



# GREENHOUSE GAS EMISSIONS AND NUTRIENT DYNAMICS IN LEGUME AND POTATO ROTATIONS

*Introductory Research Report E2007-20*

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## BACKGROUND

The benefits of using organic farming methods for health and vitality of the farm ecosystem and products have long been sustained by science. The benefits extend beyond the farm gate to the consumers of organic produce, and the lessened environmental impacts from restricted production inputs compared to conventional farming. Inorganic fertilizer can be lost from soil through gasification, and use of non-renewable energy for manufacturing and shipping fertilizers, chemicals, etc. adds to greenhouse gases released into the atmosphere. It has been estimated in Canada that about 10% of total greenhouse gas emissions come from agriculture. In recent years, published scientific findings have suggested lower levels of greenhouse gases released from soils under organic management compared to other farming systems. The gases of main concern, nitrous oxide (N<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), and methane (CH<sub>4</sub>) arise from soil microbiological activity, stimulated by readily available substrates of nutrients and carbon in the surface layer of the soil. There are indications that absence of inorganic fertilizer and relatively high quantities of stable organic matter in soils under organic management regulate the availability of nitrogen (N) and carbon (C) needed for release of gases. Other benefits of organically managed soils, such as improved physical structure, may also reduce gas emissions.

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## RESEARCH APPROACH

In this study, regular measurements were made on greenhouse gas emissions from a field of experimental plots, where potatoes grew in 2006, following two years of either timothy or clover. Effects of fall or spring plowing, as well as a comparison of conventional fertilizer treatments and organically managed plots were included in the experimental design. Measurements of gas emissions were made weekly or bi-weekly from early spring to late fall. Soil samples were also

taken at the time of each gas sampling, and analyzed for measurements of bioavailable N and C. Other factors that affect biological activity in soils such as soil temperature and moisture content were also monitored. Harvest measurements of timothy, clover, and potatoes were done to compare yield and nutrient uptake from different management systems. A second research field was established where the same measurements were made, also from potatoes, focusing on comparison of variable inputs of organic compost and conventional fertilizer on the release of greenhouse gases.

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## APPLICATION OF RESULTS

The extensive data set from 2006 will be further supplemented by data from the 2007 growing season, in order to assess the efficiency of organic agriculture in Eastern Canada. Quantification, statistical analysis, and modeling of greenhouse gas emissions, nutrient efficiency, soil condition and crop yield will form the basis for conclusions regarding the environmental and economic sustainability of organic management practices compared to conventional production systems.

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