Refining Nutrient Management in Organic Production Systems

By Derek Lynch

Minimizing nutrient surpluses and improving the efficiency of nutrient use is a key challenge for all agricultural production systems – organic and conventional alike. The need to reduce losses and make the optimum use of applied nutrients has been driven by both economic and environmental concerns, and is now increasingly being driven by regulatory constraints. While some research suggests that organic soil management and cropping strategies may reduce nutrient losses, others have found the benefits to be generally small, and argue that there is room for improvements and refining best management practices in all production systems.

Organic potato production and organic dairying are areas of potential growth within the organic sector. As production expands to meet the demand for organic potatoes and dairy products there is a need to look more closely at the overall nutrient efficiency and effectiveness of best management practices in these systems. This is especially important since organic potato and dairy production systems also face unique nutrient management challenges. To help address these challenges, research is being coordinated by the Organic Agriculture Centre of Canada (OACC), based at the Nova Scotia Agricultural College. While the focus is on new approaches to nutrient management in organic potato and dairy systems, it is hoped that the research will offer solutions that may be of benefit to the conventional dairy and potato industries as well.

A key challenge in potato production is managing soil nitrogen and soil moisture and the use of soil amendments is crucial in managing these factors. The intensity of nutrient use in organic potato production may be changing, however, as the availability of commercial soil amendments, such as pelletized dehydrated manures and bulk composts approved for use in organic production increases, and the demand for organically produced potatoes suitable for the processing market grows. Composts or pelletized manures applied prior to planting may differ from traditional organic amendments or legume plowdowns in their ability to supply nitrogen through the critical period of high crop nitrogen demand after hilling. Increased soil moisture retention following compost application may also benefit yield directly or indirectly by influencing soil nitrogen processes.

To examine seasonal moisture and nitrogen availability in organic potato production a series of trials is currently being conducted by the OACC in collaboration with Dr. Bernie Zebarth of the AAFC Potato Research Centre in Fredericton, New Brunswick, at five Maritime Canada sites. Funding for the project is provided by the Prince Edward Island Department of Agriculture and Forestry, and the New Brunswick Department of Agriculture, Fisheries and Aquaculture. The amendments being tested include two pelletized chicken manures (from Agrior, St. Patrice de Beaurivage,Que and Envirem Technologies, Fredericton, N.B.), a wild sourced fish meal (B. Fleming, Union Crnr, N.B.), and a commercial hog manure compost (Atlantic Country Composting, Antigonish Co., N.S.). The amendments are being applied to three potato varieties at varying rates to supply up to 200 kg per hectare of plant available nitrogen. These rates of compost equal up to 45 t of compost dry matter per hectare. The researchers will measure soil moisture,

soil mineral nitrogen, and crop tissue nitrogen throughout the season, as well as soil mineral nitrogen prior to planting and after harvest. Using this data, they hope to characterize the dynamics of soil moisture and soil nitrogen in response to the different amendments. The effects on tuber yield and quality (including tuber nitrate levels) and the potential for nitrate losses from the soil will also be examined.

On the dairy side, phosphorous will be the focus of the research. This is in response to a lack of understanding of the nutrient efficiency of organic dairy production, despite a growing body of research that describes the technical characteristics and economic performance of the Canadian organic dairy sector. Most dairy farms run large nutrient surpluses as a result of high feed nutrient inputs relative to the outputs in the milk. However, recent research from Europe suggests organic dairying systems may, in fact, be prone to phosphorus deficiencies in the long term. Also, the higher biological activity in organically managed soils has been associated with greater phosphorus mineralization.

The OACC will focus on a systems approach to nutrient management on organic dairy farms. It will continue to build on recent work led by the OACC staff in examining nutrient management on Atlantic Canada dairy farms undergoing the transition to organic production. This research demonstrated how an integrated approach to farm nutrient management can link livestock and crop nutrient requirements with soil nutrient status and effectively reduce farm phosphorus surpluses to close to zero. To continue this approach in addressing nutrient management challenges for the Canadian organic industry, a three year research initiative is set to commence this fall. It will be conducted by the OACC in collaboration with the University of Guelph, and funded by the New Directions program of the Ontario Ministry of Agriculture and Food.

The first objective of the research will be to evaluate how this integrated nutrient management approach can be applied on commercial dairy farms in Ontario. The researchers hope to generate a database of farm systems case studies that will be useful in farm nutrient management planning and as support tools for dairy farmers interested in the transition to organic dairying. Mass nutrient ('farm-gate') balances for N, P, and K will be determined annually for each farm over a three year period. Standard soil tests will be conducted for all fields of each farm and combined with farm records to characterize trends in soil fertility. Livestock dietary and supplementation regimes will be documented, and opportunities for improving the phosphorous status of the whole farm system will be examined.

The research will also examine the usefulness of key indices of soil biological activity as a soil management tool, and evaluate local Ontario sources of rock P as a soil amendment and mineral P source. Specifically, the group hopes to find opportunities for improving the efficiency of phosphorus use in organic dairying. By examining phosphorus use in both livestock and crop components, the goal is to develop and assess recommendations for improved efficiency of P use across the entire farm system, and it is hoped that this systems approach will benefit all dairy producers.

Office: (902) 893-7256, Email: oacc@nsac.ns.ca

References:

Drinkwater, L.E., Wagoner, P., and Sarrantonio, M. 1998. Legume-based cropping systems have reduced carbon and nitrogen losses. Nature 396: 262-265.

Stopes, C., Lord, E.I., Philipps, L., and Woodward, L. 2002. Nitrate leaching from organic farms and conventional farms following best practice. Soil Use and Management 18: 256-263.

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