



Phosphorus is important in energy transfer and as a component of bones and teeth.

Too much phosphorus is expensive and potentially polluting.

Balance phosphorus content of feed according to dietary needs of cattle, avoiding excess P excretion.

Introduction

Dairy cows (and the rest of us, as well) require phosphorus in our diets. Phosphorus is a key element in energy transfer, as well as an important component of bones and teeth. In an effort to avoid phosphorus deficiency, dairy cows are often given more phosphorus than they need. This excess is excreted in the feces, and to a much lesser extent, in the urine. The excreted phosphorus becomes part of the dairy operation's waste stream. Phosphorus will build up on the farm (or in the groundwater) if more P is brought in, in the form of feed, fertilizer, or bedding, than leaves the farm in the form of milk, compost, crops, or animals sold.

Benefits of Phosphorus

Because phosphorus is essential to energy transfer, it is important in all aspects of an animal's functioning. Reproduction and milk production are the measures of success in dairying, and these will be influenced by P availability, but all aspects of the animal's health will be affected. Strong bones and teeth are clearly important to animal health. Fortunately it is not difficult to supply the phosphorus needs of dairy cattle.

Drawbacks of Excessive Phosphorus

Phosphorus is expensive, whether as feed or as fertilizer. It makes no sense to purchase extra phosphorus if the addition does not promote improvement in a cow's health, reproductive system, or milk production. Pollution is another consideration. Phosphorus is important in plant, as well as animal systems. As with animals, sufficient P is required for plant life. Too much P, however, can have negative effects. For example, ponds in areas of excessive P runoff will develop excessive plant growth, depleting oxygen in the water and threatening animal life in the pond.

How to Adjust Phosphorus in the Dairy Cows' Diet

Find out how much phosphorus is being excreted. There are many ways to sample manure. At the end of this document is a list of manure sampling laboratories. Their sampling recommendations reflect the assumption that manure is being sampled for its fertilizer value, so they suggest including bedding, and sampling as close as possible to the time of field application. To estimate fecal phosphorus, however, it is best to sample only feces, and that as soon as possible after leaving the cow. It is difficult to get a herd-wide sample without including material other than feces. Wear gloves. Scoop a cupful of fresh feces into a clean 5 gallon bucket. Collect a number of samples; the more you collect, the more representative the result will be. Mix well, and send to the lab as directed. Estimate per cow P output as either 150 lb manure per day for a lactating Holstein dairy cow or 80 lbs manure per 1000 lbs body weight. Note that the latter will likely give a lower manure estimate.

Determine phosphorus intake in feed. This is fairly straightforward when using purchased grain with nutrient content printed on the label. Baled hay can be sampled

using a hay probe. Hay, grain, and silage samples can be tested by the same labs that test manure, as well as additional labs (see below). Pasture fed cows' intake is a bit trickier to estimate. However, pasture samples can be taken and analyzed as hay samples. Phosphorus intake can be estimated by multiplying percent P in the different feeds and adding the estimated intake of each feed.

Adjust feed to balance needs of cows vs need to avoid excess P excretion. Dairy cows not being fed excessive amounts of P should excrete approximately 73% of dietary P intake, with 27% going to milk (Harrison). For Holstein cows producing 55 to 120 lbs milk containing 3.5% fat and 3.0% true protein per day, dietary recommendation is from 0.32 to 0.38% P (Powell and Satter). P absorption increases when P is in short supply. Phosphorus coming from different sources may differ in absorption by cows, with concentrates having higher absorption coefficients than forages. However, research in this area has not shown consistent results. Because values for both fed P and excreted P are estimates, it is wise to consider both values when making changes to rations.

Manure Testing in the Northeast

University of Maine
Analytical Laboratory and Maine Soil Testing Service
5722 Deering Hall
Orono, ME 04469
<http://anlab.umesci.maine.edu/default.htm>

Penn State University
Agricultural Analytical Services Laboratory
University Park, PA 16802
<http://www.aasl.psu.edu/manureprgSTD.html>

Dairy One Cooperative Inc.
730 Warren Rd
Ithaca, NY 14850
<http://www.dairyone.com/Forage/services/Manure/manure.htm>

University of Minnesota lists nationally certified manure analysis laboratories for 2011:
<http://www2.mda.state.mn.us/webapp/lis/manurelabs.jsp>

University of Massachusetts does not test manure, but does test plant tissue and soil:
Soil and Plant Tissue Testing Lab
West Experiment Station
682 North Pleasant Street
University of Massachusetts
Amherst, MA 01003
<http://www.umass.edu/soiltest/index.htm>

Resources

Harrison, Joe. Western Integrated Nutrition and Nutrient Management: Feed Management Education for the Agri-Professional.
<http://www.puyallup.wsu.edu/dairy/nutrient-management/data/publications/SARE101-%20WholeFarmDairyPExample.pdf>

Powell, J. Mark, and Larry D. Satter. Dietary Phosphorus Levels for Dairy Cows.
http://www.sera17.ext.vt.edu/Documents/BMP_dietary_phosphorus.pdf

Wu, Z., L. D. Satter, A. J. Blohowiak, R. H. Stauffacher, and J. H. Wilson. 2001. Milk Production, Estimated Phosphorus Excretion, and Bone Characteristics of Dairy Cows Fed Different Amounts of Phosphorus for Two or Three Years. *J. Dairy Sci.* 84:1738–1748

Wu, Z., S. K. Tallam, V. A. Ishler, and D. D. Archibald. 2003. Utilization of Phosphorus in Lactating Cows Fed Varying Amounts of Phosphorus and Forage. *J. Dairy Sci.* 86:3300-3308

For more information visit www.umass.edu/cdl
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