WIN^{2}ME
Western Integrated Nutrition and Nutrient Management
Feed Management Education for the Agri-Professional

102 - PHOSPHORUS ON THE FARM FROM FEED GRAINS AND BY-PRODUCTS

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Disclaimer
This fact sheet reflects the best available information on the topic as of the publication date.

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Introduction

Phosphorus (P) is an important plant nutrient for growing dairy forages. Unfortunately, many dairies have more P excreted and stored in manure than they can use during a crop year. Soils have the ability to store moderate over-applications of P for future crop production, but continued over-application can lead to losses of P to surface water.

Much of the P brought onto the dairy is in livestock feeds. Proper ration balancing giving credit to the P in all feeds, developing rations to consistently meet animal requirements, and avoiding the use of "insurance" supplementation are good for the environment and the producer's bottom line.

An example of phosphorus in feeds

Let's look at a 400 cow dairy and the potential for concentrating P on the farm. If we assume a requirement for P of 0.4% and animals eat 50 pounds of dry matter daily, we need 0.2 pound P per animal each day. This times 400 cows and 365 days shows the dairy will have 29,200 pounds of P in feeds each year. If cropping on the farm removes 35 pounds P per acre per year, the dairy needs 835 acres of cropland to utilize this phosphorus, or more than 2 acres per cow!

The good news is that not all that P hits the ground in manure. A dairy cow will absorb about 20% of feed P to support her body maintenance and production needs. That means 80% is excreted by the cow. Seems like a lot, but 45 to 60% is indigestible without special extraction prior to feeding. Animals fed deficient or marginally deficient diets absorb more P so over-feeding this nutrient reduces the absorption rate and adds more P to the manure (Morse, 1992).

Farm balance case studies

Developing a whole farm balance where nutrients in feed, fertilizer, bedding, animals brought onto the farm are balanced against nutrients exported in meat, milk, animals, sold feeds, manure is a useful process to plan how to better match manure nutrients to crop uptake.

A project in 1992 looked at whole farm balances for 3 dairies and a beef operation in an Oregon watershed listed as water quality-impaired due to P. The dairies each milked about 100 cows, raised their own heifers, produced part of their forages, and grew crops for sale.

Not surprisingly, much of their imported P came from feeds brought on the farm (Table 1).

Table 1. Phosphorus imported on to livestock operations, Washington Co., Oregon 1992

	Total P	Feed P	% feed P
Dairy 1	3,383	2,400	71
Dairy 2	13,321	6,500	49
Dairy 3	10,354	5,700	55
Cow-calf beef	1,040	1,000	96

Much of the farm to farm variation in this study was due to the amount of feeds raised on the farm and the amount of crops sold off the farm. For example, dairy 2 with only 49% imported in feed sold seed crops off the farm. Phosphorus-laden fertilizers were used on the crops and were a major source of imported P in this case.

Even with more intense cropping, feed P is still a major contributor to P accumulation (Gamroth, 1992).

Typical phosphorus levels in feeds

Most species require P in the diet at 0.16 to 0.4% of ration dry matter. Many of our traditional feed sources contain adequate or abundant P for supporting animal growth and milk production (Table 2).

Table 2. Phosphorus content of selected feeds

Feed	% P (DM basis)
Legume hay	0.26
Cool-season grass	0.23
Cereal silage	0.31
Corn silage	0.26
Corn grain	0.30
Barley grain	0.39
Oats	0.40
Soybean meal	0.70
Canola meal	1.10
Distiller’s grain	0.83
Brewer’s grains	0.67
Almond hulls	0.13
Whole cottonseed	0.60
Wheat bran	1.18
Wheat midds	1.02
Soy hulls	0.17

Table 2 shows typical P values. All feeds, especially by-products, vary in nutrient content. It is wise to analyze each feed ingredient to know its nutrient content, including P.

With adequate to high levels of P in animal feeds, it is common to see P fed at levels above requirements. A recent survey of dairy herds in Virginia showed that P could be reduced by 45% if diets were formulated to meet NRC requirements (Sink et al., 2000. The average P fed in 33 surveyed herds was 0.49%, while calculated requirements averaged only 0.34%. Not only could herds in the survey reduce the P in manure by 71% by formulating rations more precisely, but they would also save $800 to $1,500 per year in feed costs .

Information presented by Patrick French at this short course will show Northwest dairies also over feed P and can benefit from more precise ration formulation.

Conclusion

As animal units increased relative to land managed it will become more important to evaluate <u>and manage</u> the whole farm balance. This management involves reducing P imports and increasing P exports.

Reduce P brought onto the farm

Test soils and target manure applications to reduce purchased P fertilizers.

Balance rations often to precisely meet P requirements by production stage. Don't ignore the P provided in by-product feeds. Avoid free-choice and ready-to-use minerals not matched to feeds.

Plant appropriate varieties for greater yields of high-quality forages or cereal grains.

Increase P sent off the farm

Maintain an efficient herd or flock for best conversion of feed to animal product.

Develop a manure management system that allows for export of manure off-farm. Composting dries the product, reduces volume, and is more acceptable to users. Lagoon sludge is rich in P.

Consider planting crops for sale that pull P out of soils.

Avoid death loss. Dispose of mortalities off-farm when possible.

Contract graze with other producers when forage is more than sufficient for farm needs.

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