Soil Health after 19 Years Under Organic and Conventional Agriculture Management.

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Background:
The number of certified organic acres in Canada increased from 2008 to 2009 reaching 1,718,468 acres[†]. Organic and conventional agriculture systems differ in approaches to managing crop rotation, soil fertility, and pests, which have direct consequences on soil health. The Glenlea long-term rotation located in Manitoba was established in 1992 to compare organic, conventional, no-input and restored prairie grass land management practices. Two 4-yr rotations exist under all agriculture management practices: Annual-grain and grain-forage.

Project Overview:
The objective of the present study was to evaluate the effect of conventional, organic, and no-input agricultural management on soil health. Microbial biomass carbon, microbial metabolic quotient (qCO_2), and microbial biomass phosphorus were measured to evaluate soil health. Microbial metabolic activity in soil characterizes long-term effects of agricultural management on carbon cycling, nutrient sustainability and mineralization-immobilization-turnover. High microbial biomass carbon, high microbial biomass phosphorus, and low qCO_2 reflect a healthy soil. Values for qCO_2 < 0.5- μg/g are considered dormant microbial populations.

Microbial biomass carbon, microbial biomass phosphorus, and qCO_2 were measured five times from May-October in 2010 under *Triticum aestivum* (L.) (wheat) in both rotations. Seasonal variation was significant for all measurements. Across all sample dates, microbial biomass and activity were higher in the forage-grain rotation.

Table 1.0 Microbial biomass carbon and metabolic activity under wheat across all sample dates. Letters signify within column differences (p<.05). FG (forage-grain); AG (annual-grain)

Agriculture System	Microbial Biomass C (μg-CO_2/g-soil)	Microbial CO_2 (mg-CO_2 /kg-soil/hr)	Microbial qCO_2 (mg-CO_2/g-MBC/hr)
FG No-input	1648a	1.35a	0.77a
FG Organic	1718a	2.11a	0.81a
FG Conventional	1476b	1.00b	0.69ab
AG No-input	1080d	0.73c	00.59c
AG Organic	1115d	0.62d	0.57c
AG Conventional	1179c	0.62c	0.64bc

**values presented are geometric means*

Conclusion:
Agricultural rotation and management significantly affect soil health. Perennial rotations improve soil health by increasing the size and activity of soil microbial populations. Additionally, organic management can amplify the positive effects of perennial rotations on soil health.

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[†] (Macey, Anne and Canadian Organic Growers. Certified Organic Production Statistics for Canada 2008. Ottawa, ON. URL: http://www.cog.ca/our-work/organic-statistics/ (April 2010).