

Nutrient Management for Organic Dairying

By Melissa Arcand, Cory Roberts and Derek Lynch

Dairy production systems face unique nutrient management challenges. Most dairy farms run large nutrient (NPK) surpluses as a result of high nutrient imports (mostly as feed) relative to farm nutrient exports (mostly as milk). For example, studies in the north eastern US, found that for dairy farms with livestock stocking rates of 2.0 animal units per hectare, phosphorus was accumulating on these farms at an average of 36.7 kg P per hectare per year. As production expands to meet the demand for organic dairy products in Ontario, there is a need to look more closely at the nutrient efficiency of these dairy management systems. Research being coordinated by the Organic Agriculture Centre of Canada (OACC), in collaboration with the University of Guelph, is characterizing the nutrient status of Ontario organic dairy farms, and attempting to link more closely livestock and crop nutrient requirements with soil fertility status. The project, which commenced in 2003, is funded by the New Directions program of the Ontario Ministry of Agriculture and Food.

A soil survey was conducted on 15 dairy farms throughout southern and eastern Ontario, which had been managed organically for at least 10 years. We took top soil samples from the majority of fields on each farm. Based on standard soil test analysis, the overall average soil K level was medium (range 75 - 160 mg/kg). The average available P level was also medium (range 4.4 - 26.4 mg/kg). However, eight of the farms averaged in the low to very-low available P range. The data suggest a trend towards available P levels on some farms may be becoming low enough to limit crop and forage yields. However, the Ontario soil test P method may not be appropriate on organic farms where soil organisms may play a larger role in nutrient cycling. Further research could focus on addressing this possibility.

Another aspect of the project is examining nutrient flows on the same 15 farms. Farm-gate nutrient budgets (imports minus exports) are being calculated to determine the average amount of nutrients being added to or removed from each farm hectare every year. In year 1, the average K surplus for these farms was 12 kg K per hectare. The average P surplus was 1.0 kg P per hectare. Half of the farms had small negative P budgets (annual net P loss) and others had small positive P surpluses. These values, which are consistent with results for organic dairy farms in Europe, are quite low compared with high nutrient surpluses often found for confinement-based dairy operations.

A negative P budget will ultimately lead to a soil nutrient deficiency over time. The soil is a large storage compartment for various forms of P but only a fraction is plant available. To avoid eventual nutrient deficiencies P must enter the system at the same rates as it is removed. Phosphate rock (PR) application may be an option to correct any P deficiencies on organic farms. High pH soils, as are found in Ontario, greatly reduce P release from PRs, however. Planting a green manure crop, such as buckwheat, that has an enhanced ability to use PR may increase plant-available soil P for subsequent crops.

We are currently examining how well buckwheat can take up P from various types of PR in the field. We compared plant biomass yield and P uptake of buckwheat resulting from the application of Calphos, a PR from North Carolina, and Spanish River Carbonatite and Volcanaphos from Ontario at 100, 400, and 800 kg P/ha. In 2004,

buckwheat biomass yield (avg. ~3.0 t dry matter per hectare for all treatments) increased with the addition of Calphos PR alone. Over seven weeks growth, approximately 0.6% of the P applied in Calphos was taken up by the plant. Further work is examining how well the P present in the buckwheat residue is recycled to the following crop and will assess the economic feasibility of PR use. An alternative approach, for those farms with negative P budgets, would involve adjusting P imports in livestock dietary and supplementation regimes. We hope to assess the potential of this approach also.

The overall objective is to develop fully integrated nutrient management plans for these farms. While the focus is on new approaches to nutrient management for organic dairy systems, it is hoped that the research will offer solutions that may be of benefit to the conventional dairy industry as well.

Melissa Arcand and Cory Roberts are graduate students, Dept. Land Resource Science, Univ. of Guelph. Derek Lynch is Research Professor, OACC, located at the Nova Scotia Agricultural College. For more information contact , Website: . One month after publication, OACC newspaper articles are archived at <http://www.organicagcentre.ca>)