Best Management Practices for Fertilizer Use on Dairy Farms

By Tom Bruulsema

Dairy farms in the Northeast have made considerable progress in adopting best management practices (BMPs) for managing their impacts on the environment. Nutrient management forms an essential component of such practices, but most BMP publications focus on manure management. This article addresses fertilizer management practices appropriate to the cropping systems that support dairy farms.

Nutrient cycling on dairy farms is intensive. Large amounts of nutrients are both removed from the field in the harvest of forages, and returned in the form of manure. Nutrients also flow onto the farm in the form of purchased feed inputs, and they leave the farm in the form of milk, animals, and other materials sold.

There are three general categories into which we can group the management practices that foster the effective and responsible use of fertilizer nutrients: diagnostics, application, and minimizing nutrient loss from fields.

Diagnostics

Crediting nitrogen (N). Non-legume crops like silage corn or grass forage can demand large amounts of N. Nitrogen is a mobile nutrient. Soils can be sampled for the nitrate form of N, but the sampling must usually be done just before the crop starts taking it up at high rates. The previous crop, and applications of manures and biosolids, can supply large amounts of N. In order to calculate the amount available, manures should be analyzed for both the ammonium and organic forms of N.

Soil testing. Soil sampling for less mobile nutrients including phosphorus (P) and potassium (K) should be done every 3 years, preferably at the same point in the rotation each time. The depth is usually 6 to 8 in. and must be consistent.

Forage harvests remove large amounts of K so it is critical to monitor the levels of this nutrient closely, since deficiencies can cut yields. However, excesses can cause imbalances in the feed ration for dry cows. Micronutrient levels—including copper and zinc—can also be important, particularly for their influence on the composition of the diet (Brock et al., 2005).

Crop scouting and plant analysis. Transient deficiencies of nutrients can impact crop performance, and even crops that look okay may be suffering from "hidden hunger". A regular program of monitoring both visual symptoms and nutrient levels in the plant tissue can help diagnose nutrients that either limit crop yield or pose risks of excess in the dairy diet.

Yield goal determination. Recommended rates of fertilizer often depend on the expected yield, or yield goal, of the crop to be grown.

Nutrient removal calculation. Forages in particular remove large amounts of nutrients.

Application

Placement of N. When N sources contain urea or ammonium, there is a risk of ammonia being lost to the air as a gas. However, when applied to an actively growing crop in cool temperatures, as is often the case with winter cereals, losses arising from urea topdress applications in early spring are small. Based on laboratory

research conducted over 40 years ago, it has been concluded that ammonia losses from applied urea remain reasonably small at temperatures below 60 °F if the soil pH is 6.5 or less (Overdahl et al., 1991). Following first and second cut grass forage, however, alternative sources of N should be considered unless urea can be applied directly before irrigation or rain.

Band placement of P and K. Corn, cereals, and other crops respond most to P when their seedlings are young. Placement near the seed ensures access by the young seedlings, and placement in a band concentrates the nutrient to minimize fixation by the soil.

Timing of N. Being vulnerable to losses, N applied too early poses more risk of loss than when applied just before the period of rapid uptake. Alternatively, if controlled release or stabilized N technologies are used, the N can be applied prior to or at planting.

Management zones for variable rate application. On some farms, the same rate and blend of fertilizer is applied to all fields growing a particular crop. Soil test levels tend to vary strongly among fields, owing to differences in past manuring history.

Accurate rate metering. Maintaining and calibrating the machinery used for applying fertilizers is essential to delivering the right rate.

Minimizing Nutrient Losses

Nitrogen transport. Nitrogen can be lost by several pathways. Nitrate-N will be leached below the root zone if water moves down through the soil too quickly. When soils are saturated with water, nitrate can be denitrified to nitrous oxide or dinitrogen. Nitrous oxide is considered a potent greenhouse gas and a depletor of stratospheric ozone. Ammonium forms of N can be lost as ammonia gas to the air.

Phosphorus transport. Applying P at rates that balance removal is an important aspect of minimizing losses, but not the only one. Most soils remain fertile when application rates balance removal, but some may require more or less than removal depending on the soil tendency to retain or release phosphate. In some areas, deep tillage may help reduce P losses. The use of a P index gives a relative ranking of the influence of all major source and transport factors influencing the loss of P (Sharpley et al., 2003). Its use gives the best assurance for protection of water quality. Specific indexes, with software to facilitate calculation, are available for most states and provinces. BC

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To view a chart listing fertilizer BMPs for this region, plus additional information and references, visit the PPI website: ***>www.ppi-ppic.org<.***

References

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