cautious. They may not take baits immediately unless placed directly in their path. They may pass up baits even when correctly placed if a better food source is readily available.
- They are excellent climbers and are able to enter buildings by a variety of routes.

- House Mouse *(Mus musculus)*

Adults are between 13 and 18 centimeters (5 and 7 inches) long from nose to tail. Their hairless tail is as long as their body. They have light brown to black fur with a white underside.

- Mouse burrows are small, ranging from 6 to 13 millimeters (1/4 to 1/2 inch) in diameter. They are found along foundations, under boards, near feed bins, in manure under slats and cages and in other similar areas. They also nest in walls, ceilings and curtains left down for extended periods.
- Mice feed throughout the day, with greatest activity at dawn and sunset.
- Droppings are smooth and about 6 millimeters (1/4 inch) long. They may be seen along interior walls, on sills and in secluded areas where mice move and congregate.
- Mice are very curious and will investigate bait stations and bait placed in their path.
- They are excellent climbers and are able to enter buildings by a variety of routes.

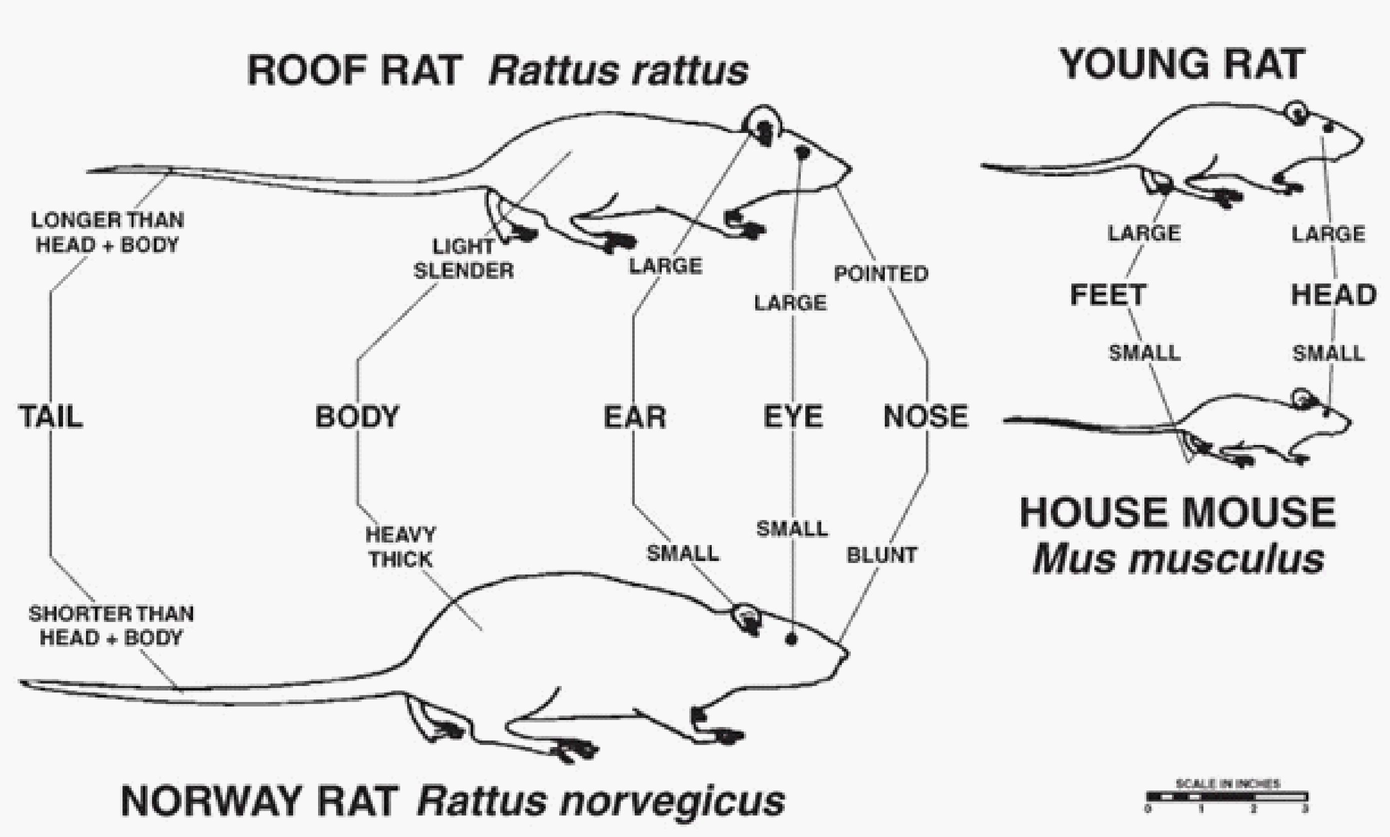



**Figure 1. Distinguishing between Norway rats, roof rats, young rats and house mice.**

# Rodent Biology

In general, rodents have three basic requirements: food (Figure 2), water and harborage (places to hide and nest). If one or more of these items is missing from the area, rodent populations will remain low. Unfortunately, all three usually are abundant in and around poultry houses.

An adult rat eats about 1 to 2 ounces of food each day, whereas a mouse will eat far less, about 0.1 ounce per day. Individually, this is not a lot of feed, but a large population can account for several tons of food each year.

Although both rats and mice need water to survive, mice often are able to get what little moisture they need from the food they eat. This ability allows them to nest and feed in locations where water is not abundant. Rats are not so adaptable. They cannot extract enough moisture from their food and must be relatively close to a source of water.

Rats and mice both are burrowing animals, but mice also build nests above ground in hidden, secluded areas such as walls and ceilings. Rats, on the other hand, generally nest almost exclusively underground and come out only to find food or water.

The reproductive capacity of rats and mice is quite high. Both breed throughout the year, producing four to eight litters annually. Rats are sexually mature at three to five months of age and have six to 12 young per litter. Mice reproduce when younger (one to two months) and deliver five to six young per litter. Based on reproductive potential alone, a single pair of rats could produce 1,500 offspring in a single year. Fortunately, other factors such as predation, food availability and population density limit reproduction and survival in nature. Even so, rat and mouse numbers can rise quickly if they are ignored.

# Control

Three elements make up a good rodent management program: sanitation, rodent proofing and rodent killing. Sanitation and rodent proofing, the first lines of defense, include a number of cultural practices easily incorporated into the overall management of the poultry farm.

Successful management of rodent infestations also involves some method of killing rats and mice. Rodenticides (baits, concentrates, tracking powders and fumigants) are the most efficient method of rodent control but should be selected and used carefully to be effective.

# Sanitation

Sanitation is nothing more than a combination of cultural practices that deny rodents harborage and food. Rats and mice are most troublesome where there is good cover to hide their movements and sites in which to nest. A well-maintained poultry facility not only exposes them to predators but also makes it easier to spot any burrowing activity. This last point is a big help when using rodenticide.

The following items are important to the success of a good sanitation program:

- Keep the area around poultry houses mowed. Maintain a clear zone of not less than 50 feet from field borders and fence or tree lines.
- Remove old equipment, lumber and trash from around buildings. Lumber may be stacked near buildings if it is elevated 1 to 2 feet above the ground.
- If side curtains are dropped for the summer, raise and lower them twice a week to stop mice from nesting in the folds.
- Clean up feed spills inside poultry houses and at feed bins.


**Figure 2. Clean up feed spills.**

# Rodent-Proofing

Completely rodent-proofing a poultry house is impractical, if not impossible. But sealing up obvious entry points makes it a little more difficult for rodents. Even small cracks and holes in walls, foundations and screens should be patched. Mice need only a 1/4-inch hole to get into a building.

- Seal openings around water pipes, drain spouts and vents with concrete or heavy mesh (Figure 3).
- Cover openings and floor drains with mesh.
- In new structures with corrugated siding, use flashing to seal both tops and bottoms of the siding. Be sure corner seams are tight.

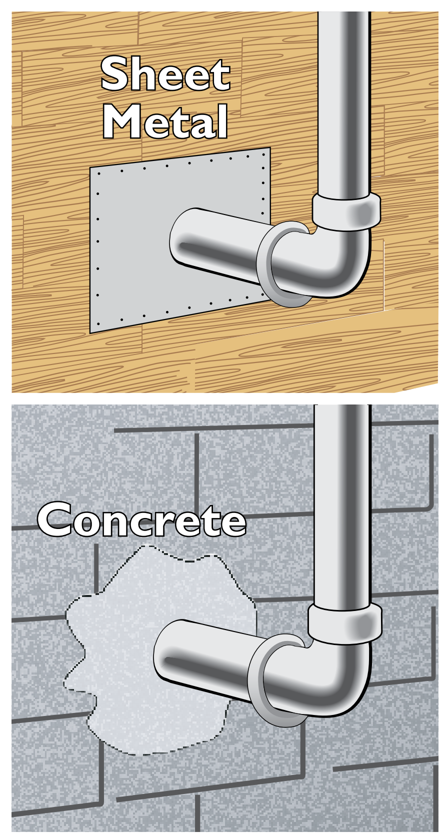



**Figure 3. Rodent proofing.**

# Killing Rodents

(Using Rodenticide)

Glue-boards and traps are devices that can be used to control rodent populations. In small areas, these devices can be efficient. In a 12,000- to 20,000-square-foot house, however, baits often are more practical.

### Rodenticides

A wide variety of rodenticidal compounds and formulations are available. The selection of the right material for a specific situation is important. (See listings under multiple-dose and single-dose rodenticides later in this section.) An understanding of the basics is necessary to know how to use a particular compound and formulation most effectively.

Rodenticides are formulated as pellets, bar baits, tracking powders and concentrates. Pellets are formulations of poisons mixed with grain products and a binder. They may be packaged loose or in individual pitch packs. Bar baits are formulated with rodenticide, grain products and a binder with a high wax content to withstand moisture for long periods.

Tracking powders are compounds formulated with talc or other inert material. They are intended for use along rodent runways. Rodents pick up the poison on their fur, tail and feet and ingest it during grooming. Concentrates are designed to be mixed with feed or water.

The most important thing to know about a rodenticide is that the type of active ingredient determines how the material is to be used. Failure to use a particular rodenticide correctly will result in poor control and may present a hazard to nontarget animals.

In general, rodenticides can be classified as either multiple- or single-dose poisons. All of the multiple-dose and two of the single-dose products affect the rodent's nervous system or other bodily functions.

Multiple-dose poisons must be eaten every day for seven to 21 days for the rodent to accumulate a lethal dose. Any interruption of exposure breaks the cycle, and although rodents may become ill, they will not die. In such cases, rodents may learn to avoid the bait.

### Active Ingredients in Multiple-Dose Rodenticides

- Warfarin
- Fumarin
- Chlorophacinone
- Diphacinone

Single-dose poisons have a decided advantage over multiple-dose rodenticides since rats and mice receive a lethal dose after only one or two feedings.

### Active Ingredients in Single-Dose Rodenticides

- Brodifacoum
- Bromadiolone
- Bromethalin
- Cholecalciferol
- Zinc phosphide

Once a rodenticide has been selected, it must be used properly to be effective. Random placement of bait or tracking powder around a poultry facility rarely is successful. Always remember that rodents will not go out of their way to eat poison bait if they have other food readily available. Similarly, tracking powders will not work as intended if rodents do not run through the material on their way to and from their feeding or nesting areas.

Since baits are the most efficient and economical way to deliver rodenticide, we will limit our discussion to the proper use of baits to control rats and mice. Because baiting methods differ for rats and mice, they will be discussed separately.

# Rat Baiting

Rats are much easier to bait than mice. Their burrows are conspicuous and, once located, can be baited by placing the rodenticide directly in the burrow. The following method is called pulse baiting and is an effective way to kill rats.

- 1. Locate and mark all burrows.
- 2. Seal all burrows with newspaper or soil.
- 3. Inspect burrows the next day and place a packet of bait well inside each open burrow. It is not necessary to open the packets.
- 4. Bait all open burrows for two consecutive days if using a single-dose product and 10 to 14 days if using a multiple-dose rodenticide.
- 5. Close all burrows and wait one week.
- 6. Repeat step 4.
- 7. Close all burrows and monitor for activity. Bait all new burrows when they first appear.

Where rat burrows are located in inaccessible areas such as the manure under slats and along steep banks, bait stations should be used (Figure 4). Place stations against walls or on rodent runways with the first station as close to the burrows as practical. Orient the entry holes along the wall or path. Well-used runways are easy to spot (by the large amounts of droppings, rodent tracks, greasy-looking rub marks, etc.) and are the best place to locate bait stations. Position stations at 10- to 15-foot intervals to cover a large area and give rats ample opportunity to find the bait before reaching their normal feeding sites. Put one or two stations around feed bins, as well. Inspect the stations every few days and add 1 ounce of fresh, loose bait as needed. If the bait has not been taken within several days, place the station at a new location.

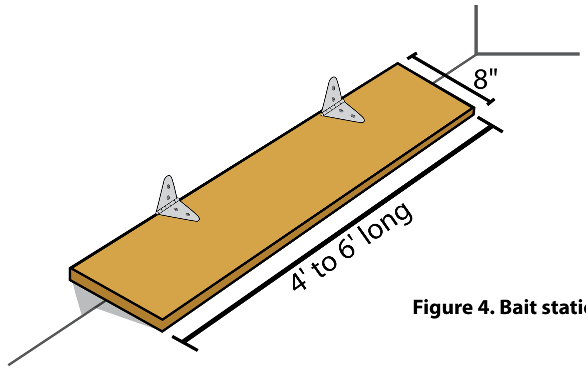



**Figure 4. Bait station.**

## Mouse Baiting

Large numbers of mice often will nest in the walls and ceilings of poultry houses. Consequently, mouse baiting is a matter of quantity and persistence. Bait bars or stations baited with an ounce of loose bait should be placed at 5- to 10-foot intervals throughout the house. Sill plates and horizontal wall braces often are good locations to place bait in breeder, turkey and other open-floor houses. Bait stations may also be placed along alleyways in facilities where birds are caged or penned. Egg rooms, offices and attic spaces also should be baited. As with rat baiting, placement is important.

Bait stations and bar baits should be placed next to walls or on the horizontal surface of sills and braces. Corners are good locations, as are cool cells and housings for exhaust fans. In all cases, care should be taken to attach stations firmly and in such a way that birds cannot reach the bait.

Once bait has been placed, inspect the locations frequently and replenish the bait as needed. Inspection intervals depend on the severity of the mouse infestation and type of bait used. Where multiple-dose baits are used or the infestation is heavy, check locations daily for the first week. Try increasing the amount of bait placed in each station if mice have eaten it all. This will allow for less-frequent inspections. In time, it will be necessary to inspect stations only once a week. Bar baits are partially useful in locations, such as sill plates, that are near the ceiling. Most bars have a hole in the center that allows the bait to be nailed in place (Figure 5). Bar baits generally last much longer than loose baits because mice cannot carry them to their nests

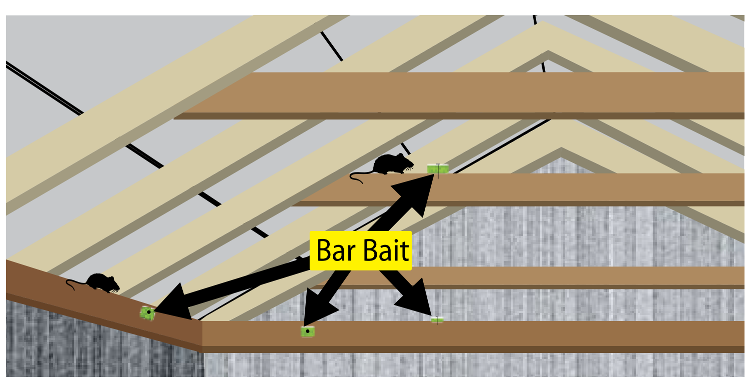



**Figure 5. Bait bar placement.**

# Responding to Complaints

It only takes a drive through any parish back road to see that more and more families are moving into rural areas of Louisiana. These families typically come from a nonfarmer background and do not understand contemporary agricultural practices. For a variety of reasons, they also are increasingly sensitive to issues related to agriculture, environmental quality, food safety and quality. Concerns about agricultural odors, dust and chemicals are exacerbated by both limited knowledge of agriculture and the desire of these rural immigrants to have a home in the country. Balancing the expectations of rural landowners and the needs of poultry producers to provide a safe and economical supply of meat and eggs will become more challenging in the years to come. There are some things that can be done, however, to make the situation better.

Being friendly and courteous to people who are neighbors to your farm can go a long way to help improve the image of the operation. The appearance of the farming operation also helps. A clean atmosphere is much more pleasing to look at than a dirty and unclean one. The way a manager handles complaints and concerns also is a vital part in keeping good relations with neighbors.

Be caring to neighbors. Give advance notice when you are planning to spread manure that may cause offensive odors. Talk with your neighbors to avoid spreading manure around outdoor weddings, barbecues, picnics and other social events that potentially could be ruined. Let your neighbors know you are willing to talk about odor problems and that you care. Ask your neighbors if they would like some compost or separated solids for their gardens.

A system of communication also may need to be set up. This will help solve any problems before they get out of hand. Some people feel more comfortable talking to someone other than the person with the problem. Give concerned members of the community a contact person to talk to. This third-party can be separated from the issue, be less emotionally involved and can likely identify simple and mutual solutions. Finally, poultry producers need to work with community leaders and regulatory agencies before complaints get out of hand. Today, in most parts of the country, community leaders set and enforce the regulations on farming operations. A poultry producers working with community leaders may reduce the demands for regulations against odor. If poultry producers farmers do not work with neighbors and community leaders, it could mean losing profits or even your farm.

# Farmstead Management

Farmstead Management is a generic term to describe several BMPs that might be necessary on your farm. Many of these may only apply if an operation is producing both poultry and cattle on the same land. Consult with your local NRCS office or LSU AgCenter county agent to determine which if any of these practices might benefit your situation.

## Fuel storage tanks

Above-ground fuel storage tanks in Louisiana are regulated by the State Fire Marshal's Office and by the EPA if surface water is at risk. Above-ground tanks containing 660 gallons or more require secondary containment. The state fire marshal recommends that some sort of secondary containment be used with all fuel storage tanks. This could include the use of double-walled tanks, dikes around the tank for impoundment or remote impoundment facilities.

These practices are to be followed:

- Additional secondary containment measures are required for operations that store more than 1320 gallons of fuel. NRCS Code 710 is designed to prevent accidental discharge of petroleum products into the environment. Additional information can be obtained from your local NRCS office in consultation with the local LSU AgCenter agent.
- The tank and storage area should be located at least 40 feet from any building. Fuel storage tanks should be placed 150 feet and down slope from surface water and water wells.
- It is recommended that the storage tank be on a concrete slab to prevent any spillage from entering surface water and groundwater.
- The storage area should be kept free of weeds and other combustible materials.
- The tank should be conspicuously marked with the name of the product that it contains and "FLAMMABLE–KEEP FIRE AND FLAME AWAY."
- The bottom of the tank should be supported by concrete blocks approximately 6 inches above the ground surface to protect the bottom of the tank from corrosion.
- If a pumping device is used, it should be tightly and permanently attached and meet NFPA approval. Gravity discharge tanks are acceptable, but they must be equipped with a valve that will automatically close in the event of a fire.
- Plans for the installation of all storage tanks that will contain more than 60 gallons of liquid must be submitted to the State Fire Marshal's Office for approval.
- All tanks that catch on fire must be reported to the State Fire Marshal's Office within 72 hours of the fire.
- Underground storage tanks are defined as containing more than 10 percent of their total volume beneath the soil surface. Underground tanks represent more of a problem than above-ground tanks, because leaks can often go for long periods without being detected. This poses a serious threat to groundwater sources in the vicinity of the tank. If you have an underground fuel storage tank, you need to contact the State Fire Marshal's Office for regulations affecting these storage tanks.

## Heavy-Use Area Protection (NRCS Code 561)

Open, unpaved, bare areas are common on many Louisiana farms – especially those producing livestock. Examples are feeding or watering areas, pathways to the barns, pre-milking staging areas, shaded animal areas and transition areas from pavement to dirt. These areas may be considered to need runoff controls in most cases, and improvements to these areas will minimize the effects of runoff into streams.

Unpaved areas of high livestock density, such as around open feed areas or transition areas from pavement to dirt, may be underlaid with suitable surface materials to reduce muddy conditions. One option might be geotextile fabric or filter cloth. If used, the surface on which the nonwoven geotextile is placed should be graded smooth and free of loose rocks, depressions, projections and standing or flowing water. The geotextile is unrolled and placed loosely on the graded soil surface, overlapping at the seams by 18 inches. Approximately 6 to 8 inches of crusher-run gravel is placed on top of the geotextile. This installation allows surface liquids to drain through and provides a firm footing for the animals, thereby preventing miring of their hooves.

When possible, dirt lots should be located at least 100 feet away from perennial streams or 25 feet away from intermittent streams and drainage ways and have a permanently vegetated buffer. These lots should not have an unfenced stream or wet area within their boundaries. All surface water from above these lots should be diverted around them. Sloping lots should have cross terraces to reduce erosion and collect eroded sediment and manure solids. At the lowest point of the lot edge, earthen or concrete settling basins should be placed to help trap solids that may otherwise leave in rainfall runoff. Where possible, these lots should be rotated and the surface manure pack scraped from the unused lot before reseeding with grass. Waterers located within these areas should be kept in good repair to minimize leakage and spillage.

## Trough or Tank (NRCS Code 614)

Some livestock are managed on pastures in partial confinement. While animals are on pasture, their waste should not be a resource concern if stocking rates are not excessive, grazing is evenly distributed and grazing is minimized to the degree possible during rainy periods when the soil is saturated.

It is best for pasture feeding areas to be located on the higher points of the pasture and away from streams. Portable feed bunks should be moved periodically. Permanent waterers should be located away from streams and have an improved apron around them of concrete, gravel or gravel and geotextile fabric.

If using rotational grazing, where pastures are divided into paddocks separated by electric fencing, paddock subdivisions that allow a one- to three-day rotation of the livestock have been found to be successful. When subdividing long slopes, make the paddocks cross the slope so animals are not forced to graze up and down steep, narrow hillsides, if applicable. Lanes that provide access to shade and water should be as centrally positioned as possible for efficient livestock movement. Lane surfaces will likely need to be improved with gravel, geotextile fabric or both.

Drinking water, when provided in every pasture or paddock, increases the amount of time the livestock graze and reduces the amount of manure in the vicinity of the primary waterer. Shallow tubs beneath fence lines can serve two or more paddocks. Water can be piped in through underground lines (NRCS Code 516). Quick couplers can be installed in water mains to allow one to two tubs to be moved with the cattle from paddock to paddock.

## Stream and Stream Bank Protection (NRCS Code 580) and Access Road Requirements (NRCS Code 460)

Livestock movement from pasture to pasture or paddock to paddock is best done by improved walking lanes and stock trails. These lanes should be planned efficiently for animal movement, should follow the contour of the land whenever possible and should be as far away from streams as possible. Lane surfaces, in many cases, will need to be improved with gravel, geotextile fabric or both to reduce muddy conditions and erosion.

Improved crossings in pasture or dry-lot areas where livestock must cross a stream can help to maintain bank integrity and reduce erosion. These crossings may be in conjunction with fenced stock trails, or they may be in open pastures. In open pastures, an approach segment of the stream above and below the crossing may need to be fenced to train the animals to use the crossing.

One method to improve a stream crossing (NRCS Code 578) is to uniformly grade a 10- to 15-foot section of the bank on each side, as well as the stream bottom. If it is not solid, use geotextile fabric and gravel on the surface of the graded section. Concrete slabs also have been used to hard-surface crossings.

Another crossing method is to install a culvert covered with compacted soil in the stream. Care must be taken to size the culvert with enough capacity to handle storm events. A third method is to construct a bridge for livestock to cross larger or wider streams. Professional advice should be sought to ensure bridges and culverts will be structurally sound.

## Stream Fencing (NRCS Code 382) and Access Control (NRCS Code 472)

Fencing livestock out of streams is needed only when the water quality or stream banks have been or will be significantly degraded because of the presence of animals congregating or lounging in the stream. Stream segments through feedlots, near heavy-use areas or where stream banks have been severely eroded probably will need to be fenced to restrict livestock access. Wetlands or spring-fed water courses also may need to be fenced. Streams in pasture or wooded areas where stream bank integrity is maintained and stream edges have permanent wooded or vegetated buffers may not need to be fenced.

## Sediment Basin (NRCS Code 350) or Waste Storage Facility (NRCS Code 313)

This is a basin or storage facility constructed to collect and store manure and sediment generated from livestock. Its purpose is to prevent deposition on bottom lands and to trap sediment, agricultural waste and debris. Another application of the sediment trap can be used to help prevent field borders or filter strips from becoming inundated with solids. A sediment basin placed before the vegetative filter to separate manure solids from the wastewater is good management practice, when practical, to prevent the upper side of the vegetative filter from clogging with solids and reducing soil infiltration. The most common type of settling basin is a shallow, reinforced concrete structure with a sloping entrance ramp to permit equipment access for solids cleanout. The basin should have a drain in one sidewall so liquids can be removed. Solids should be removed from the basin monthly or after each heavy rainfall, when practical.

Vegetated areas receiving settling basin liquid overflow consist of either an overland flow plot or a shallow grassed channel or waterway. These areas should be bermed or terraced so that all surface water outside the infiltration area is diverted.

Care should be taken during construction of a vegetative filter. Since infiltration is most important, every effort should be made to maintain soil integrity and permeability. Mulching, fertilizing, liming and even watering should be used to establish a healthy sod as soon after seedbed preparation as possible to prevent soil erosion.

Vegetative filter areas should be prepared and seeded at least one growing season before use. A combination of seasonal forage species that can tolerate wet conditions is suggested. Foliage should be clipped periodically and removed from the filter area. Do not remove late-fall foliage. Foliage growth will help filter winter and spring runoff. Vegetative filters can provide low-cost, low-management control of most barnyard runoff. Studies indicate vegetative filters can remove more than 95 percent of the nutrients, solids and oxygen-demanding material from wastewater. They are not effective, however, on farms where large areas of paved feedlot drain into the filter. See Section on Vegetated Buffers and Filter Strips in this manual for additional details.

## Roof Runoff Management (NRCS CODE 558)

This practice can be used if rainfall runoff from barns or other structures is flowing across animal waste areas or bare ground areas where significant erosion is occurring. Management of this runoff ensures manure waste and sediment are not transported into drainage branches or small creeks that ultimately can carry pollutants into surface water off the farm. The practice also can sometimes have the added benefit of protecting the foundation of the building from water inundation and weakening. In some cases, if desired, roof runoff can be collected, stored and used for other purposes such as lot wash-down water.

Gutters and downspouts are commonly used with care taken to ensure water from downspouts is directed away from the building foundation and areas of concern. Water velocity from downspouts is emptied onto the ground surface with velocity dissipation systems such as rock pads, rock-filled trenches or concrete to prevent erosion and to ensure ground infiltration.

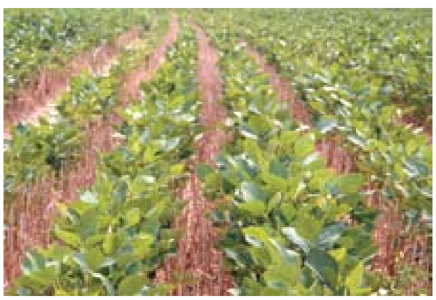
## Critical Area Planting (NRCS Code 342):

Examples of applicable areas are levees, cuts, fills and denuded or gullied areas where vegetation is difficult to establish by usual planting methods. The easiest and most effective way to protect these areas is to maintain perennial plants in these locations. These plants provide soil stabilization, control erosion, protect water quality and supply wildlife habitat.

The roots of native grasses, low shrubs and aquatic plants bind to the soil and provide the necessary benefits. Proper treatment of a critical area involves the planting of vegetation, such as trees, shrubs, vines, grasses or legumes, on highly erodible or critically eroding areas. This practice does not include planting trees for wood products.

Although any rooted plants growing in these areas are helpful, some plants give better protection than others. Low grasses and shrubs that provide deep, strong, fibrous root systems are the best and grow faster than trees. One group of native trees that grows relatively fast and provides the necessary root system is the willows (Salix). Unlike other trees, these are woody shrubs that love water and develop deep, strong root systems in wet soil. Plants that are suitable for planting in these areas can be found in most nurseries or can be transplanted from existing stands. For advice on the proper plants for your situation, contact your nearest NRCS office or LSU AgCenter Extension Service county agent.

Survival of these plants depends on proper planting and care until the plants are firmly established. Bank shaping, weeding, fertilization, mulching and fencing from livestock may also be necessary depending on individual circumstances.



## Conservation Tillage Practices (NRCS Code 329):

This system is designed to manage the amount, orientation and distribution of crop and other plant residues on the soil surface year-round. In conservation tillage, crops or forage are grown with minimal cultivation of the soil. When the amount of tillage is reduced, the stubble or plant residues are not completely incorporated, and most or all remain on top of the soil rather than being plowed or disked into the soil. The new crop is planted into this stubble or small strips of tilled soil. Weeds are controlled with cover crops or herbicides rather than by cultivation. Fertilizer and lime are either incorporated earlier in the production cycle or placed on top of the soil at planting.

A sequence of changing tillage practices in several watersheds in Oklahoma enabled comparison of surface water and ground water effects associated with native grasses, conventionally tilled wheat and no-till wheat. Conversion of native grasses to conventionally tilled wheat increased soil loss dramatically. In areas where no-till cultivation was practiced, however, dramatic soil losses were minimized. Substantial reductions in nutrient runoff were a consequence of soil retention, and soil moisture increased as an added benefit.

Reduced tillage practices in agronomic crops from forages such as corn, wheat and other forage species were introduced more than 50 years ago to conserve soil and water. Experience over that 50 years has proven crops grown without tillage use water more efficiently, the water-holding capacity of the soil increases and water losses from runoff and evaporation are reduced. For crops grown without irrigation in drought-prone soils, this more efficient water use can translate into higher yields. In addition, soil organic matter and populations of beneficial insects are maintained, soil and nutrients are less likely to be lost from the field and less time and labor are required to prepare the field for planting. In general, the greatest advantages of reduced tillage are realized on soils prone to erosion and drought.

There also are disadvantages of conservation tillage, however. Potential problems are compaction, flooding or poor drainage, delays in planting because fields are too wet or too cold, and carryover of diseases or pests in crop residue. A further consideration is the difficulty of planting typical no-till systems, the field is prepared for planting by killing the previous crop with herbicidal desiccants such as glyphosate (for example, Roundup) or gramoxylin (for example, Paraquat). The no-till seeders available for agronomic crops were designed to plant into these dried residues. Recently, agronomists have been developing no-till systems where cover crops are planted for weed control and then killed with flail or other types of mechanical cutters instead of herbicides. No-till seeders must be modified to work on these tougher residues.

This practice may be applied as part of a conservation management system to supplement one or more of the following:

- Reduce sheet and rill erosion.
- Maintain or improve soil organic matter content and tilth.
- Conserve soil moisture.
- Provide food and cover for wildlife.

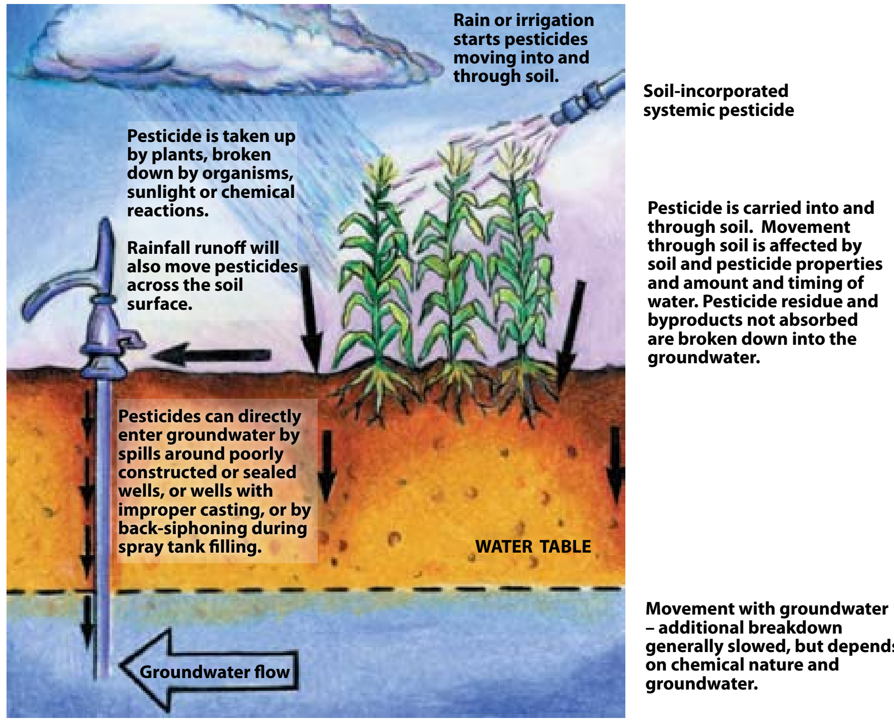
## Irrigation Water Quality

Irrigation water (surface and/or well) should be tested in the spring to determine the salinity (salt) level before irrigating a field or pasture. Take samples to an approved laboratory for analysis.

# Pesticide Management and Pesticides

## Introduction

To preserve the availability of clean and environmentally safe water in Louisiana, contamination of surface water and groundwater by all agricultural and industrial chemicals must be reduced. Some sources of contamination are easily recognizable from a single, specific location. Other sources are more difficult to pinpoint. Nonpoint-source pollution of water with pesticides is caused by rainfall runoff, particle drift or percolation of water through the soil. Pest management practices should be based on current research and extension recommendations. By using these recommendations, pesticide use will follow environmentally sound guidelines.




## Pest Management Procedures

Pesticides should be applied only when they are necessary to protect the crop. The pesticide should be chosen following guidelines to assure that the one chosen will give the most effective pest control with the least potentially adverse effects on the environment.

Water quality, both surface and ground, will be protected by following all label recommendations and guidelines dealing with water quality.

- Carefully read all label statements and use directions designed specifically to protect groundwater.
- Closely follow specific best management practices designed to protect surface water.
- Use erosion control practices (such as pipe drops, etc.) to minimize runoff that could carry soil particles with adsorbed pesticides and/or dissolved pesticides into surface waters.

## Pesticide Application

Management practices such as the pesticide selected, the application method, the pesticide rate used and the application timing influence pesticide movement. Pesticides should be applied only when needed to prevent economic loss of a crop.

In pesticide application, "the label is the law." Using chemicals at rates higher than specified by the label is ILLEGAL as well as an environmental hazard because more pesticide is exposed to erosion, runoff or leaching. Poor timing of a pesticide application (application just before rain falls) can result in pesticide movement into water sources, as well as give little control of the targeted pest.

Certain areas on your farm, such as streams and rivers, wellheads and lakes or ponds, are sensitive to pesticides. You should create buffer zones around these areas where pesticide use will be reduced or eliminated. By buffering these areas, you may reduce water quality problems. Areas such as roads, off-site dwellings and areas of public gatherings should be identified. You may want to limit the use of pesticides near these types of areas, too.

## Follow these practices:

- Select the pesticide to give the best results with the least potential environmental impact outside the spray area.
- Select application equipment with care and maintain it carefully.
- Carefully calibrate application equipment at the beginning of the spray season and periodically thereafter. Spray according to recommendations.
- Minimize spray drift by following the label instructions and all rules and regulations developed to minimize spray drift (the physical movement of spray particles at the time of or shortly after application).

- Before applying a pesticide, make an assessment of all of the environmental factors involved in all of the area surrounding the application site.
- Carefully maintain all pesticide applications, not just restricted use pesticides.

# Pesticide Selection

When selecting pesticides, consider chemical solubility, adsorption, volatility and degradation characteristics. Chemicals that dissolve in water readily can leach through soil to groundwater or be carried to surface waters in rainfall or irrigation runoff. Some chemicals hold tightly to, or are adsorbed on, soil particles, and these chemicals do not leach as much. But even these chemicals can move with sediment when soil erodes during heavy rainfall. Runoff entering surface waters may ultimately recharge groundwater reserves. Chemicals bound to soil particles and organic matter are subject to the forces of leaching, erosion or runoff for a longer period, thus increasing the potential for water pollution.

When selecting pesticides:

- Base selections on recommendations by qualified consultants, crop advisors and published recommendations of the LSU AgCenter / Louisiana Cooperative Extension Service.
- Select the pesticide to be used based on its registered uses and its ability to give the quality of pest control required.
- Consider the effects a pesticide may have on beneficials (beneficial insects), other non-target organisms and on the general environment.

# Pesticide Storage and Safety

Farmers and commercial pesticide applicators are subject to penalties if they fail to store or dispose of pesticides and pesticide containers properly. Each registered pesticide product, whether general or restricted use, contains instructions for storage and disposal in its labeling. The Louisiana Pesticide Law addresses specific requirements for storage and disposal. The applicator must follow these requirements carefully and ensure that employees follow them as well.

The recommended procedures do not apply to the disposal of single containers of pesticides registered for use in the home and garden. These containers may be disposed of during municipal waste collection if wrapped according to recommendations.

For other containers, storage sites should be chosen to minimize the chance of pesticides escaping into the environment. Pesticides should not be stored in an area susceptible to flooding or where the characteristics of the soil at the site would allow escaped chemicals to percolate into groundwater. Storage facilities should be dry, well ventilated and provided with fire protection equipment. All stored pesticides should be carefully labeled and segregated and stored off the ground. Do not store pesticides in the same area as animal feed. The facility should be kept locked when not in use. Further precautions include appropriate warning signs and regular inspection of containers for corrosion or leaks. Protective clothing should be stored close by but not in the same room as the pesticides to avoid contamination of the protective clothing. Decontamination equipment should be present where highly toxic pesticides are stored.

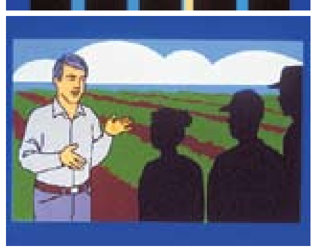
## Exceptions for Farmers

Farmers disposing of used pesticide containers for their own use are not required to comply with the requirements of the hazardous waste regulations provided they triple rinse or pressure wash each container and dispose of the residues on their own farms in a manner consistent with the disposal instructions on the pesticide label. Note that disposal of pesticide residues into water or where the residue is likely to reach surface water or groundwater may be considered a source of pollution under the Clean Water Act or the Safe Drinking Water Act and therefore is illegal.

After the triple-rinse procedure, the containers are then "empty," and the farmer can discard them in a sanitary waste site without further regard to the hazardous waste regulations. The empty containers are still subject to any disposal instructions contained within the labeling of the product, however. Disposal in a manner "inconsistent with the labeling instructions" is a violation of EPA guidelines and could lead to contamination of water, soil or persons and legal liability.

## Agricultural Chemicals and Worker Safety

The EPA has general authority to regulate pesticide use to minimize risks to human health and to the environment. This authority extends to the protection of farm workers exposed to pesticides. All employers must comply with ALL instructions of the Worker Protection Standard concerning worker safety or be subject to penalties. Labels may include, for example, instructions requiring the wearing of protective clothing, handling instructions and instructions setting a period of time before workers are allowed to re-enter fields after the application of pesticides (Restricted Entry Interval).



Employers should read the Worker Protection Standard regulations governing the use of and exposure to pesticides. The regulations set forth minimum standards that must be followed to protect farm workers and pesticide handlers. The regulations include standards requiring oral warnings and posting of areas where pesticides have been used, training for all handlers and early re-entry workers, personal protective equipment, emergency transportation and decontamination equipment.


The EPA regulations hold the producer on a farm, forest, nursery or greenhouse ultimately responsible for compliance with the worker safety standards. This means the landowner or producer must ensure compliance by all employees and by all independent contractors working on the property. Contractors and employees also may be held responsible for failure to follow the regulations.

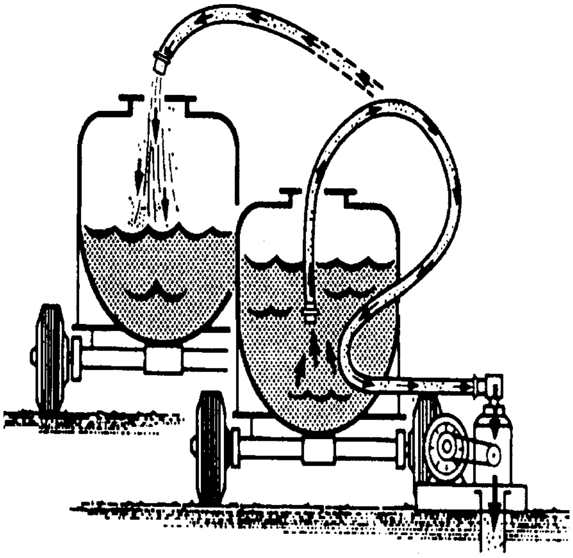
## The Occupational Safety and Health Act (OSHA)

The federal government also regulates farm employee safety under the Occupational Safety and Health Act (OSHA). OSHA applies to all persons (employers) engaged in business affecting interstate commerce. The federal courts have decided that all farming and ranching operations, regardless of where goods produced are actually sold or consumed, affect interstate commerce in some respect and thus are subject to OSHA's requirements. In general, every employer has a duty to provide employees with an environment free from hazards that are causing or are likely to cause death or serious injury.

# Pesticide summary:

- All label directions should be read, understood and followed.
- The Louisiana Department of Agriculture and Forestry (LDAF) is responsible for the certification of pesticide applicators in Louisiana. All commercial and private pesticide applicators applying restricted use pesticides must successfully complete a certification test administered by the LDAF. The LSU AgCenter conducts training sessions and publishes study guides in various categories covered by the test. Contact your LSU AgCenter county agent for dates and times of these sessions.
- All requirements of the Worker Protection Standard (WPS) should be followed, including, but not limited, to:
  - Notifying workers of a pesticide application (either oral or posting of the field).
  - Abiding by the restricted entry interval (REI).
  - Maintaining a central notification area containing the safety poster; the name, address and telephone number of the nearest emergency medical facility; and a list of the pesticide applications made within the last 30 days that have an REI.
  - Maintaining a decontamination site for workers and handlers.
  - Furnishing the appropriate personal protective equipment (PPE) to all handlers and early entry workers and ensuring that they understand how and why they should use it.
  - Assuring that all employees required to be trained under the Worker Protection Standard have undergone the required training.
- Pesticides should be stored in a secure, locked enclosure and in a container free of leaks, abiding by any specific recommendations on the label. The storage area must be maintained in good condition, without unnecessary debris. This enclosure should be at least 150 feet away and down slope from any water wells.

- All uncontained pesticide spills of more than one gallon liquid or four pounds dry weight will be reported to the director of Pesticide and Environmental Programs with the Louisiana Department of Agriculture and Forestry within 24 hours by telephone (225-925-3763) and by written notice within three days. Spills on public roadways will be reported to the Louisiana Department of Transportation and Development. Spills into navigable waters will be reported to the Louisiana Department of Environmental Quality, U.S. Coast Guard, U.S. EPA.
- Empty metal, glass or plastic pesticide containers should be either triple rinsed or pressure washed, and the rinsate will be added to the spray solution to dilute the solution at the time or stored according to the LDAF rules to be used later. Rinsed pesticide containers will be punctured, crushed or otherwise rendered unusable and disposed of in a sanitary landfill. (Plastic containers may be taken to specific pesticide container recycling events. Contact your county agent for dates and locations in your area.)
- All pesticides should be removed from paper and plastic bags to the fullest extent possible. The sides of the container should be cut and opened fully, without folds or crevices, on a flat surface; any pesticides remaining in the opened container should be transferred into the spray mix. After this procedure, the containers may be disposed of in a sanitary landfill.



- Application equipment should be triple rinsed and the rinsate applied to the original application site or stored for later use to dilute a spray solution.
- Mix/load or wash pads (NRCS production code Interim) should be located at least 150 feet away and down slope from any water wells and away from surface water sources such as ponds, streams, etc. The pads should be constructed of an impervious material, and there must be a system for collecting and storing the runoff.
- Empty containers will not be kept for more than 90 days after the end of the spray season.
- Air gaps should be maintained while filling the spray tank to prevent back-siphoning.

*The complex nature of nonpoint pollution means programs designed to reduce its impact on the environment will not be easy to establish or maintain. Controlling these contaminants will require solutions as diverse as the pollutants themselves. Through a multi-agency effort, led by the LSU AgCenter, these BMP manuals are targeted at reducing the impact of agricultural production on Louisiana's environment. Agricultural producers in Louisiana, through voluntary implementation of these BMPs, are taking the lead in efforts to protect the waters of Louisiana. The quality of Louisiana's environment depends on each of us.*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