

Phosphorus In Dairy Rations

Purchased feeds account for 45-80% of the total phosphorus input on the farm. Phosphorus is also the third most expensive nutrient supplemented in a dairy ration, behind energy and protein. So, a lot of expensive phosphorus is imported onto the farm, while a small percentage actually leaves the farm. Several studies have looked at the amount of phosphorus being fed to the cows and compared that to the amount leaving the farm in the product form: milk. It has been determined that 70-80% of all of the phosphorus coming onto the farm remains on the farm, and is not exported in any product form.

For example: A 1,350 pound cow milking 100 pounds of milk per day will consume about 52 pounds of dry matter each day. If the ration contains 0.48% P, the cow would be consuming 113 grams of P each day. If 20-30% of the feed P (22-34 grams) is exported in the milk or meat, then 79-91 grams of P will go into the manure and ultimately onto the soil.

Figure 1 illustrates the phosphorus cycle.

Phosphorus does not have the same loss pathways to the air that nitrogen does. This means that excess phosphorus imported onto the farm stays on the farm and accumulates in the soil. Higher phosphorus concentrations in the soil become an environmental risk when soil erosion occurs.

It has been thought that phosphorus does not move in the water in the soil. This idea came about because inorganic phosphorus will

bond with calcium and magnesium in the soil and become a solid that is not soluble in water. This happens very effectively in high pH soils, but more slowly in acidic soils. Phosphorus in manure does not necessarily behave the same way as inorganic phosphorus. Phosphorus in manure is primarily in the organic form and is soluble in water. Downward movement of the phosphorus in manured soils has also been linked with the presences of wormholes. It appears that wormholes accelerate the movement of phosphorus and other manure constituents downward below the root zone.

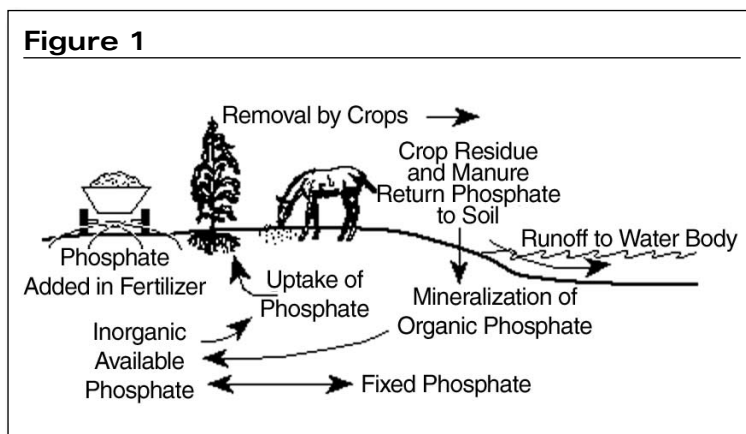
When P moves into the water supply either by soil erosion or by the movement of water soluble P, streams and lakes begin to accumulate phosphorus. Many inland lakes and streams are phosphorus limited, which means that an addition of phosphorus may encourage the growth of algae. High levels of algae reduce water clarity and can lead to decreases in available dissolved oxygen as the algae decays — conditions that can be

very detrimental to the fish population.

Excess P in the soil and water, and the reduced oxygen in the water, are not sustainable and are not acceptable to the general public. Several states have already begun enacting laws to regulate the application of

manure, with soil P or N as measures of nutrient levels in the soil. How these laws directly impact the dairy will depend on the state; however, it is clear that the number of acres available for manure application and the number of animals in an operation will be

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closely linked. Maximum allowable levels of P may also affect the value of land, particularly if the current levels are near the maximum allowable level by law. That land will be of lesser value since the amount of manure that could be applied would be limited. So, dairies would be in better positions environmentally and financially if they began reducing the amount of P being applied today, before all of the state and federal regulations become fully in effect.

Phosphorus Requirements For The Lactating Dairy Cow

The requirement of the dairy cow for absorbed phosphorus is derived from that needed for maintenance, growth, pregnancy, and lactation. How efficient the phosphorus is absorbed is also taken into account when determining the phosphorus requirement of the dairy cow. The U.S. feed industry has for some time recommended about 20% more phosphorus than the NRC recommendation for several reasons.

Why Is Phosphorus Being Overfed?

Phosphorus Content And Availability In Feeds

Variation exists in the content of phosphorus in many feeds. In some cases, the laboratory analysis is higher than the value found in reference books. If the book values are less than the actual values and are being used to formulate diets for the dairy cow, over-supplementation would occur. This illustrates the importance of having actual "wet chemistry" laboratory analysis in feedstuffs that are either known to have great variations in phosphorus levels, such as by-product feeds, or that potentially contribute significant amounts of phosphorus to the rations, such as grains and protein supplements.

Although phytate phosphorus is of great concern to those balancing diets for non-ruminants, it is of less importance in ruminant diets. About two-thirds of the phosphorus in cereal grains, oilseed meals, and many grain by-products are bound in the complex phytase molecule. Ruminal microbes are able to break down the phytate molecule, making the phosphorus available to ruminants. Therefore, it is not necessary to make any adjustments or discount the feeds fed to cattle since being in the original form of phytate phosphorus does not significantly reduce phosphorus availability.

Because Vigortone has concerns about the availability of phosphorus in some organic and inorganic sources, we have recommended that at least 10 grams of phosphorus

be provided in the ration from highly available inorganic sources. This recommendation will help to maintain adequate phosphorus levels in the cow, yet minimize the excretion of excessive phosphorus into the environment.

Uncertainty About The NRC Recommendations

There has been and continues to be a great deal of uncertainty in the animal feed industry about the validity of nutrient recommendations made by the various NRC Nutrition Committees. The uncertainty is broad, covering nearly every recommendation made by NRC for various nutrients. This uncertainty is not specific to dairy cattle but is general and covers all species. Some of the lack of confidence in the values of certain nutrient recommendations is warranted since scientific evidence was sparse and far from conclusive; however, there continues to build a library to support many NRC guidelines.

Recent research from the U.S. and Europe has supported NRC recommended feeding levels of phosphorus for dairy cattle. Several recent Wisconsin studies looked at long term lowered phosphorus levels, on reproduction and milk production. What can be concluded from those studies is that both reproduction and milk production appears to be unaffected at the recommended levels and that there is no economic advantage to feeding excess phosphorus to a lactating dairy cow. The notion that feeding excess phosphorus may improve the reproductive performance of lactating dairy cattle is not supported by any research from the U.S. or abroad. It appears that additional phosphorus much above that recommended by the NRC to improve milk production and reproduction is not warranted. Furthermore, by overfeeding phosphorus to livestock, contamination of the inland lakes and streams become more common and environmentally damaging.

New Recommendations: Production And The Environment

Recent studies confirm that supplementing phosphorus above NRC recommendations is not justified. The dairy industry does not have the luxury of feeding excessive amounts of phosphorus. Optimum levels of phosphorus supplementation must be used in dairy diets to maintain good production, keep feed costs in line, and protect the environment. By utilizing sound nutritional practices and introducing aggressive nutrient management programs, we will be able to maintain profitability, while ensuring a quality environment for generations to come.