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Joseph P. Harner

Michael J. Brouk

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## **EFFICIENCY OF PHOSPHORUS UTILIZATION IN DAIRY OPERATIONS**

*M. J. Brouk and J. P. Harner<sup>1</sup>*

### **Summary**

Efficient utilization of nutrients is a must on modern dairies. Most of the phosphorus arriving at the dairy will either be found in purchased feedstuffs or commercial fertilizer used to raise grain and forage for the dairy. In general, those dairies that purchase all feeds are more efficient with phosphorus utilization than those that grow forage and grain. This is likely due to increased inefficiencies associated with feeding and crop enterprises. Careful evaluation of diets to reduce feeding excess phosphorus can reduce phosphorus excretion in the manure by as much as 50%. This not only reduces input costs, but also reduces the total cost of land application. The most efficient way to manage dairy farm nutrients is to develop a comprehensive nutrient management plan that includes both the cropping and animal enterprises. This plan will help producers predict phosphorus requirements of cattle and crops, and then allow the producer to control phosphorus inputs to meet the requirements.

(Key Words: Nutrient Management, Phosphorus.)

### **Introduction**

Phosphorus utilization has become a concern for Kansas dairy producers, and is a key factor in whole-farm nutrient management.

Whole-farm nutrient management allows producers to evaluate phosphorus utilization across the entire farm, including both animal and crop utilization. Research in the past 10 years has indicated that it is possible to improve the efficiency of phosphorus utilization by dairies. This reduces phosphorus imports and exports via manure. Reducing phosphorus exports via manure could potentially reduce the area required for manure land application. In addition, more efficient application of manure and reduction of phosphorus excretion through increased feeding efficiency will reduce the cost of phosphorus inputs, increasing the total farm profitability. This paper will explore the sources of phosphorus found on the dairy farm, export of phosphorus from the dairy, and the impacts of reducing phosphorus imports to the dairy.

### **Phosphorus Imports**

Phosphorus is imported onto the farm in 4 major areas; feed, fertilizer, animals, and bedding. One important distinction between farms is the presence or absence of a cropping enterprise. Dairies that do not raise crops will generally import more than 95% of the total phosphorus in feedstuffs. These dairies import both concentrates and forages. Bedding and animals would account for the remaining amount. Dairies that have cropping enterprises will import about 55 to 65% of the phosphorus in purchased feeds and approxi-

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<sup>1</sup>Department of Biological and Agricultural Engineering.

mately 33 to 42% in commercial fertilizer. When feeding a mix of corn silage and legumes, approximately 25% of the total phosphorus is associated with the forages, and the remaining 75% is associated with the concentrate supplements. Careful management of dietary phosphorus in animal diets and fertilizer application is key for minimizing phosphorus imports onto the dairy farm.

### **Phosphorus Exports**

Phosphorus is exported from the farm in animal products, manure, and cash crops. Animal products, including animal sales and milk, account for about 55 to 75% of the total phosphorus exports. Farms that do not have a cropping enterprise will have greater exports because manure will be distributed to other farms for land application. Efficiency of phosphorus utilization is a key factor in reducing the build-up of phosphorus on commercial dairy farms.

### **Phosphorus Balance**

Several studies conducted during the last decade have shown that most dairies import more phosphorus than is necessary for efficient dairy production. When surveyed, many dairies typically feed diets that contain 0.4 to 0.5% phosphorus on a DM basis. Based on the rates of milk production and normal DM intakes, dietary phosphorus should be 0.35 to 0.38%. Thus, many dairies are feeding 20 to 25% more phosphorus than is needed for efficient milk production. This excess phosphorus will be excreted in the manure, increasing the land mass necessary for manure disposal. Farms that have cropping enterprises have been shown to import excess phosphorus in the form of fertilizer. This, combined with excess phosphorus in the feed, generally makes these units more inefficient in phosphorus utilization than dairies without cropping enterprises. As greater amounts of corn processing co-products (distillers grains and corn

gluten feed) are used in dairy diets, there is a potential that amounts of dietary phosphorus may increase. These products generally contain high concentrations of phosphorus, and this must be taken into account when balancing rations. When using high concentrations of corn co-products, it may not be possible to keep the dietary phosphorus below 40%. Phosphorus content of these feedstuffs may become the limiting factor in determining the maximum amount included in diets.

On the cropping side, many dairy producers have been land-applying manure for a few generations. Applying manure year after year will likely result in phosphorus build-up in the soils. This is much more common when crop removal has been exceeded by land application of manure. This problem is much more common in those fields that are closest to the dairy. It is difficult to resist the temptation to dispose of manure on the fields near the dairy.

### **Comprehensive Nutrient Management**

Because of the variation in soil phosphorus concentrations found on many dairy farms, dairy farms should develop a comprehensive nutrient management plan that is not limited to just phosphorus. Developing a plan will increase total farm nutrient utilization and, over time, may reduce nutrient concentrations in soils that exceed recommended levels. The key to a successful plan is to first determine the true phosphorus needs of both the animals and, if included, the cropping operation. The next step is to track the nutrient flowing into and out of the dairy. Efficient use of phosphorus in animal diets will reduce phosphorus excretion in the manure. Reductions in phosphorus concentration in the manure reduce the land area required for efficient land application. When cropping enterprises are included, balancing soil levels, crop removal rates, and manure application will ensure that phosphorus does not continue to accumulate in the soil.