Impacts of N fertilizer addition to soil C and N dynamics in conventional and organic farming systems

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Introduction

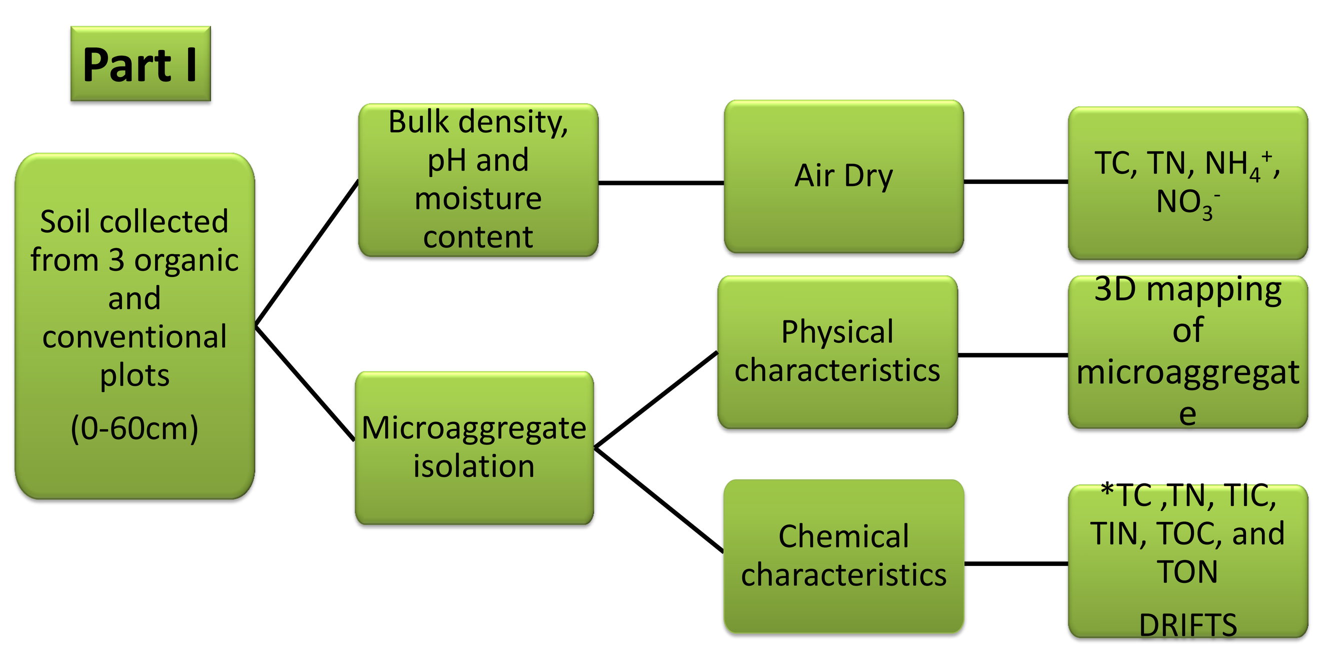
Soil microaggregates have been implicated as a primary factor for the stabilization of soil carbon in agricultural soils. We hypotheses activities that have an effect on soil microaggregates, such as long term farm management practices, have a considerable effect on soil C and N dynamics. Soils from plots under organic and conventional farming system for 10 years were collected from the Long Term Agricultural Research Station (LTRAS) in Davis, CA.

Objectives

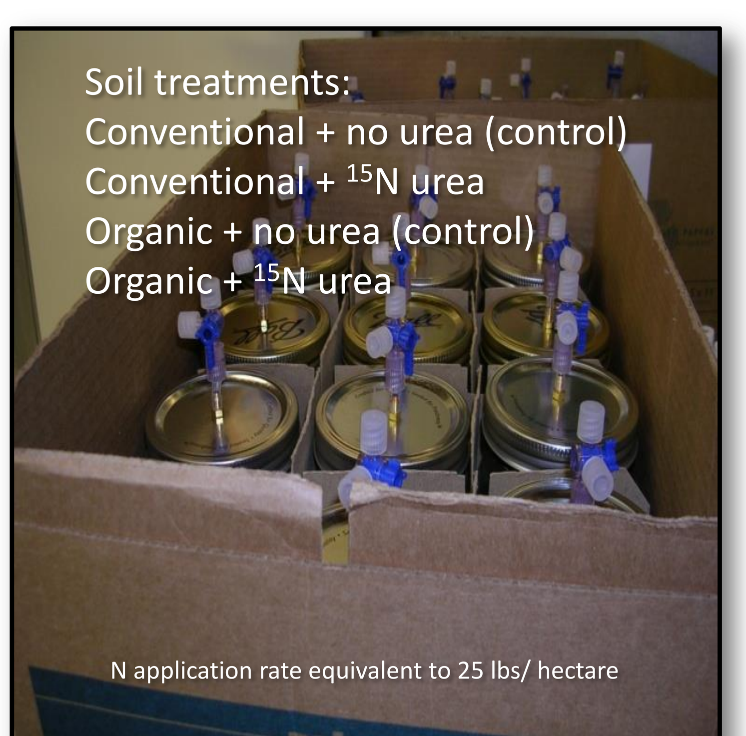
To determine the effect of farming management (conventional vs organic):

- on microaggregates carbon and nitrogen pools, and
- microaggregate formation rates following N fertilizer addition.

Methodology



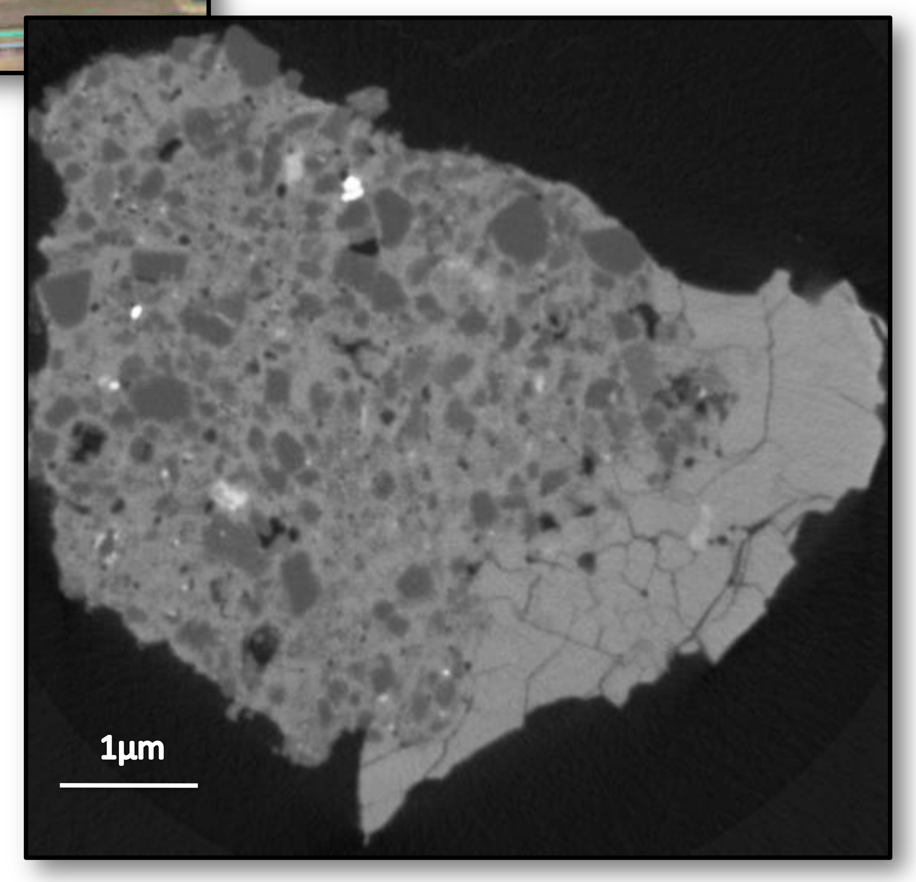
*Total C (**TC**), total N (**TN**); total inorganic C (**TIC**) ; total inorganic N (**TIN**); total organic C (**TOC**); total organic N (**TON**)and Diffuse reflectance Fourier transformed infrared spectroscopy (**DRIFTS**)



Part 2

Soils from the two farming systems (0-30 cm) were used in laboratory microcosms to investigate the effect of added labeled ^{15}N fertilizer (urea) on soil microaggregate C and N dynamics and composition over a period of 28 days.

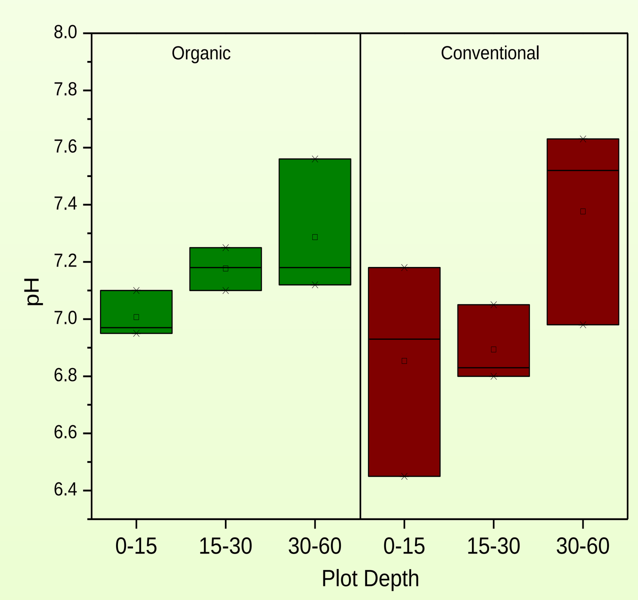
Plots where samples were collected at LTRAS.
20 samples collected at random from each plot.



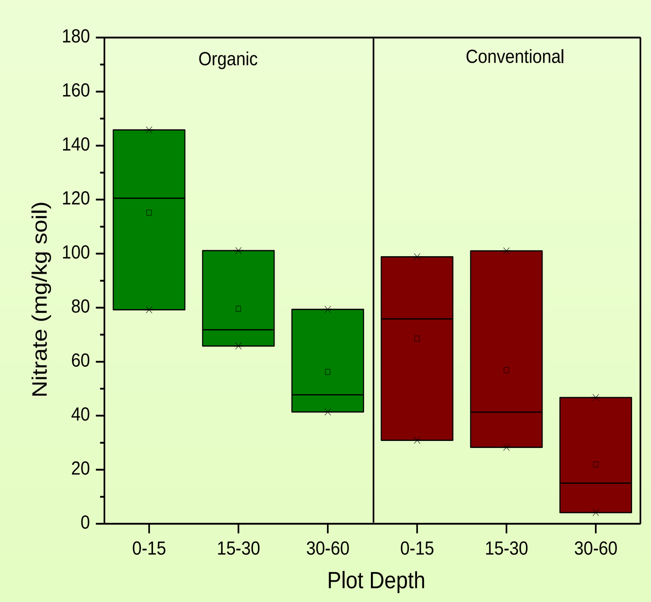
X-ray tomography cross-section image of conventional plot microaggregate (0-15cm)

Part I: Plot Characterization

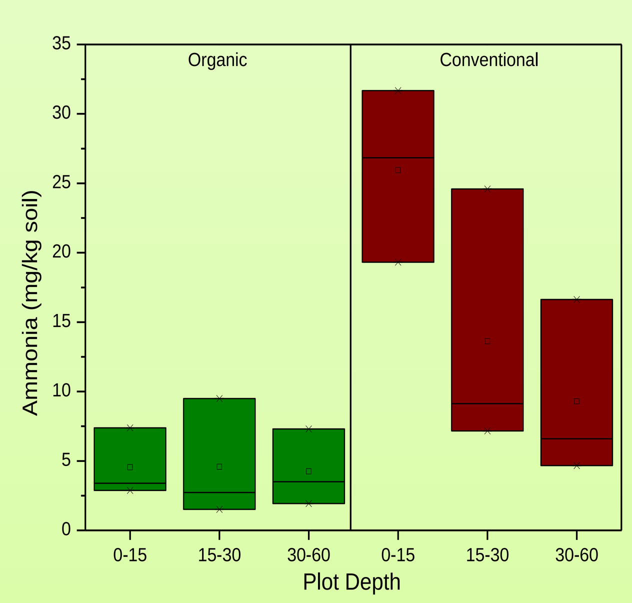
Whole Soil



- Generally pH increased with depth
- Greater variability in pH of conventional plots

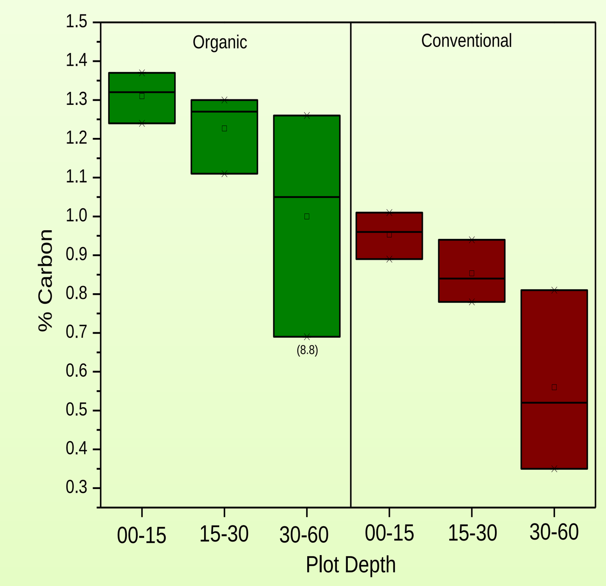


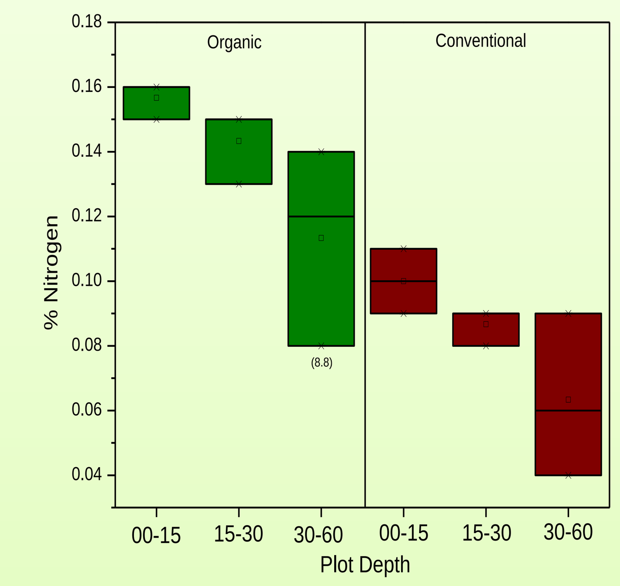
- Generally higher nitrate levels in organic plots
- Decrease in nitrate concentration with depth
- Considerable variability in concentration among plots of the same treatment



- Higher ammonia levels in conventional plots
- Decrease in ammonia concentration with depth for conventional plots
- Little variability in concentration of organic plots
- Considerable variability in concentration of conventional plots

Microaggregates



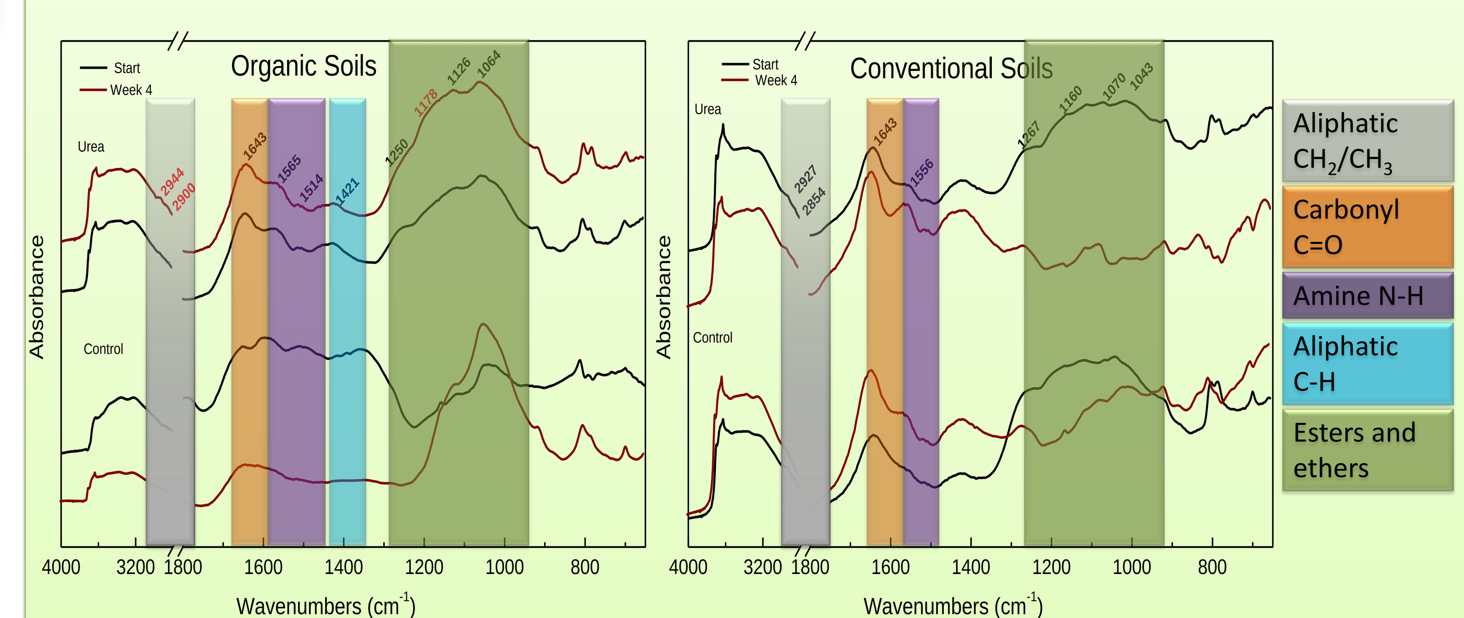


- Higher % C in organic plots
- % C decreases with depth
- Higher % total organic C in the organic microaggregates
- Greater variability with depth for both treatments
- Similar C:N ratios

- Higher % N in organic plots
- % N decreases with depth
- Higher % total organic N in the organic microaggregates
- Greater variability with depth for both treatments

Part 2: Incubations

DRIFTS spectra of incubated microaggregates



- Differences in microaggregate organic matter composition of two farming treatments
- Controls: Greater reduction in organic matter functional groups in the organic microaggregates (1600-1350 cm^{-1}).
- Urea additions: Greater conservation of organic matter functional groups in organic microaggregates

Next Steps

- Measure greenhouse gas emissions (CO_2 and N_2O) produced during incubation of the microcosms
- Isotopic analysis of N_2O emissions to determine fate of ^{15}N labeled urea
- Measure potential changes in microaggregate size distribution over incubation period.
- Measure weekly changes in C and N in microaggregates over time of incubation (0- 4 weeks)

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