

Case Study 7.3-3 Improving nutrient balances on dairy farms through forage management. In the northeastern United States, dairy farming is a large part of agriculture. Dairy farms typically grow their own forage crops (i.e. hay, haylage, and corn silage) for feed, but purchase grain supplements to provide the required levels of digestible energy and protein. Manures are usually spread on the land where the forages and corn silage are grown, recycling a large proportion of mineral nutrients back to the soil.

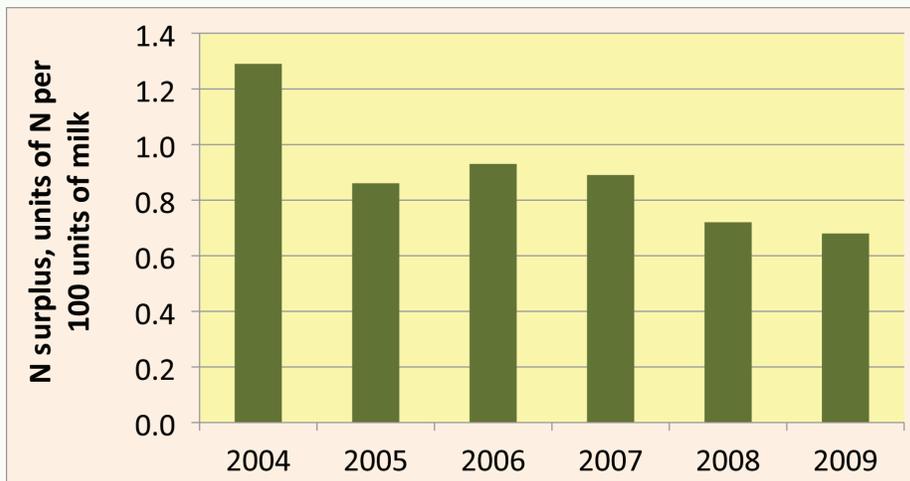
On many dairy farms, the amount of nutrients imported in the form of purchased grains and mineral supplements exceeds the amount of the nutrients exported in the form of milk and animals sold. On these farms, surpluses of nutrients returned to the soil in the form of manure can slowly build up soil reserves of P and K to levels higher than necessary for crop production, and these higher levels can result in higher risk of nutrient runoff harming water quality.

The nutrient surplus issue can be addressed by managing forages for optimum quality. When higher quality forages are fed, fewer supplements in the form of purchased grains and minerals are needed in the diet.

Charles C. Stallings, Extension Dairy Scientist with Virginia Tech, states:

“Maximizing the amount of forage in the ration not only can improve cow health, but reduces the need for supplemental feeds that are typically high in P. For instance, soybean meal contains 0.7% P (dry basis) compared to 0.3% for alfalfa. Simply supplying more protein with alfalfa will reduce the need for more soybean meal and result in lower ration P. Also, many by-product feeds contain high concentrations of P. Feeds such as whole cottonseeds (0.6%), brewer’s grains (0.67%), and distiller’s grains (0.83%) are good examples. Using more forage in the ration can reduce the need for these feeds.”

As shown in the figure, on an 1,100-cow dairy farm in New York, as the diet was shifted from 52% forage to 60% between 2004 to 2009, the farm’s N surplus was cut nearly in half (Fields, 2011). The farm’s crop manager notes “The high forage diet is achieved by having top quality homegrown forages, so we need to fully utilize the nutrient value of the manure that’s produced. We’ve shifted to direct injection at the time of spreading ...with the injection, N losses through volatilization are greatly reduced so we’re capturing a higher level of N for the corn.” Similarly, another 650-cow dairy farm in central New York reduced the N and P content of its manures by 17% and 28%, respectively, as the proportion of feed produced on-farm increased from 43% to 59% over the course of 5 years (Tylutki et al., 2004).



Improvement in the N and P nutrient balance is a result of combined effects of:

- Minimizing nutrient losses from manure in storage;
- Applying manures and fertilizers at the right rate, time, and place;
- Selecting forage species, crop rotations and harvest timings to meet quality targets for protein and neutral detergent fiber;
- Minimizing losses from feed storage;
- Feeding as precisely as possible to animal requirements for protein and P.

References

Fields, L. 2011. Cornell University Nutrient Management Spear Program, Whole Farm Evaluation Series.
 Stallings, C.C. 2005. Virginia Cooperative Extension.
 Tylutki, T.P. et al. 2004. The Professional Animal Scientist 20:58-65.

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