



CAFOs
Concentrated Animal Feeding Operations

Nutrient Management for Livestock Operations



Tamilee Nennich

*Department of
Animal Sciences*

Purdue University

Nutrient management is an important issue for livestock operations. Although nutrient management is often discussed in the context of environmental regulations, nutrient management on livestock operations can have benefits beyond adhering to laws and regulations. The goal of nutrient management is to conserve and recycle nutrients in the most environmentally and economically beneficial manner possible. Nutrients are a valuable resource.

Although nutrient management most commonly refers to the management of nutrients in manure, it is very important throughout the livestock operation. The management of nutrients starts with feeds that are either grown or brought onto the livestock operation to be used in the diet of the animals. The amounts of nutrients excreted by livestock depend on the types and ages of the animals being fed, the production levels of the animals, and the animals' diets. Waste feed, water management, bedding, animal purchases and sales, fertilizer applications, and sales of food products such as milk and eggs are other factors that add nutrients to or remove nutrients from a livestock operation. Urine, feces, bedding, and waste feed typically comprise the manure that is applied to cropland. Accounting for all of the nutrients on a livestock operation can be a very complex process.

Livestock producers can use a variety of management practices and technologies to

handle manure and nutrients on livestock operations. The most common means of managing manure to best use nutrients is to land apply the manure as a fertilizer for growing crops. However, other management practices and technologies that provide means of separating or concentrating nutrients increase the potential uses of manure nutrients.

Producers Need a Plan

Although often thought of in negative terms, manure is a valuable source of nitrogen, phosphorus, potassium, and many other essential crop nutrients. Some manure is also high in organic matter, which is beneficial for soils and growing crops. The nutrients in organic matter become available to plants over time as the organic matter is broken down by soil microbes. Incorporation of manure helps to blend the nutrients into the soil and decreases the likelihood of nutrients leaving the soil through leaching or runoff. But, to make this work, a producer needs to plan.

A nutrient management plan matches the nutrients in manure with the nutrient needs of the soils and crops on a farm-wide basis. To determine the appropriate application rate, livestock producers need analyses of the nutrients available in the soil and the nutrient content of the manure, as well as an estimate of the nutrient needs of the crop.

Manure is usually applied according to either the nitrogen or phosphorus concentration in the manure. This presents a challenge, because the ratio of nitrogen

and phosphorus in manure is usually much lower than plant requirements. Therefore, application of manure at a nitrogen rate will result in over-application of phosphorus. Conversely, application of manure at the correct phosphorus rate will result in a shortage of nitrogen, and additional nitrogen fertilizer will be needed to meet the plant nutrient needs.

An additional challenge of manure nutrient management is the timing of application, since manure either cannot or should not be applied at certain times of the year. During the growing season when a crop is present, application is often limited to irrigation, and only manures with high moisture content that can be pumped are suitable for crop applications. During the four or five months when crops are in the field, solid manures cannot be easily field-applied. The other time of year that is challenging for manure application is winter. When soils are saturated, frozen, or snow-covered, manure nutrients face a greatly increased risk of runoff. Also, nutrients applied prior to crop demand are more susceptible to environmental losses.

Storage Is a Must

Since application timing is very important due to the restrictions, environmental concerns, and the need to make sure applied nutrients will reach the crop, finding the best opportunity to field-apply manure can be very challenging. Therefore, livestock operations need to be able to store manure.

Manure is typically stored in storage ponds, lagoons, or pits where it can be kept until the manure can be safely land-applied. Manure storage facilities are carefully constructed and are either made from water-tight materials or are lined to prevent nutrients from moving into the adjacent soil.

Technology Can Help

A wide variety of technologies are available to assist with handling of manure nutrients. Technologies can be incorporated as part of a manure management system or used for the entire manure system. Technologies used to treat manure often affect how manure and manure

nutrients are handled and managed. Examples of common technologies used to treat manure include solids separation, composting, and anaerobic digestion.

- Solids separation removes solids from the manure stream and may be done by gravity, mechanical means, or a combination of the two. The advantage of solids separation is that the resulting product is easier and less expensive to handle as a result of its reduced moisture content.
- Composting results in a product that is typically dryer, more stable, and has less odor than manure that has not been composted. During the composting process, aerobic bacteria break down the organic matter in manure and generate heat that destroys pathogens and weed seeds.
- Anaerobic digestion produces energy when anaerobic bacteria break down (digest) the organic matter in the manure to generate biogas (mostly methane and carbon dioxide). The methane in the gas can be captured and used to generate energy. The nutrients originally present in the manure remain, usually in a more concentrated form, after the treatment is complete.

A variety of other technologies are currently in use or are under development. Their goals range from the separation of individual nutrients to systems that process manure into distilled water and a concentrated nutrient product. The economics and the efficiency of any manure management technology are important considerations for any livestock operations interested in implementing them.

Summary

When livestock producers properly manage nutrients from their operations, they both protect the environment and ensure that the nutrients are used efficiently. They do that by reducing nutrient imports to livestock operations, properly collecting and storing manure, field-applying manure at recommended rates and times, and using technologies to help contain and conserve nutrients.