ECOLOGICAL IMPACT OF ORGANIC FARMING SYSTEMS

Introductory Research Report E2006-20

BACKGROUND

The expansion of organic farming has continued at 20% per year in the last decade. With over 24 million hectares worldwide organic production has become mainstream practice for some crops (Anon, 2004). Organic farming is based on management principles assumed to enhance the abundance, diversity and activity of soil biological life, yield benefits with respect to soil C sequestration and nutrient efficiency at the whole farm level, and reduce impacts on air (greenhouse gas emissions) and water quality. Data to test this hypothesis are extremely limited, however.

Organic systems rely on legume crops for N_2 fixation as source of N. Recent research (Rochette and Janzen, 2005) has shown that unlike other sources of N (fertilizer, manure) emissions of nitrous oxide (N_2O), a potent greenhouse gas, are very low from legume crops when they are actively fixing N_2. With a few exceptions, few studies have examined the impact of rotations characteristic of organic management (including fertilization, type and timing of legume tillage, mowing or mulching) on temporal variability of N_2O emissions and the overall trace gas budget of such systems.

Recent work by Pattey et al. (2005) with beef and dairy manures provides convincing evidence that the composting process clearly reduces GHG emissions (N_2O and CH_4 combined) when compared with stockpiling solid manure or storing liquid manure. Composts turn over slowly in soil, and as much as 80% or more of compost N is plant available in the years after application (Lynch et al., 2006), assuming little is lost to leaching or denitrification of N. However, only a limited number of studies have measured GHG emissions from compost-amended soil, while examining the impact of compost use on key soil quality attributes. Organic cropping systems change both the quantity, distribution and quality of soil organic matter but studies are lacking that have examined in an integrated way, how these systems affect crop performance, soil microbial processes, and the relationship of greenhouse gas emissions to soil organic matter turnover.

FUTURE WORK

Commencing in 2006, planned research at NSAC and AAFC Bouctouche, NB, will examine the impact of long-term rotations and management of legumes and composts in organic potato and vegetable production on greenhouse gas emissions and relationship to soil attributes and turnover of soil C and N.

REFERENCES

Anon. 2004. Organic farming enters the mainstream. Nature 428:783.

Lynch, D.H., Voroney, R.P., and Warman, P.R. 2006. Use of ^{13}C and ^{15}N natural abundance techniques to characterize carbon and nitrogen dynamics in composting and in compost-amended soils. Soil Biology and Biochemistry, 38:103-114.

Pattey, E., Trzcinski, M.R., and Desjardins, R.L. 2005. Quantifying the reduction of greenhouse gas emissions as a result of composting dairy and beef cattle manure. Nutrient Cycling in Agroecosystems 72:173-187.

Rochette, P., and Janzen, H.H. 2005. Towards a revised coefficient for estimating N_2O emissions from legumes. Nutrient Cycling in Agroecosystems 73:171-179.

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