Soil Carbon Management for Sustainable Farming
To Conserve or Consume ?

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1. Introduction

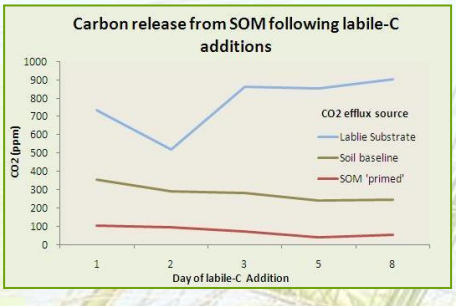
A sustainable future for agriculture requires effective management of soil carbon (C). This study combines laboratory work with soil analysis from contrasting farm systems to identify how changes in agricultural practices will influence soil C-dynamics. Laboratory work has shown that the priming effect is a critical factor to consider for understanding soil response to management change. Field analysis has been undertaken across farm soils which have recently been converted from a conventional fertilizer regime to compost amendments with minimal inorganic fertilisation. Results indicate that the microbial biomass is highly responsive to composting practices.

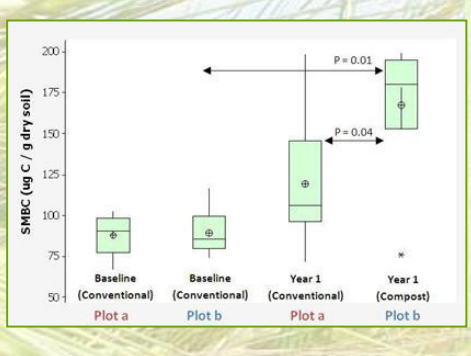
Research Aim
Enhance understanding of the biotic processes which drive soil carbon turnover

2. Results

The Priming Effect

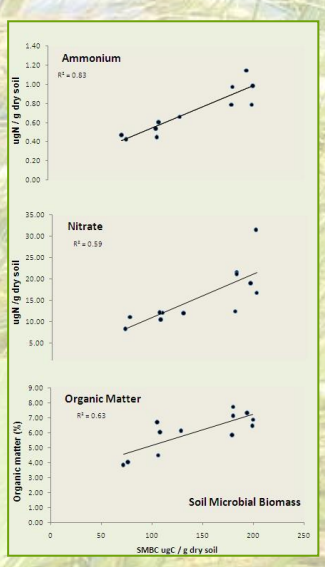
Priming effects (PE) can be defined as changes to the turnover of organic matter as a result of soil amendment. A positive PE is identified in laboratory experiments where ^{13}C enriched glucose (labile-C source) is added to soil as a surrogate for root exudates. This phenomenon is shown to cause a counterintuitive loss of SOM derived-C following the addition of a labile C-source. Biotic processes are considered to drive the PE, consequently the PE is a major consideration for soil C-management.





Farm Management Change

Baseline soils with a history of conventional practices were separated into replicated split-plots. Plots 'a' continued with conventional practices and Plots 'b' incorporated compost amendments, minimum tillage and reduced fertiliser inputs. Year 1 results indicate significantly increased soil microbial biomass carbon (SMBC) in 'b' Plots. Potentially, increased microbial activity and increased soil organic matter content of compost amended soils ($p = 0.03$) could initiate field-scale priming effects.



Soil Relations

System analysis reveals a positive correlation between SMBC and the organic matter content of field soils. Similarly, mineral nitrogen pools are found to increase with SMBC content of soils. Agricultural systems which receive high inputs of organic matter have augmented labile-C pools. Considering this, and the observed correlations, greater microbial activity is likely in compost amended soils leading to increased N-supplying power of soil.

3. Main Message

Initiatives to conserve carbon in agricultural soils must not overlook the value of microbial-C consumption. In order for crops to acquire nitrogen and other soil nutrients, microbial driven decomposition must occur The priming effect represents how this C-mineralisation can be stimulated through microbial processes and result in inevitable loss of soil-C. Respectively, field studies show how management practices can greatly influence the microbial biomass of soils. For these reasons, and in the current climate of global and financial change, research into the biotic drivers of soil-C turnover is crucial.