Sustainable Best Management Practices for Beef Production

LSU AgCenter Research & Extension

BMPs

Louisiana Department of Agriculture and Forestry

NRCS

Farm Bureau Louisiana

Table of Contents

1. Why BMPs Are Important to Louisiana 2
2. Introduction 3
3. The Practical Side of BMPs 4
4. Whole Farm Nutrient Planning 5
5. Beef Management Practices 9
6. Livestock Mortality Management 15
7. Soil Testing 16
8. Manure Sampling 17
9. Managing Water Sources 19
10. Buffers and Field Borders 22
11. Manure Application. 24
12. Farmstead Management 27
13. Odor Prevention 30
14. Responding to Complaints. 31
15. Record Keeping 32
16. Pesticide Management and Pesticides 33

1. Why BMPs Are Important to Louisiana

Louisiana is 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 ensuring an abundant and 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 always have been an important part of the LSU AgCenter's mission. Working with representatives from agricultural commodity groups and the U.S. Department of Agriculture's Natural Resources Conservation Service, Louisiana Department of Environmental Quality, Louisiana Farm Bureau Federation and Louisiana Department of Agriculture and Forestry, the LSU AgCenter has taken the lead in assembling a group of best management practices, also known as BMPs, for each agricultural commodity in Louisiana.

BMPs are practices used by agricultural producers to control the generation and transmission of pollutants from agricultural activities to water resources of the state. By exercising such controls, producers 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 the accompanying standards and specifications are published by the Natural Resources Conservation Service in its Field Office Technical Guide.

2. Introduction

The cattle industry in the southeastern United States is predominately comprised of cow-calf production systems, and the vast majority of those are small- and medium-size beef cattle producers. The number of farms in Louisiana where beef cows and heifers first calved in 2007 and their distribution based on herd size is shown in Table 1.

Louisiana producers generally have small numbers of cows, with approximately 80 percent having less than 50 productive females and approximately 50 percent having less than 20 females. Approximately 90 percent of the calves weigh less than 500 pounds at weaning.

Table 1. Number of farms distributed by beef cow herd size for Louisiana.

Number of farms with beef cow herd size of:	Louisiana
1 to 9	3,565
10 to 19	2,667
20 to 49	3,536
50 to 99	1,469
Total herds	12,355

Producers with cow-calf herds containing less than 50 cows are concerned with rising production costs and, in some cases, a decreasing opportunity to buy land. Without the economy of scale needed to spread costs over a larger herd, the profitability of the small cow-calf herd becomes questionable, especially with increasing feed, fuel and fertilizer costs. Therefore, profitability and the rising cost of land are threats to these producers.

Improving genetics, adapting to change and continuing education are viewed as ways to make improvements. Producers see a tremendous opportunity to improve, but economics alone does not affect their production management decisions. Often, management practice decisions are based on time limitations because many of these producers have a different primary job either off or on the farm. Therefore, the time these producers can devote to the beef cow herd is limited.

Best management practices, or 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 livestock 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 list of BMPs is a guide for the selection and implementation of those practices that will help cattle farmers conserve soil and protect water and air resources by reducing pollutants that can reach both surface water and groundwater.

3. The Practical Side of BMPs

By implementing or using best management practices, Louisiana cattle 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 beef producer can strive for, both from an economical and environmental perspective. 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/ranch and into rivers and streams is a financial loss to the operation. Soil lost in this manner can never be used by the cattle producer 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 increasing the turbidity of water, reducing light penetration, impairing photosynthesis and altering oxygen relationships (which 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, in some situations and given a long enough period of time, partially fill lakes and reservoirs.

In addition, sediment often is 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 important to livestock operators. Cattle producers should practice all cost-effective methods to ensure all waste 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 use for swimming, water contact or fishing. Not all of this pollution can be attributed to livestock operations, but in the public's minds, livestock 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. In fact, 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, the Louisiana Department of Health and Hospitals states 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 cattle 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, DHH may issue advisories or closures of affected surface waters. Additionally, manure runoff also contains nitrogen and phosphorus and can result in nutrient overenrichment of water bodies, which can cause algae blooms and oxygen depletion in surface waters and result in killing of fish and other aquatic animals.

Nutrient management is another profoundly important aspect of livestock operations, and much attention is given to this aspect of cattle management in this manual. Excessive nutrient runoff can cost the farm significant amounts of money. Often, without a sound, comprehensive nutrient management plan, cattle 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, however, can accelerate algae and plant growth in streams and lakes, resulting in oxygen depletion or critically low dissolved oxygen levels. Often referred to as nutrient overenrichment or hypoxia, it is a major concern in many water bodies of Louisiana and the Gulf of Mexico.

4. Whole Farm Nutrient Planning

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

Manure is an excellent source of organic nutrients that can be incorporated into most farming operations when properly managed. For cattle producers, the proper management of manure 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 is offered as a material in an alternative use process, the proper management of the manure is essential. Storage, transportation, application, disease prevention and proper documentation are just a few of the items that need to be included in the manure 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 comprehensive nutrient management plan. The best plan is one that is matched to the farming operation and the needs of the person implementing the plan.

A comprehensive nutrient management plan 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, animal manures 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 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 comprehensive nutrient management plan and is important to understand for your individual farming operation.

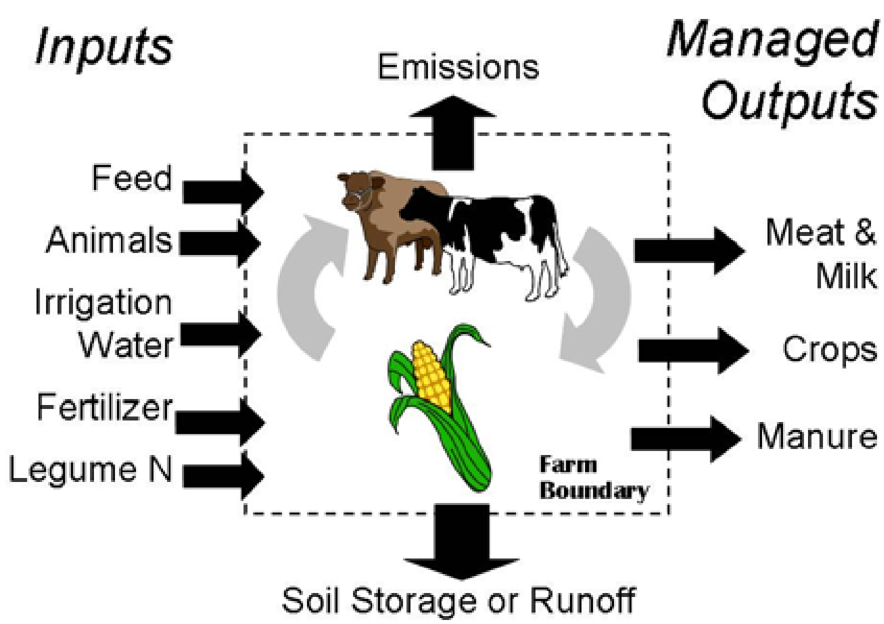
Whole Farm Nutrient Balance

Nutrients are transported along multiple pathways and in a variety of forms on a livestock operation. Our tendency is to focus on a small part of the total picture, such as the nutrients in manure and their loss into the environment. An understanding of the big picture is necessary, however, to identify 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 livestock 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 livestock production that accumulate in soils as well as those nutrients that escape into the environment.

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

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.



turn recycled as animal feed for livestock or poultry production.

Nutrients exit a livestock operation preferably as "managed outputs" including animals and crops sold and possibly other products moved off farm (for example, manure 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. Livestock operations with a significant imbalance are concentrating nutrients, resulting in increased risk to water quality. In contrast, livestock 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 livestock operation and water flow in a farm pond (Figure 2). The farm pond is the equivalent of a livestock 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 livestock 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 in a pond, 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 the imbalance of water. A sustained nutrient imbalance leads to nutrient contamination of water.

Figure 2. A farm pond as a sustainability illustration.

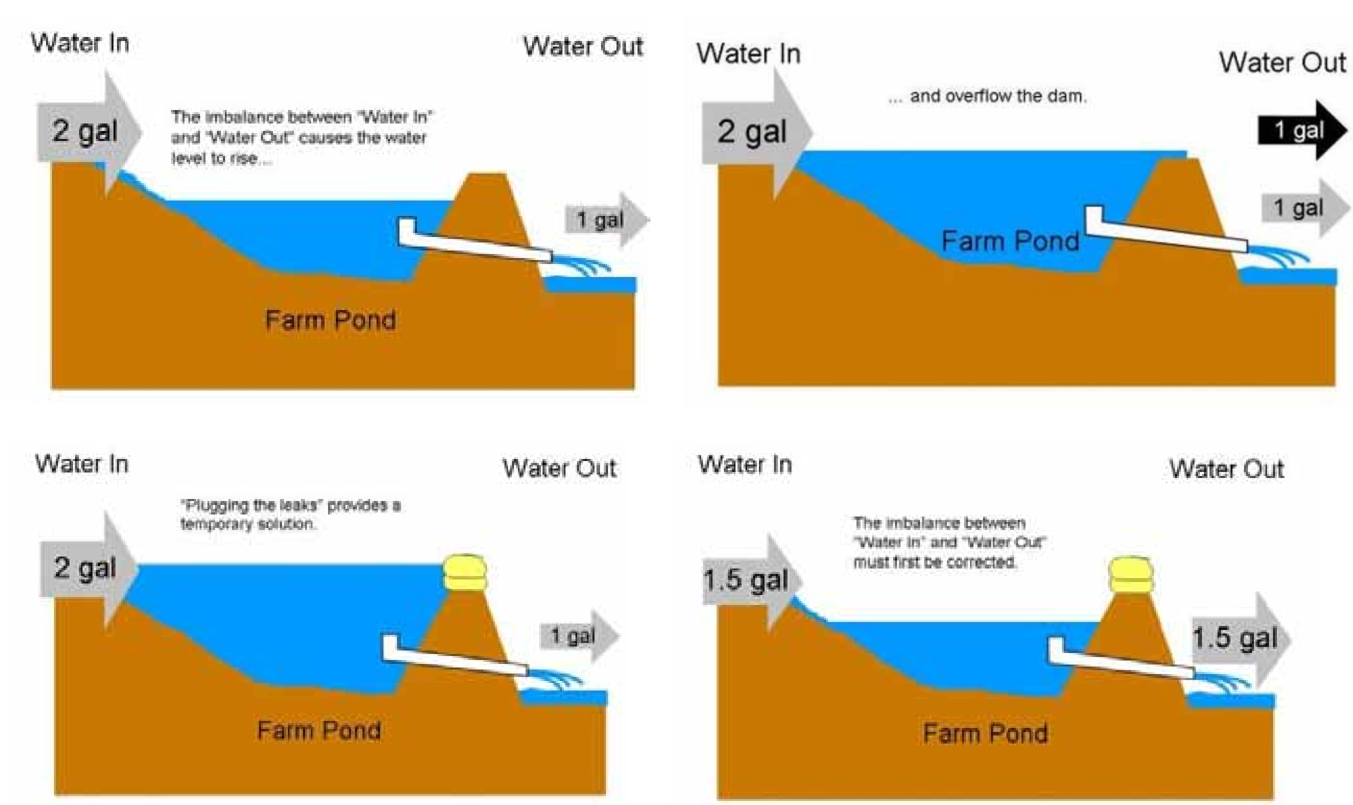
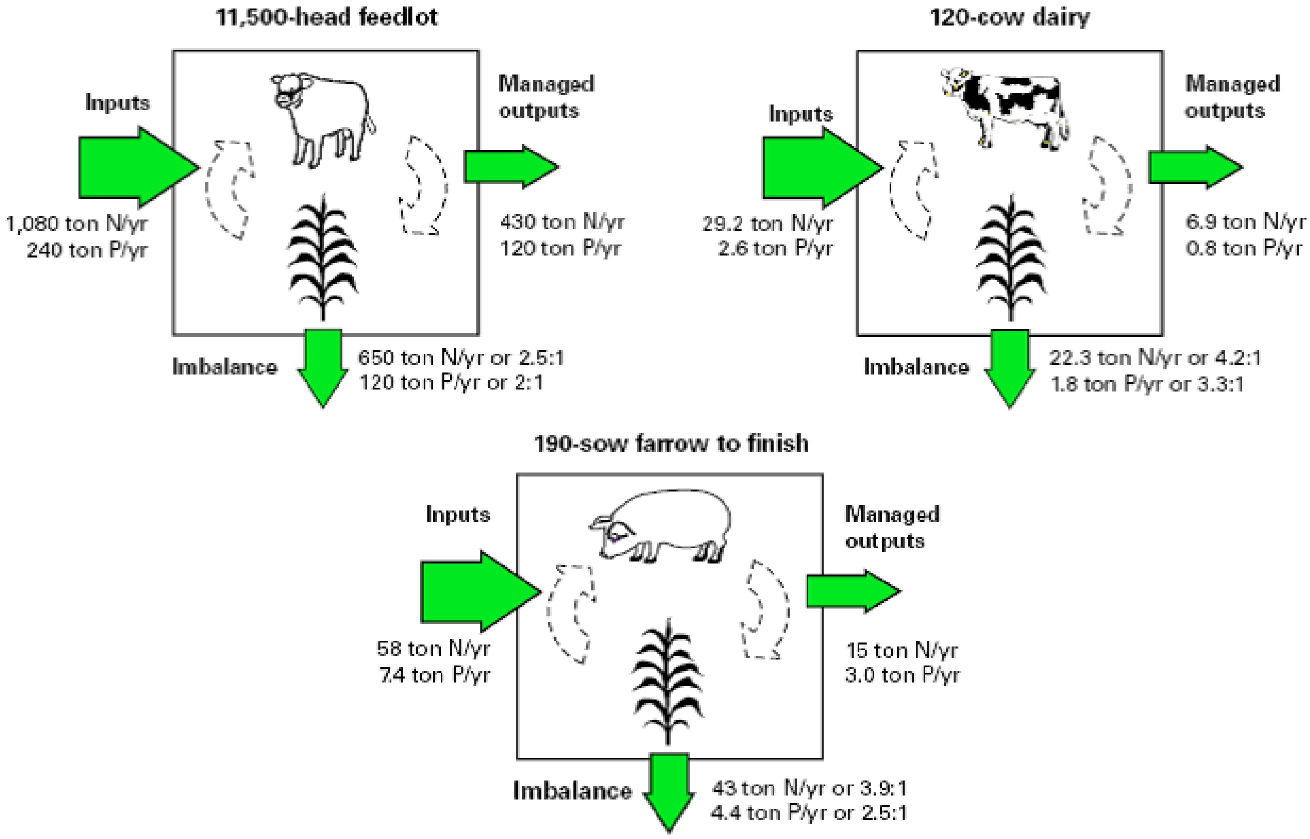


Figure 3. Typical nutrient imbalance observed for several different livestock systems.



Sandbags provide a temporary solution to this problem in a pond. If the water imbalance is not corrected, however, the water level eventually exceeds what the sandbags can hold back. Many current best management practices or BMPs for manure handling focus on plugging leaks without correcting the origin of the imbalance. BMPs such as grass filter strips, prohibiting applications on frozen soil or soil erosion control do not correct the imbalance and provide only short-term benefits.

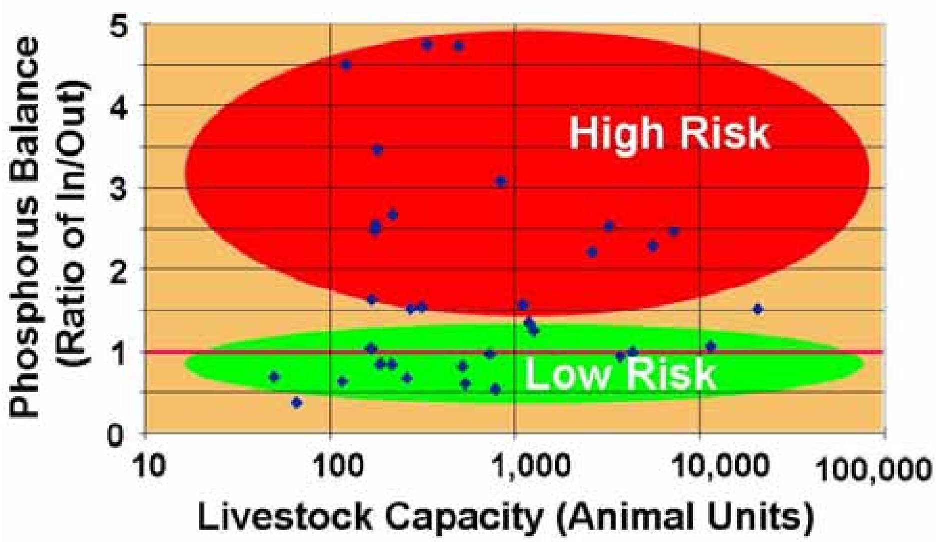
Ultimately, the imbalance of water flows must be corrected to save the dam and the property downstream. To achieve a balance, the quantity of water entering the pond needs to be reduced and/or the water exiting the outlet pipe must be increased. Similarly, nutrient management planning must ensure a whole farm nutrient balance. The nutrients arriving on farm must roughly balance 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 three to one (3:1) 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.

Typical Nutrient Balances

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

Figure 4. Phosphorus balance versus size for 33 Nebraska livestock operations.



Size generally is a poor indicator of the nutrient imbalance in livestock 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 livestock operations as shown in Figure 4. Many of the operations involved in this study experienced a phosphorus balance near the ideal 1:1 ratio while some exceeded ratios of 4:1. Several of the worst imbalances were observed for livestock operations with less than 1,000 animals.

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 N2 gas) and the relatively harmful environmental losses (for example, nitrate loss to water or ammonia volatilization). In contrast, phosphorus losses affect only 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 1:1 ("low risk" group in Figure 4) have the potential to be environmentally sustainable. Since soil is the primary reservoir for phosphorus, average soil phosphorus should not increase for an input-output ratio near 1:1. If manure is managed appropriately within the available land base, the nutrient-related water quality risk should not increase.

Livestock operations with a large imbalance (1.5:1 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 be corrected before this growing pollution potential will stabilize. These "high risk" operations are not environmentally sustainable.

BMPs also are important to a successful comprehensive nutrient management plan and help us manage the imbalances on livestock farms. BMPs, such as soil testing and manure 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 must be included in a comprehensive nutrient management plan for cattle operations, too.

5. Beef Management Practices

Hay Management

Feeding hay is a fact of life in cow/calf production. There are two primary times of year during which hay usually is fed as a supplement for cattle in Louisiana – during late summer and winter. Hay comes in various shapes and sizes.

The creation of the round bale has been a blessing and a curse. The convenience of a round bale allows you to feed hay for multiple days with one trip. This convenience can also be a detriment, however, because cattle may waste more hay than they consume. Reports have shown that 2 percent to 60 percent of the hay fed in rings can be lost.

This wasted hay then becomes a liability because it can harbor stable flies and/or be a source for runoff pollutants since it contains bacteria and nutrients. In addition to the potential environmental effects from the waste that can occur during feeding, there also are consequences from the increase in manure in the feeding area. Aside from the potential money lost in wasted hay, the accumulation of this hay and manure can create environmental conditions that can potentially increase pathogenic soil bacteria and become favorable for stable fly production.

Hay Waste

Researchers at Purdue University have shown that cattle will waste less hay if fed a controlled amount per day. Researchers at Michigan State University also have shown that the type of feeder you use can influence the amount of hay wasted. They compared ring, cradle, trailer and cone style feeders. The amount of hay wasted was 6.1, 3.5, 14.6 and 11.4 percent, respectively, for each type.

The hay and manure that can potentially accumulate at an unmanaged feeding site also can contribute to a significant increase in fecal-borne bacteria and nutrients such as phosphorous, sulfur and potassium. In 1995, Kansas State University researchers showed these accumulations can stretch up to 100 feet from the feeding site.

In another report, Kansas State University researchers predicted that one round bale feeding site could produce 1 million stable flies, since field studies showed as many as 364 flies emerging from 1 square foot of feeding site.

Another way to more efficiently feed hay is through limiting the amount of time cattle have access to feed. A study conducted at the University of Illinois at Urbana-Champaign showed cows can be limited to three hours of feeding time and maintain acceptable performance levels.

While accumulations are to be expected as animal feeding activity increases in an area, the potential for nonpoint pollution can be reduced by following a few best management practices. These practices include moving feeding sites numerous times during the season, composting these sites to kill any harmful bacteria or by burning these sites at the end of the season. It also is recommended to locate round bale feeding sites at least 100 feet away from riparian areas to prevent runoff from the feeding site from reaching the watershed area.

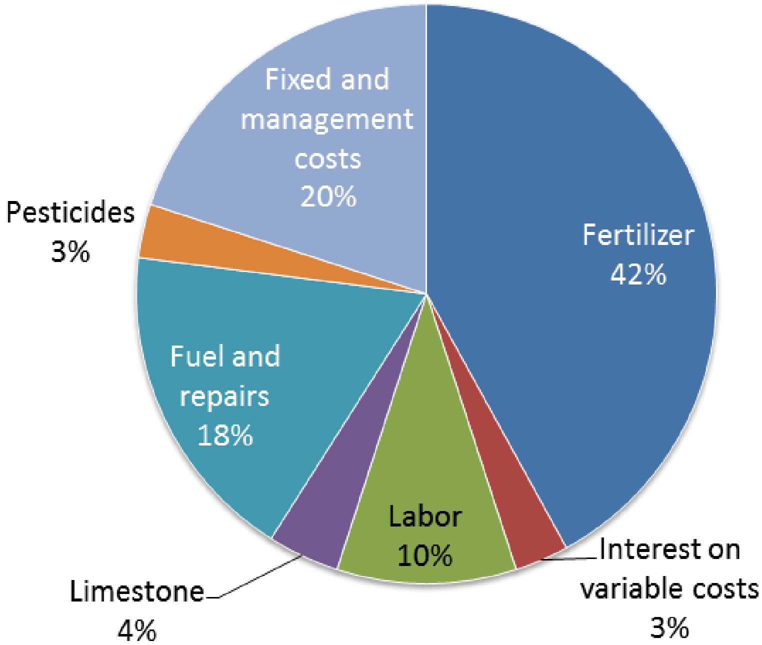
Almost all cattle producers will use hay in their operations at some point. Reducing the amount of hay waste can help keep the environment clean and most certainly can put more money in your pocketbook.

Practical Recommendations

- Feeding sites from round bale and other types of feeders are potential areas of nutrient accumulation and breeding grounds for stable flies. Removing these sites at the end of the feeding period or moving the feeding site during the feeding period can reduce or eliminate this potential.
- Round bale feeding sites should be placed at least 100 feet away from any watershed or riparian areas.
- Round bale feeding sites should be managed by either burning or by piling waste into compost and later spreading it after it has composted. These steps can be avoided completely, however, if the site at which the bales are fed is moved often.
- Reduce hay waste by using better feeding equipment or limiting the time cattle have access to the hay.

An important question for a producer with less than 50 cows is whether to produce hay or if he or she is better off buying it. Because of the cost of producing hay (Figure 5) it is highly recommended to do the math and determine the best approach. Among the advantages of purchasing hay are that a producer won't need to invest in haymaking equipment or fertilization or to manage around weather situations (if it rains or not). You also must consider if there is a greater opportunity to use an alternative forage source that could be cultivated where the hay field would be. Conversely, buying hay will require dealing with custom operators or hay buyers, varying hay prices and the quality and quantity availability.

Figure 5. Cost of hay production (adapted from Hancock, 2009).



Management Practices for the Herd

There are a number of management practices a producer with a small number of cows can implement that can improve time management, beef production efficiency and, hopefully, profitability.

Among these is the control of the length of the breeding season. A 75-day breeding season (preferably in spring or early summer for Louisiana) will give the producer the chance to concentrate activities that save time and labor. Advantages include: 1) reduction in the number of times the herd is gathered for vaccinations, de-worming and other activities; 2) uniform calf crop; 3) development of an optimized feeding program and better chance of matching forage availability with herd requirements; 4) better control of animals during calving season; and 5) facilitating record keeping, which is important at the time of making culling decisions.

Beef cattle producers owning small herds also need to consider the possibility of a couple of management practices that can free up land for the cow herd. These are leasing of bulls and/or buying replacement heifers.

Based on the length of a breeding season, a producer "needs" his bull(s) for 75 days while the other 290 days of the year, the animals must be maintained and fed. Small producers may not have enough paddocks to keep the bull(s) separate from the herd. Also, fences, waterers and feeders can be easily torn down. If the producers raise their own heifers, leasing bulls helps prevent inbreeding.

Purchasing replacement heifers, on the other hand, may have several advantages, although this needs to be carefully evaluated by each individual producer. Several factors should be considered if the decision is to purchase them. These include biosecurity, appropriate and adapted source of heifers (including genetics) and the use of resources that otherwise would be used for the rest of the herd.

Management Practices for Pastures and Forage

Use of pasture and forage is the world's most common beef production system. Through photosynthetic processes, green plants combine nutrients obtained from the soil and sunlight to produce plant material and compounds that can be harvested and processed by the ruminant animal into edible tissues. Successful livestock production depends on forage programs that supply large quantities of adequate quality, homegrown feed. Major percentages of the feed units for beef cattle (83 percent) and dairy cattle (61 percent) come from forages. In addition, forages supply an estimated 91, 72, 15 and 99 percent of the nutrients consumed by sheep and goats, horses, swine and ruminant wildlife, respectively.

Forages provide benefits to the local environment. Perennial forage species are deep-rooted and consequently reduce erosion greatly and protect watersheds from flooding. Soil erosion losses from pastures have been estimated to be about 0.3 tons per acre compared to more than 4 tons an acre for other croplands. Extensive root systems of forages add significant amounts of soil organic matter. A three-year-old perennial forage crop has been reported to return more than twice the soil organic matter than annual cereal grain crops. Conservation of energy is another benefit. Nutrient recycling from grazing animals lowers fertilizer inputs compared to row crop production, and pesticide use tends to be lower on grasslands than other crop areas.

Though there are advantages, grazing programs using small-grain forages have faced several challenges, including too much or too little precipitation, which can cause delayed planting, poor growth or muddy conditions. Establishment of annual grasses into living, partially killed or completely killed perennial sods is becoming increasingly possible with a combination of ecological strategy, conservation tillage and herbicide-resistant plant varieties.

The benefits of conservation tillage are numerous and include: 1) reduction in fuel, time and labor necessary to manage crops; 2) reduction in machinery wear; 3) more timely planting under wetter soil conditions; 4) improvement in soil and water quality;

5) reduction in soil erosion; 6) reduction in water runoff and more effective use of precipitation and 7) improvement in wildlife habitat. Increased costs of equipment, fuel and labor have raised questions about whether conventional tillage methods are the best option. In the southeastern United States, and Louisiana is no exception, areas with shallow, erosive soils generally are used for grazing. Therefore, farmers are urged to adopt conservation-tillage systems such as no tillage or reduced tillage. No-tillage techniques can maintain soil moisture and improve seedling establishment when precipitation is lacking. In addition, no tillage is an economically sound alternative to conservation tillage because of reduced labor, machinery and fuel costs. Cattle producers are reluctant to implement conservation-tillage practices, however, due to fears of reduced forage yields. Many soil conservation practices (contour tillage, reduced tillage and no tillage) also help prevent soil loss from wind and water erosion.

Forage composition influences intake, digestion rate, rate of passage and nutrient-use efficiency. Forage plants differ in available energy derived from total nonstructural carbohydrates, fiber digestibility and protein degradation in the rumen. Botanically diverse pastures can extend the grazing season, improve system stability and help meet season-long nutritive demands of cattle. Intensive rotational pasture stocking and interseeding or overseeding can improve forage nutritive value and herbage distribution over the grazing season. Additionally, grazing animals distribute manure across the field with minimal attention needed by the farmer or rancher, which contributes to soil fertility and reduces purchased fertilizer inputs. The nitrogen to energy ratio in grazed herbage often is not balanced for efficient capture of forage nitrogen by livestock, however. Forage combinations can be created to improve the nitrogen to energy ratio. Legumes added to forage-based diets improve overall weight gain of ruminants.

Legumes are an important component of a grazing system because they extract atmospheric nitrogen and convert it to plant-available forms within their roots. The amount of nitrogen fixed by legumes varies among species due to soil conditions, amount of available water and other seasonal factors. It can range from 9 to more than 121 pounds of nitrogen per acre per year. A Texas study found that adding a cool-season clover to a warm-season perennial grass extended the grazing season, raised the nutritive value higher than the grass alone and provided excellent summer weed control.

There are many factors affecting forage quantity and nutritive value of pastures including species and cultivar selection, defoliation frequency, grazing method and fertilization. A management strategy that has been shown to have a disproportionately large effect on forage and associated animal responses is grazing intensity, which can be expressed as stocking rate, forage mass, canopy height, forage allowance and grazing pressure.

Research, demonstrations and farmer experiences have documented the positive contributions of legumes in grass pastures. Adding legumes to hay and pasture fields provides at least four major benefits:

1) **Higher yields:** Adding legumes (red clover) can produce more forage mass than high fertilization rates (73 pounds of nitrogen per) of grasses (tall fescue).
2) **Improved quality:** Adding legumes to grass fields improves forage quality over grass alone. This added quality includes increases in palatability, intake, digestibility and nutrient content. The result is improved animal performance.
3) **N fixation:** Legumes get their nitrogen needs from symbiotic bacteria that live in nodules on their roots. These bacteria are added when legume seed is inoculated. This "fixed" nitrogen provides the nitrogen needed by the legumes and also by grasses growing with them.
4) **Legumes in rotations:** In general, any nonlegume crop following legumes will show improved production. Legumes can provide nitrogen for the following crop, help break disease and insect cycles, improve soil conditions, reduce erosion and potentially improve profit. Different legumes are able to "fix" different amounts of nitrogen. Alfalfa usually fixes the most, while annual legumes fix the least – red and white clover can fix 30 to 81 pounds of nitrogen per acre.

Forage Quantity

From 60 to 90 percent of the variation in average daily gains usually is quite well explained by pasture availability or allowance. The pattern of response often shows linear increases in average daily gains to increasing forage quantity when quantity is low, but as forage quantity reaches greater levels the average daily gain response typically plateaus. Whether the animal response may reveal no detectable relationship between forage quantity and average daily gains, however, is evaluated only at greater levels of forage mass and allowance. The forage mass at which quantity no longer affects average daily gains will differ for different forages, but it likely will occur when animals have opportunity for selection and intake when they choose.

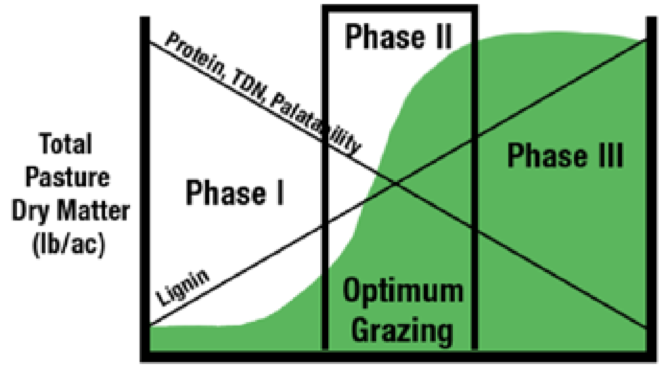
Forage Nutritive Value

On the other hand, forage nutritive value may explain more than 50 percent of variation in average daily gains when quantity is not limiting. Across a wide range in quantity, including low forage mass, there may be no detectable relationship between nutritive value and average daily gains because of the overriding influence of forage quantity. This means that nutritive value sets the upper limit on individual animal performance. Nutritive value determines the forage mass at which average daily gains plateau, with forages of greater nutritive value requiring less forage quantity to reach maximum average daily gains.

A conclusion that forage quantity is the only important driver of average daily gain response to stocking rate is too simplistic, however, and is inaccurate. Nutritive value sets the upper limit for individual animal response (e.g., average daily gain), the slope of the decline in average daily gains with increasing stocking rates and the forage mass at which the decline in average daily gains begin. Forage quantity determines the proportion of potential average daily gain response that actually will be achieved for a given forage, and it is the primary driver of the direction of the average daily gain response (negative) to increasing stocking rates.

Figure 6 shows a representation of what can be expected in terms of forage mass and nutritive value through a growing season or regrowth after grazing. In Phase 1, the rate of growth is small and nutritive value characteristics are the highest and lignin (a nondigestible entity) is lowest while crude protein content, total digestible nutrients, digestibility and palatability present the highest values. At this stage, plants also are immature and low in total production. The root system is still developing or recovering during this stage, so grazing management is crucial to allow time for the pasture to grow or recover. As forage is produced, lignin concentration increases while the other variables decrease. As this occurs, nutritive value gradually will decrease. In Phase 2, the forage has increased production through tillering.

Figure 6. Phases of plant maturity (adapted from Nobel Foundation website at www.noble.org).



Although the quality has dropped some due to maturity and stem elongation, the combination of quality and quantity is optimum for grazing, and the root system is normally "replenished." For those of you who make hay, this stage would be the same as right at or just before the grass is in the "boot stage." Phase 3 is characterized by higher quantity, lower digestibility, mature forage with lots of stems and seedheads. The optimum time for grazing is in Phase 2 when there is a fair compromise between forage mass and nutritive value. (Please note, however, that they are not at a maximum.)

A producer should know the forage mass and nutritive value of the pastures being used. This will help a producer understand animal response, and the continuous evaluation of both pastures and animals will increase the efficiency of production for the farm.

If hay or any other conserved forage is used, its nutritive value has major relevance. Producers cannot just assume hay is "good quality." You need to make sure of the levels of protein, digestibility, etc. Appropriate timing of hay making and storage are critical. Assuming these factors have been taken care of, the next step is to know the nutrient concentration. For animals with higher requirements (lactating cows, growing animals), this is even more important. Usually, to cover the animal's requirements, hay has to be supplemented with other feedstuff. Make sure you know the requirements of your cattle as well as the nutritive value of the hay (or other conserved forage like silage or haylage) that you are feeding.

Grazing strategies (grazing methods) should match the unique combination of physical, biotic and management resources and the specific management objectives of each ranch or farm. No two farms have the same resources or management objectives. Therefore, why should they have the same grazing management plans? Grazing plans also change over time as the manager learns and different forage species are used. There is not one unique best management practice or a grazing system "template." A rancher can mix grazing methods – with different grazing methods applied at the same time on different parts of the ranch or on the same area over time.

The complexity of grazing methods and management varies greatly across a gradient from continuous fixed stocking to adaptively managed, intensive, rotational grazing. "Intensive" grazing management as used here refers to the intensity of management required, not to the degree of use of forage. It is extremely important that the producer/manager of the farm knows the resources (fencing, livestock, water availability and quality), principles of plant and animal response to management, time and capital available so he or she can decide on management goals and, at the end, what grazing method to use. The appropriate decisions on this issue can involve such things as changing species composition within a paddock to more productive ones, improve forage utilization and nutritive value, improve gain/acre, wildlife habitat, minimize stored feed and supplements and maximize recycle nutrients. But it can't cure all problems due to overstocking, poor genetics, poor health plan or increased forage production unless it produces a change in plant vigor or change in species composition. Even then, it still may not always increase livestock production.

Beef Cattle Herd Requirements

The largest portion of the energy used in beef production is associated with maintaining the cow herd (Figure 7). The large proportion of the total nutrients associated with the cow herd suggests improving cow nutrient efficiency would greatly contribute to improving overall biological and economic efficiency of beef production. Feed costs account for 60-70 percent of the annual cow cost.

Regardless whether you are considering a fall or spring calving herd, the energy requirement for the cow at each stage is depicted in Figure 8. Energy use by a mature cow can be divided into four general categories. Those are: energy required for 1) activity, 2) maintenance, 3) pregnancy and 4) milk. During pregnancy, there is an important energy need for fetus development, and milk production is another big energy consumer after calving. Energy used for cattle activity is the most variable. Grazing behaviors, terrain, forage availability and water availability all contribute to the variability in activity energy expenditure. Maintenance is the amount of energy the cow needs to "stay alive." Organs and tissues are constantly degrading and reforming and require maintenance energy.

Figure 7. Energy requirements in a beef herd.

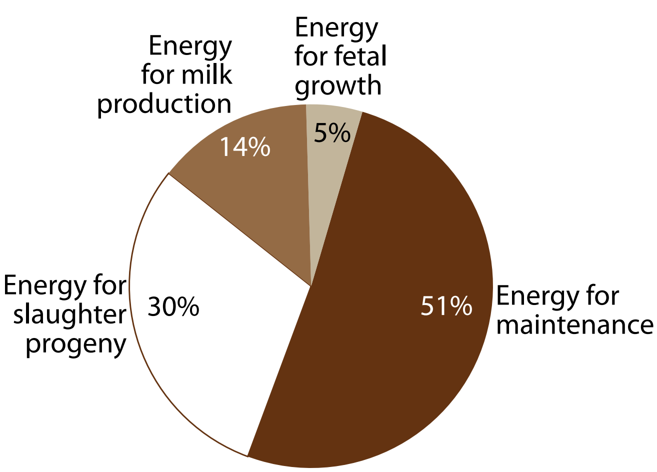
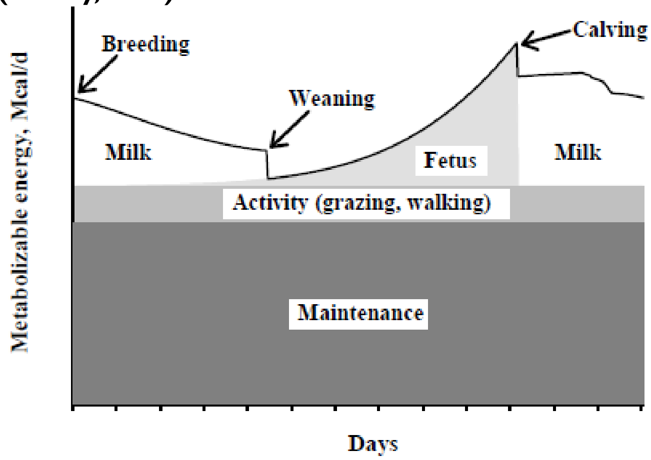


Figure 8. Nutrient requirements of a beef cow (Freetly, 2009).

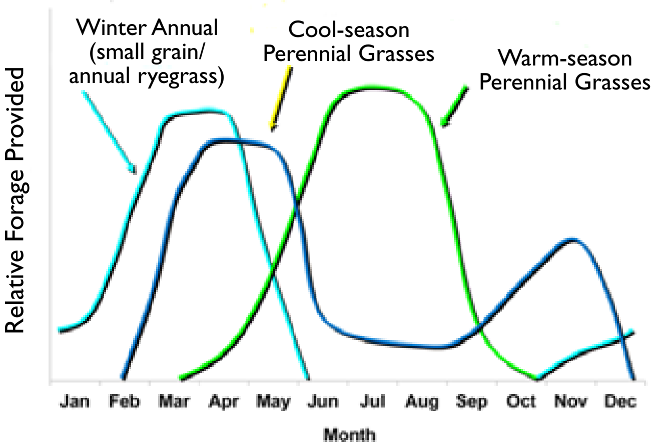


In addition, the gastrointestinal tract needs a lot of energy to keep it up and running. Cow size is the main factor influencing maintenance requirements. Energy dedicated to maintenance and lactation represent two-thirds of the requirements of a beef cow in a year.

Do not rush into reducing the cow size, however, without thinking what may happen. For example, reducing mature cow size also will reduce the size of the offspring at any given age.

All these comments assumed the cow maintains weight during the year, but we know that is not the case all the time. In grazing-based production systems, forage availability is not always enough (quantity) or good enough (nutritive value or quality) to match the requirements of a dam. Due to this, cows will lose and regain weight depending on feed availability. It is widely accepted that cows need to be in a positive energy balance, which means they should be gaining weight, before breeding. The efficiency of "weight cycling" is comparable to maintaining weight and, when timed correctly during the production cycle, it can be used to offer more flexibility in managing feed resources. This is when managing the body condition score or BCS appropriately can help producers save money on feed and have a production herd with good reproductive rates and weaning weights. Body condition scores are excellent indicators of the nutritional status in beef cows. Ideal live weight varies from cow to cow, whereas ideal body condition (BCS 5-6) is the same for all cows. Also, body condition can be measured in the field without gathering or working cattle. Body condition scores are numbers used to estimate energy reserves in the form of fat and muscle

Figure 9. Relative forage production in a year-round system in Louisiana.



of beef cows and range from 1 to 9, with a score of 1 being extremely thin and 9 being very obese. For more information about the use of body condition scores, consult your local LSU AgCenter county agent.

Matching Cow Requirements with Forage Production

Relative forage distribution of annual (winter) and perennial (cool- and warm-season) forages are presented in Figure 9.

Based on Figure 7 and Figure 8, a 75-day breeding season starting in April seems to be the most appropriate "fit" for a beef herd (even though we should agree that it may not be exactly the same in north Louisiana as in south Louisiana).

Cows will start calving in January when winter annuals are starting or are already producing some forage. Maximum production of milk will coincide with a peak in production of high nutritive value pastures.

In north Louisiana, cool-season pastures like tall fescue can be available after the peak of ryegrass. That is not possible in south Louisiana, however. This same tall fescue (as an example) is the one that can provide good grazing from October to December after the warm-season perennials and before the cool-season annuals are available.

In south Louisiana where such a scenario may not be the case, other forage species should be used. Producers should stockpile summer forages – use conserved forages (hay or baleage) with (probably) the need to include some kind of a commercial feed to supplement the animal's diet. The use of conserved forages and supplements will be discussed below.

In a fall calving herd, the last third of gestation occurs during the last few months of perennial grass production. Assuming appropriate grazing management is in place, forage mass is guaranteed, although the nutritive value of this forage should be evaluated. A fall calving herd will wean in May or June; hence calves will graze on high nutritive pastures for the last few months before separation from the dam. If appropriate grazing management has been in place, this may help the weaning weights of calves.

In Figure 10 the percent total digestible nutrients or TDNs for different forages and the requirements of different classes of cattle are shown. As clearly stated, there is no need to have dry cows on high nutritive value pastures. For a cow/calf pair, a good quality pasture is enough to cover the requirements.

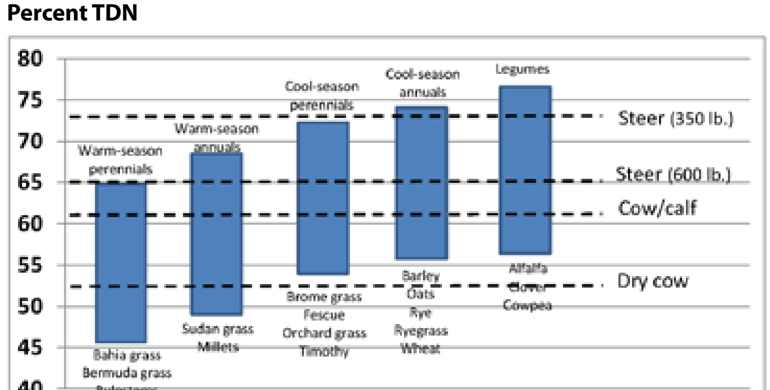
Hay making or hay and supplement purchasing represent a very important decision because that can affect the profitability of the cow/calf enterprise. The first step before this decision is a forage analysis of the forage or hay you have. That evaluation will give you an idea of what nutrient(s) is(are) missing. Knowing this, as well as the cattle's nutrient requirements, a producer can decide if she/he needs to buy a supplement or not to complement the pasture or hay.

To minimize costs, cattle with the same requirements should be grouped together. Placing lactating and dry cows in the same paddock and feeding the same supplement or ration will result in either overfeeding of an expensive feed to the dry cows or underfeeding the lactating cows. The results can be poor cattle performance. Of course, that brings us back to a point about a short breeding season; its advantage is that most the cows could be at the same stage of production.

For more information on beef cattle management, please refer to LSU AgCenter Pub. 2836, "Beef Cattle Production in Louisiana: A Handbook." In addition to being published by the Louisiana State University Agricultural Center, it is endorsed by the Louisiana Beef Industry Council.

Figure 10. Percentage of total daily nutrients supplied by different forages during respective grazing seasons and requirements for different classes of cattle (adapted from Evers, 2008).

Percent TDN



6. Livestock Mortality Management

According to Louisiana Revised Statute 3:2131, animal carcasses must be disposed of by cremation or burial.

The statute reads: "In order to prevent, control and eradicate anthrax or charbon, glanders, blackleg, hemorrhagic septicemia, hog cholera and all other contagious or communicable diseases of mules, horses, cattle, sheep, goats and swine throughout the state, the carcasses of all animals shall be disposed of in a sanitary manner by cremation or deep burial. Burial in this sense means that the animal carcass shall be placed in a hole or pit not less than 6 feet deep in the disposition of carcasses of cows, mules and horses and not less than 4 feet as applying to carcasses of sheep, goats and swine. The owners, agents, firms or corporations, or persons in charge of any or all livestock on ranges, pastures or other premises, shall be responsible for disposition of all carcasses in those herds over which they have jurisdiction, with reference to complying to the provisions of this part. The provisions of this part shall not apply to animal carcasses within the limits of a city or town, which is provided with an incinerator or in which a rendering plant is operated, provided such incinerator or rendering plant is equipped with facilities to properly transport or handle carcasses in a manner to prevent dissemination of infection."

Some parishes have their own regulations dealing with animal mortality. Contact your parish sanitarian to find out your parish's regulations.

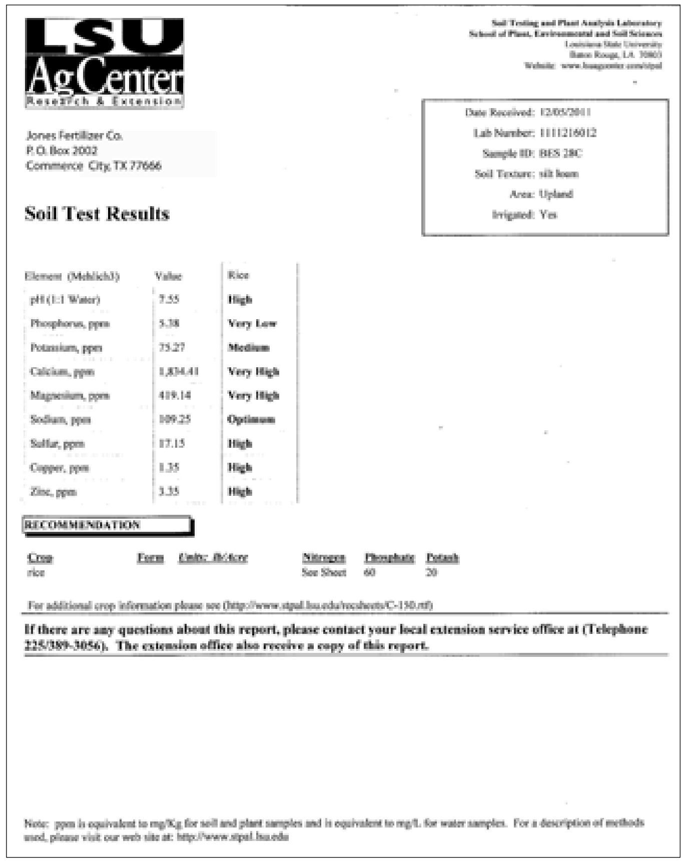
7. Soil Testing

Soil testing is critical to the success of any nutrient management plan and can save you money. Testing can help cattle producers select the right nutrient rate and application strategy, so forage crops or pasture lands use nutrients efficiently. This not only reduces nutrient loss to runoff but increases profitability of beef production.

Soil tests should be conducted at least every two to three years. The county agents in each parish LSU AgCenter Extension Service office can give you advice and assistance on how to take soil samples and where to have them analyzed. They also can help you interpret the results.

Generally, a soil test can be taken successfully by keeping the following 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 so as to make a representative sample.
- Mix all random subsamples from one sampling area thoroughly before filling a sampling carton or container to be mailed to the Lab. For each sampling area, the laboratory 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 you plan to grow. For pastures, and 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.


LSU AgCenter Research & Extension

Soil Testing and Plant Analysis Laboratory
School of Plant, Environmental and Soil Sciences
Louisiana State University
Baton Rouge, LA 70803
Website: www.lsuagcenter.com/stpal

Jones Fertilizer Co.
P.O. Box 2002
Commerce City, TX 77666

Date Received: 12/05/2011
Lab Number: 1111216012
Sample ID: BES 28C
Soil Texture: silt loam
Area: Upland
Irrigated: Yes

Soil Test Results

Element (Mehlich3)	Value	Rice
pH (1:1 Water)	7.55	**High**
Phosphorus, ppm	5.38	**Very Low**
Potassium, ppm	75.27	**Medium**
Calcium, ppm	1,834.41	**Very High**
Magnesium, ppm	419.14	**Very High**
Sodium, ppm	109.25	**Optimum**
Sulfur, ppm	17.15	**High**
Copper, ppm	1.35	**High**
Zinc, ppm	3.35	**High**

RECOMMENDATION

Crop	Form	Units: lb/Acre	Nitrogen	Phosphate	Potash
rice			See Sheet	60	20

For additional crop information please see (http://www.stpal.lsu.edu/recsheets/C-150.rtf)

If there are any questions about this report, please contact your local extension service office at (Telephone 225/389-3056). The extension office also receive a copy of this report.

Note: ppm is equivalent to mg/Kg for soil and plant samples and is equivalent to mg/L for water samples. For a description of methods used, please visit our web site at: http://www.stpal.lsu.edu

8. Manure Sampling

Proper sampling is the key to reliable manure analysis. Although lab procedures are accurate, they have little value if the sample fails to represent the manure product.

Manure samples submitted to a lab should represent the average composition of the material that will be applied to the field. Reliable samples typically consist of material collected from a number of locations. Precise sampling methods vary according to the type of manure. The lab, extension agent or crop consultant should have specific instructions on sampling, including proper containers to use and maximum holding or shipping times.

The key to sampling manure piles is to collect multiple samples (as described below) 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.

Your local extension agent can help you interpret the results of your manure.

General sampling recommendations include:

Equipment Needed:

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

Procedures:

- Select 10-12 widely dispersed points on the pile.
- At each point, remove five shovelfuls of manure and set them aside.
- Mix the five shovelfuls of manure and place one shovelful into the clean bucket.
- Repeat this for all of the 10-12 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 manure.
- 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.

Handling and Testing Manure Samples

- Manure samples should be sent to the lab on the same day they are collected.
- If 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 in the mail over the weekend.
- Do not put manure samples in a hot spot.

Regardless of the method sampled, when requesting laboratory testing for each sample, request the following, at a minimum:

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

What Does the Manure Analysis Report Tell Me?

Lab results may be presented in a number of ways. The easiest to use is a wet, "as-is" basis in pounds of available nutrient (nitrogen, phosphorus or potassium) per ton, per 1,000 gallons of manure or wastewater or per acre-inch of manure or wastewater.

If a lab reports results on a dry basis, you must have the moisture content of the manure to convert the results back to a wet basis. A lab may also give results as a concentration (parts per million [ppm] or milligrams per liter [mg/l]), which likewise requires conversion factors to get the results into a usable form based on how you apply the manure. Finally, if a lab reports phosphorus and potassium (P and K) as elemental phosphorus and potassium, you must convert them to the fertilizer basis of P_2O_5 or K_2O. This can be done with the following conversions:

$P \times 2.29 = P_2O_5$

$K \times 1.20 = K_2O$

Select a lab that reports an analysis on an "as-is" basis in the units of measure most useful to your operation.

9. Managing Water Sources

The view of cattle drinking from streams is largely seen by two distinctively different sets of eyes. One group of people sees a serene landscape of rolling pastures where cattle take a sip of water from a crystal clear stream. Another set of eyes envisions the sediment, nutrients and potential millions of bacteria from the cattle polluting the waterways where their children fish, swim and paddle. These two different pictures are equally valid and foster passion and vigor whenever the involuntary fencing of cattle from streams is mentioned.

Cattle producers traditionally have depended on ponds, streams, bayous and rivers to satisfy their cattle's water needs. These water sources are both convenient and reliable. In recent years, however, these conventional practices have come under scrutiny. Many livestock producers, who have installed these practices to protect the environment, are finding other benefits through developing off-stream water sources.

Cattle access to streams, ponds and rivers can lead to the degradation of our waterways (Table 2). Cattle damage banks of ponds, streams, creeks and rivers, which leads to increased erosion and the deposition of sediment in downstream waters.

Table 2. Allowing Cattle Direct Access to Surface Waters May Lead to:

Environmental Degradation

- Damage to banks of ponds, streams, creeks and rivers
- Erosion, sediment loading and increased turbidity in water sources and downstream
- Nutrient enrichment of waterways
- Rapid growth of weeds and algae

Heard Health Problems

- Spread of water-borne diseases
- Foot rot
- Mastitis
- Leg injuries

Adopted from: F. Henning and B. Segars. Alternative Livestock Watering Systems. Georgia Cattleman. October 1997.

Deposited sediment may bury fish, amphibian and insect eggs or larvae, decreasing productivity and the value of the water resource. Nutrients, such as nitrogen and phosphorus, from the direct deposition of urine and feces may lead to unnatural enrichment of waters. This enrichment, known as eutrophication, results in the rapid growth of weeds and algae in the water. Bacteria from cattle feces may cause the spread of water-borne diseases to both humans and cattle.

These examples of degradation have led to the identification of cattle access to streams as a potential source of nonpoint source pollution. Several organizations and local agencies throughout the country have responded to this potential environmental threat by mandating that cattle be fenced from streams and ponds.

In addition to satisfying a legal mandate, developing off-stream water sources is one of the biggest hurdles to overcome before a producer can upgrade his/her pasture management systems. Systems such as rotational stocking may require additional subdivision of pastures. Water development needs to be considered and planned into the design and management of any pasture management system. Many times, off-stream sources will need to be used to receive any other benefit such as increased forage use, average daily gains and ultimately profitability.

Research has shown that prudently designed and constructed watering systems improved water quality and stream habitat without the need for mandatory stream-bank fencing. LSU AgCenter water resources specialist Dr. Ron Sheffield, while working with North Carolina State University and Virginia Tech, found that more than 90 percent of the time cattle will prefer to drink from an off-stream water source compared to an unfenced stream. Furthermore, his research showed that when cattle are given access to an off-stream water source, stream-bank erosion and the concentration of nutrients and fecal bacteria entering the stream was significantly reduced without resorting to mandatory stream-bank fencing. These results were found under very hot and humid conditions, similar to those in Louisiana, in endophyte-infected, fescue-dominated pastures. Other studies at North Carolina State University and the University of Kentucky have demonstrated the ability to manage fenced stream banks using high-intensity, low-frequency grazing to manage riparian vegetation without adversely affecting water quality and stream habitat.

Table 3. How Much Water Do You Need to Provide?
Gallons of water needed per head each day. Low values are for temperatures near 35 degrees Fahrenheit. High values reflect for temperatures near 95 F.

Species	Penned[2]	Pasture[3]
Beef cows	12-20	8-13
Growing cattle	6-15	4-10
Dairy (400-800 pounds)	6-15	4-10
Dairy (800-plus pounds)	20-35	13-23
Sheep and goats	1-3	0.5-2

[2]P.Q. Guyer, Univ. Nebraska and Midwest Plan Service, Beef Housing and Equipment Handbook.
[3]G.J. Harrington. Water Consumption of Sheep and Sattle in NZ. NZ Agricultural Engineering Institute, Lincoln College and R. Quillin, personal communication.

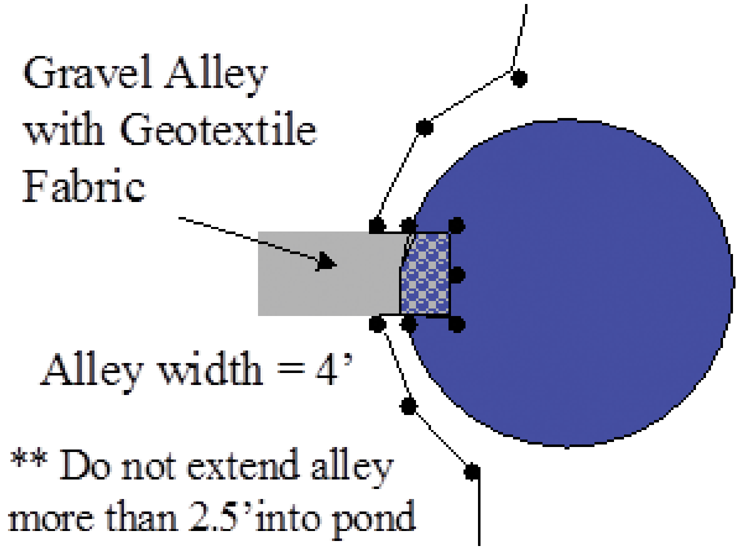
Trough or Tank (NRCS Code 614)

A trough or tank can be installed to provide drinking water for livestock. This practice provides water for livestock at selected locations that will protect vegetative cover. It also reduces or eliminates the need for livestock to be in streams. This practice applies where there is a need for new or improved watering places that permit the desired level of grassland management. It also reduces health hazards for livestock and reduces livestock waste in streams.

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 cattle 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 cattle 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 cattle movement. Lane surfaces likely will need to be improved with gravel, geotextile fabric or both.

Drinking water, when provided in every pasture or paddock, increases the amount of time cattle 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. Quick couplers can be installed in water mains to allow one to two tubs to be moved with the cattle from paddock to paddock.

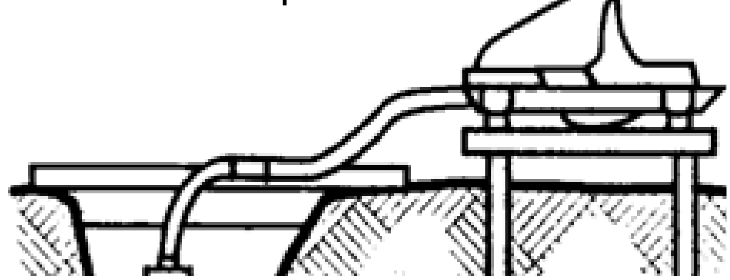


"Alternative" Off-Stream Water Sources

Access Ramps. Cattle prefer watering sites, like access ramps, that offer a good base and footing. Access ramps allow limited access to ponds, streams and rivers while limiting free access to water bodies. Cattle are given access to only a portion of the water through a sloped, stabilized bed to prevent erosion and direct deposition of urine and feces. Improved access to water has been shown to increase water intake and may help prevent leg injuries. Access ramps need to be constructed with relatively low slopes (6-8 feet of run for every foot of rise) with an alley width of 4 feet. Each ramp should serve at least 30 cows. If the ramp will serve more cattle, construct additional alleys beside each other using the same stabilized bed. Construction is simple – a 1.5- to 2-foot-thick run of gravel should be laid into a narrow bank and compacted. Geotextile fabric placed under the gravel will provide additional support and reduce the amount of stone required.

Nose Pumps. Cattle and horses can be trained to pump their own water using a nose or pasture pump. Cattle use their nose to push a pendulum that pumps water through a pipe from the pipe's other end located in a stream or pond. Livestock learn quickly how to operate the pump effectively. Manufactures recommend one pump for every 30 cows. Pumps have the ability to lift water 25 feet for a horizontal distance of 125 feet. In areas where lift is not a concern, pumps may deliver water up to a distance of 300 feet. Pumps easily can be moved with cattle, using quick-couplers or fixed delivery pipes. Producers also may consider mounting the pump on a frame 22 inches above the ground for cattle and 36 inches for horses.

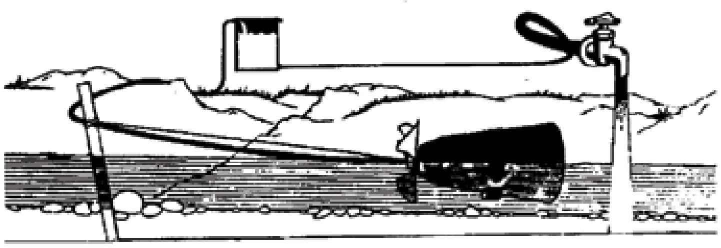
Nose/Pasture Pump with Foot Valve.



Solar Pumps: Pumping systems that are comprised of an array of solar panels and submersible or nonsubmersible pumps are possible. Sunshine is converted into electricity and powers a pump to lift water to a reservoir. Solar pump systems are extremely effective in delivering water to heights as great as 240 feet. When coupled with a gravity flow system from a reservoir, a livestock producer has the ability to deliver water to almost anywhere on a farm. Solar panels may be placed on tracking systems to get the most out of the sun even on the cloudiest of days. To accommodate variations in sunshine, however, a minimum of three days of water or electrical storage is recommended. Solar pumping systems range in price from $1,175 to more than $5,000, depending on water delivery requirements, lift (elevation) and cost of reservoir. Although costly, solar pumping systems can reliably deliver water out of steep draws to grazing areas high on a ridge top.

Sling/Propeller Pumps: These pumps move water from a flowing stream, creek or river without the aid of electricity or fuel. These devices use a propeller attached to the upstream side of a pump. Sling pumps can lift water 25 to 80 feet (depending on the design). Depending on the pump design, velocity of the stream or river and the pumping distance, these pumps can deliver as much as 4,000 gallons of water per day. A minimum of 1 to 2 feet of flowing water is required to power the pump. Opposite from ram pumps, propeller pumps are very portable and can be used on swiftly flowing stream with low slopes. These types of pumps range in cost from $750 to $1,000.

Sling Pump in Operation.



10. Buffers and Field Borders

Field borders (NRCS Code 386) and filter strips (NRCS Code 393) are strips of grasses or other close-growing vegetation planted around fields and along drainageways, streams and other bodies of water. They are designed to reduce sediment, organic material, nutrients and chemicals carried in runoff.

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 right next to susceptible water sources. Filter strips also increase wildlife habitat.

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 a 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 a 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 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 4 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 your local Natural Resources Conservation Service or Soil and Water Conservation District office.

Table 4. 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.*

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 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 (NRCS 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 (NRCS 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.

11. Manure Application

Selecting the Appropriate Land Application Method

The land application of livestock manure 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 material handling and economic factors (Table 5).

Table 5. Environmental ratings of various solid manure application systems.

Type of System	Uniformity of Application	Nitrogen Conservation	Odor Nuisances	Soil Compaction	Timeliness of Manure Application
Box spreader; tractor pulled	poor	very poor	fair	fair	poor
Box spreader; truck mounted	poor	very poor	fair	fair	fair
Flail 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

Environmental Considerations

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. Manure spreaders will need to be managed like any other fertilizer or chemical applicator. Spreaders and irrigation equipment will 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 manure. 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 deserve consideration and preference when neighbors live near application sites.

Soil compaction. Manure spreaders are heavy. In a 3,000-gallon liquid manure tank, the manure alone weighs more than 12 tons. In addition, manure often is applied at the time of year – late fall and early spring – when high soil moisture levels and the potential for compaction are common. The impact 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 manure 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.

Solid Manure Application Systems

Manure of 20 percent solids or more typically is handled by box, side-discharge or spinner spreaders.

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.

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

Application rates can be adjusted by changing the travel speed and opening or closing the opening on 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 uniform, consistent application rates. Several considerations specific to solids application equipment follow:

- The operator must control the application rate. Feed aprons or moving push gates, hydraulically driven or power takeoff (PTO) powered, impact 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 equal-size plastic sheets and then weighing the manure that falls on each sheet during application. The variation in net manure 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 must be designed to travel in agriculture fields, however. Available four-wheel drive and dual- 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 hours. 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.

Surface broadcast of liquid manure. Surface application of liquid slurries provides a low-cost means of handling the manure stream from many modern confinement systems. Tank wagons equipped with splash plates commonly are used to spread manure. Surface application suffers from several disadvantages, however, including ammonia loss, odor and poor uniformity.

- **Ammonia losses.** Surface application of slurries results in losses of 10 percent to 25 percent of the available nitrogen due to ammonia volatilization (Table 6).

Table 6. Nitrogen losses during land application. Percent of total nitrogen lost within 4 days of application.

Application Method	Type of Manure	Nitrogen Lost, %
Broadcast	Solid	15-30
	Liquid	10-25
Broadcast with immediate incorporation	Solid	1-5
	Liquid	1-5

Source: Livestock Waste Facilities Handbook, MWPS-18.

- **Odor.** Aerosol sprays produced by mixing manure and air carry odors considerable distances.

- **Uniformity.** Splash plates and nozzles provide poor distribution of manure nutrients. Wind can add to this challenge.

A few recent developments attempt to address these concerns. For the first time, boom-style application units for attachment to tank wagons or towed irrigation systems are appearing commercially. These systems use nozzles or drop hoses to distribute slurry. They tend to reduce odor concerns and improve uniformity of distribution. Other systems are under development.

Equipment Calibration

You can avoid the potentially adverse effects of overfertilization on ground 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 manure, bedding or wastewater at a desired rate – of 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 manure nutrients lets you apply manure at agronomic rates.

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 operations, such as usage and "wear and tear"
- Determine changes in manure consistency or "thickness"

Simply put, calibration enables producers to know how much manure 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 state or local regulatory limits or the conditions expressed in a livestock facility's operating permit.

12. Farmstead Management

Heavy-Use Area Protection (NRCS Code 561)

Open, unpaved, bare areas are common on Louisiana cattle farms. Examples are feeding or watering areas, pathways to the barns, 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 cattle 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 4 to 6 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 and 25 feet away from intermittent streams and drainage ways and should 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 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.

Fencing (NRCS Code 382)

Fencing cattle 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 cattle 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 cattle 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 that have permanent wooded or vegetated buffers may not need to be fenced.

Livestock Exclusion (NRCS Code 472)

The purpose of use exclusion is to protect, maintain or improve the quantity and quality of the natural resources in an area by excluding animals, people or vehicles from an area. The purpose can include aesthetic resources as well as human health and safety.

The practice is used in a conservation plan in areas where vegetation establishment or maintenance is a concern. Protecting the vegetation often is essential to conserving other natural resources.

The barriers constructed must be adequate to prevent, restrict or control use by target animals, vehicles or people. The barriers usually are fences but they may be natural and artificial structures such as logs, boulders, earth fill, gates, signs and so forth.

Livestock Shade Structures (NRCS Code 717)

Shade structures are permanent or portable framed structures with a mesh fabric roof to provide shade for livestock. These structures are used as part of a resource management system to provide shade areas for livestock, helping protect surface waters from pollution and the livestock from excessive heat. They are best installed where animal productivity and well-being is adversely affected by heat generated from sunshine or where livestock are excluded from natural shade along stream banks or other water courses.

Animal Trails and Walkways (NRCS Code 575)

These established lanes or walkways facilitate animal movement while protecting water resources. They are intended to provide or improve access to forage, water, working/handling facilities and/or shelter; improve grazing efficiency and distribution; and/or protect ecologically sensitive, erosive and/or potentially erosive sites. Established travel lanes are best applied on lands where control of animal movement is needed to facilitate access, improve grazing, prevent erosion and/or protect ecologically sensitive areas – or on marsh rangelands and grazing lands that are susceptible to overflow by water.

Stream and Stream Bank Protection (NRCS Code 580)

Cattle movement from pasture to pasture or paddock to paddock is best done by improved cow 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 cattle 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 cattle to use the crossing.

One method to improve a stream crossing is to uniformly grade a 10- to 15-foot wide 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 cattle to cross larger or wider streams. Professional advice should be sought to ensure that bridges and culverts will be structurally sound.

Sediment Basin (NRCS Code 350)

This is a basin constructed to collect and store manure and sediment. Its purpose is to maintain the capacity of lagoons, 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 boarders or filter strips from becoming inundated with solids. A sediment basin placed before the vegetative filter to separate manure solids from the wastewater is a 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; this foliage growth will help filter winter and spring runoff. Vegetative filters can provide low-cost, low-management control of barnyard runoff. Studies indicate vegetative filters can remove more than 95 percent of the nutrients, solids and oxygen-demanding material from wastewater. See sections titled Field Boarders (NRCS Code 386) and Filter Strips (NRCS Code 393) for additional details.

Cover and Green Manure Crop (NRCS Code 340)

This is a crop of close-growing grasses, legumes or small grain grown primarily for seasonal soil protection and improvement. It usually is grown for one year or less, except where there is permanent cover. It is designed to control erosion during periods when the major crops do not furnish enough cover. It also adds organic material to the soil and improves infiltration capacity, aeration and tilth.

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, help control erosion, provide water quality protection 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 tree that grows relatively fast and provides the necessary root system are the willows (Salix). Unlike trees, these are woody shrubs that love water and develop deep, strong root systems in wet soil. Plants that are suitable for planting in theses areas can be found in most nurseries or can be transplanted from existing stands. For advice on the proper plants for your situation, contact the local NRCS office or Cooperative Extension 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.

Regulating Water in Drainage System (NRCS Code 554)

Controlling the removal of surface runoff, primarily through the operation of water control structures, is designed to conserve surface water by controlling the outflow from drainage systems.

Fuel Storage Tanks

Above-ground fuel storage tanks in Louisiana are regulated by the State Fire Marshal 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 some sort of secondary containment be used with all fuel storage tanks. This could include the use of double-walled tanks, diking around the tank for impoundment or remote impoundment facilities.

These practices are to be followed:

- Any existing above-ground fuel storage tank of 660 gallons or more (1,320 gallons if more than one) must have a containment wall surrounding the tank capable of holding 100 percent of the tank's capacity (or the largest tank's capacity if more than one) in case of spillage. Additional secondary containment measures are required for operations that store more than 1,320 gallons of fuel. 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 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 for approval.
- All tanks that catch on fire must be reported to the State Fire Marshal 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 often can 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.

Irrigation Water Quality

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

13. Odor Prevention

Odors on cattle 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 said to contribute to global warming and the production of acid rain. There are four primary sources of odor from animal facilities: livestock operations with buildings or open lots, manure treatment/storage facilities, manure transport systems and areas of land application.

There are many variables that can cause odor and are almost impossible to eliminate. A combination of manure solids, dander, hair, bedding and feed are the cause of the majority of the dust problems in animal feeding 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 solid waste storage usually are considered to be less offensive than those from liquid storage. 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 solid manure to break down, it should have the appropriate ratio of carbon, nitrogen, 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. Solid manure can be stored indoors 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 manure is applied to land, the exposed surface area is enlarged and that allows a large odor plume to form. One way to solve this dilemma is to rapidly incorporate or inject the manure into the soil. Odors also can be caused if concentrated liquid manure is pumped through an irrigation system at high pressures or without dilution.

Other Emission Sources

Dead animals have potential to be a source of odor. Proper disposal of dead animals is a must. Animals should never be disposed of in manure basins or storage pits. Truck and tractor activity also 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 dairies. Any odor-control strategies should be made 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. Easy places to find them are at the end of free-stall barns where they're getting scraped, underneath the corral fence lines and stockpiled on remote areas of the farm. Any feed that spills should be cleaned up right away, as well. This not only helps reduce odors but also cuts down on flies and dust.

Plant a windbreak. A cost-effective way to reduce odors from free-stall barns is to plant a windbreak. Planting a row of evergreens and fast-growing, hardwood trees near the barnyard will break wind flow and dilute smells. Plant trees far enough away from barns so natural ventilation can still occur. They also make the farmstead more attractive.

Improve protein utilization. Managing odors really starts with the ration the cows are eating. Make sure you aren't overfeeding protein and ending up with large amounts of nitrogen in the manure. Have a cattle nutritionist review your rations to look into feed additives that may improve feed efficiency and nitrogen utilization.

Incorporate manure. Incorporate broadcasted or irrigated manure 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.

A word of caution . . .

It is important to evaluate your own farm before making any changes in how you handle manure to cut down on odors. Critically evaluate your options. A practice that works on one farm won't necessarily be successful on another farm 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 cattle management backgrounds who have seen the good and the bad of many manure systems. Work with them and take time to figure out what is going to work the best on your farm. Then design a plan, implement a strategy and monitor its success.

14. Responding to Complaints

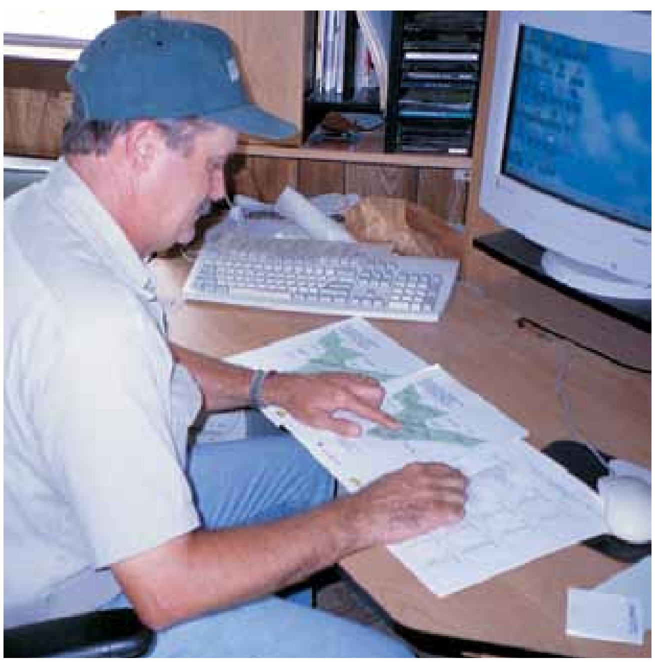
It only takes a drive through any parish back road to see that more and more families are moving into rural areas of Louisiana. These families typically come from a nonfarmer background and do not understand contemporary agricultural practices. For a variety of reasons, they also are increasingly sensitive 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 cattle producers to provide a safe and economical supply of milk 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 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, beef 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 cattle farmer working with community leaders may reduce the demands for regulations against odor. If beef producers do not work with neighbors and community leaders, it could mean losing profits or even your farm.

15. Record Keeping



Whether or not the operation has a comprehensive nutrient management plan, keeping good, detailed records that help you monitor your progress are essential to determine if your economic and environmental goals have been accomplished.

You should always keep records of:

- Nutrient management plan documents.
- Soil, plant and manure tests. Observe the response to management practices over time.
- Purchased feeds and fertilizers.
- Animal trades.
- Crop yields. Update your management plan as production changes.
- Manure exports and imports.
- Nutrient application rates, timing and application methods.
- Detailed schedules and records on calibration of spraying and spreading equipment.

16. 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. 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.

Sustainable Best Management Practices for Beef Production

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