Nutrient Management Factors that Limit Profitability and Negatively Impact the Environment

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Take Home Messages

- Nitrogen and phosphorus are the two key nutrients that interrelate with whole farm nutrient management and environmental quality.
- Long term sustainability should focus on an integrated approach to nutrient management.
- Long term sustainability will require an expanded effort to reconnect the nutrient cycle and link the movement of nutrients between sites of feed production and feed utilization.
- The National Feed Management Outreach team has developed a system and supporting decision aid tools which integrate management considerations related to feed management, manure management, and nutrient management. http://www.puyallup.wsu.edu/dairy/nutrient-management/publications.asp

Introduction

This paper will describe how environmental quality is interrelated with feed management and whole farm nutrient management. The nutrients of nitrogen (N) and phosphorus (P) will be used to demonstrate the concepts and connections between feed management and whole farm nutrient management. Others at this conference have focused on feed management strategies at the cow level (Larry Chase and Katharine Knowlton).

Society has placed an expectation on dairy operations to manage nutrients to limit their loss to the environment (Harrison et al., 2006). This emphasis on environmental stewardship comes at a time when profitability and financial

sustainability for the dairy sector has much uncertainty. There are real opportunities to adopt feed management practices that can meet the dual goal of increasing profitability and embracing environmental stewardship. The emphasis of contemporary integrated nutrient management should be placed on three areas: reducing imports, enhancing within farm efficiencies (both cropping and cow efficiencies), and seeking export opportunities for excess nutrients not utilized for crop production on the farm (see Figure 1). Long term sustainability should focus on an integrated approach to nutrient management. This will require an expanded effort to reconnect the nutrient cycle and link the movement of nutrients between sites of feed production and feed utilization.

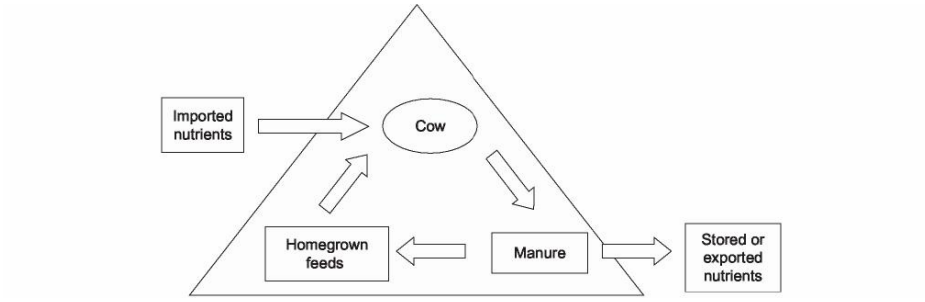

Figure 1 Three areas of primary importance for integrated nutrient management: nutrient import, within farm efficiencies, and nutrient export.

▪ Feed Management and Whole Farm Nutrient Management

The ability to produce synthetic N fertilizer after Second World War created the opportunity for N use in agriculture to increase dramatically. The use of N fertilizer in the USA increased from approximately 0.5 million tonnes/yr in 1940 to 11 million tonnes/ yr in 1980 (Lanyon, 1995). This allowed for the development of specialized regions for production of animals and crops, or animals since animal manure was no longer a requisite for crop production (Lanyon, 1995). Availability of synthetic nitrogen fertilizers has been beneficial for human health by providing increased availability of food with high nutritive value (Galloway et al., 2002). However, unintended consequences of increased use of fertilizers have been human health concerns, such as respiratory and cardiac diseases (Galloway et al., 2002) and environmental concerns such as increased saturation of terrestrial and aquatic ecosystems with reactive nitrogen (Galloway et al., 2003). The association of P with eutrophication of surface waters has resulted in a significant focus on the role of P in animal agriculture. Phosphorus-related research in recent years has

concentrated on two main areas: reducing P excretion from livestock and application and transport of P on agricultural fields.

As agriculture began to organize into specialized regions, the areas of crop production have not necessarily been in close proximity to areas of animal production (Friedmann et al., 1979). This has resulted in nutrient sinks developing in areas of animal production, since transport of nutrients in manure to areas of crop production is expensive and complicated. Lanyon (2000) described the components of an animal production system that relies on geologic P to sustain crop production and to supplement animal rations (see Figure 2). To reconnect this "broken" nutrient cycle, society should aim to become involved and assist with development of a system that will link the movement of nutrients between sites of feed production and feed utilization.

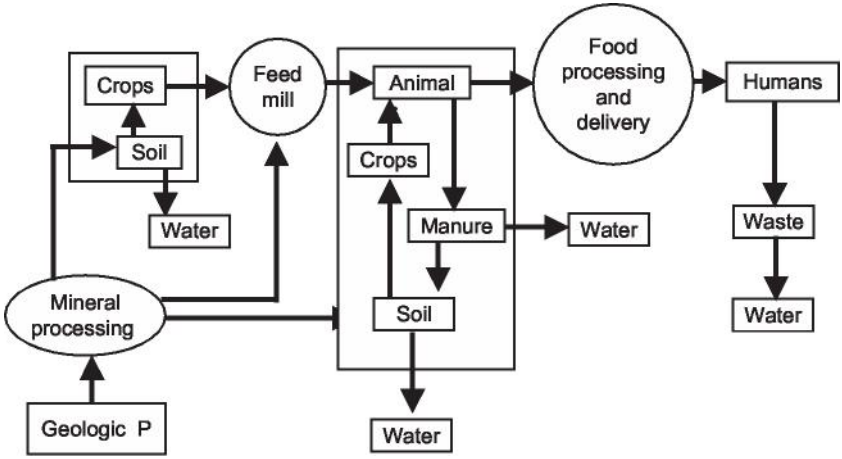

Figure 2.The components of an animal production system that relies on geologic phosphorus to sustain crop production and to supplement animal rations. Source: Lanyon, 2000.

Recent information suggests that the availability of P reserves maybe as short as a few decades. "Our supply of mined phosphorus is running out. Some initial analyses from scientists with the Global Phosphorus Research Initiative estimate that there will not be sufficient phosphorus supplies from mining to meet agricultural demand within 30 to 40 years. The geographic concentration of phosphate mines also threatens to usher in an era of intense resource competition. Nearly 90 percent of the world's estimated phosphorus reserves are found in five countries: Morocco, China, South Africa, Jordan, and the United States." (quote from "*Peak Phosphorus*" - http://www.foreignpolicy.com/articles/2010/04/20/peak_phosphorus).

■ Tools and Economic Incentives

The National Feed Management Outreach team has developed a system and supporting decision aid computer-based tools which integrate management considerations related to feed management, manure management, and nutrient management. Detailed information on the Feed Management Education Program can be located at http://www.puyallup.wsu.edu/dairy/nutrient-management/publications.asp

The key steps involved in the systematic approach include:

- determining if a detailed feed management plan has the opportunity to impact whole farm nutrient management,
- evaluating the economics of making a ration change vs. transporting manure away from the farm,
- completing a written feed management plan, and
- implementing and monitoring the plan. Assessment tools, checklists, templates, and example plans can all be found at the website noted above.

Evaluating the interrelationships between feed management and nutrient management is difficult without the use of tools to account for the fate and transformation of nutrients that occur between the point of feed acquisition and land application of manure for crop production. A decision aid tool has been developed which considers the fate and transport with outcomes of nutrient accounting and profitability http://www.puyallup.wsu.edu/dairy/nutrient-management/software.asp.

There are a number of feed management practices that have proven to reduce the amount of nutrients imported to the farm and excreted in manure. These include: controlling feed wastage, monitoring the mineral content of water, feed processing to increase digestibility, balancing for protein fractions and use of amino acid supplementation, grouping of cattle, and bovine somatotropin (bST) (Harrison, 2004; Harrison and White, 2006; Jonker, Kohn, and High, 2002; Kohn et a., 1997; St-Pierre and Tharaen, 1999). Focusing on the diet formulation component of feed management has been described as precision feed management (Cerosaletti, Dewing, and Lucas, 2006).

In the US, financial incentives exist at the United States Department of Agriculture through the Natural Resources Conservation Service to assist with the development of Feed Management Plans. In addition to the funding for development of the plans, financial incentives also exist for implementing the plans with payments made for reductions in N or P feeding to the dairy producer.

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