Long Term Effects of Biosolids on Carbon Sequestration

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Significance of Biosolids

- Reduce GHG Emissions
- Build SOM
- Sequestration of biosolids C in soil
- Carbon sink
Significance of Biosolids

- Data in kg CO$_2$ e/Mg Nf
- Nf Manufacturing: 1951
- Soil N$_2$O release: 1460 (equivalence)
- Transport: 142
- Total: 3553

(Wood and Cowie, 2004, Dusenbury et al., 2004, EPA)
Significance of Biosolids

• 50,000 T/y biosolids available in WA for application

• GHG reduction maximum from N fertilizer replacement:
  \[1,227 \text{ Mg Nf} \times 3553 \text{ kg CO}_2e/\text{Mg Nf} = 4,359,000 \text{ kg CO}_2e/\text{y in WA}\]
Carbon pools have changed significantly (Cogger et. al) Which carbon pools (recalcitrant or labile) have increased due to the biosolid application in grain-fallow rotation?
Hypothesis

No significant change in the recalcitrant carbon. Not significant time

Significant change in the labile carbon in the samples. Partially decomposed SOM in light fraction
Background

- King County biosolids
- 5 treatments
  - Anhydrous ammonia (AA), biosoilds, no fertilizer, in wheat-fallow rotation.
- three replications
- 0-10 cm: 68% sand, 27% silt, 5% clay

- Plots est. 1994 in Waterville Plateau, Douglas County
  - Lat. 47° 55', long. 119° 48' W, elevation 750
  - Semi-arid
  - Temp: 8°C
  - Precipitation 270mm, 60% in November and March
  - Timentwa ashy fine sandy loam
  - 100 yr Wheat-fallow rotation.
Treatments

- King County wastewater
- Stockpiled 2 weeks, applied with spreader w/ 15 Mg capacity
- Tillage: plowing, disking, 2 cultivations
Methodology: Acid Hydrolysis (AH)

Pre AH

- 0-10 cm soil, sieved, dried, hand ground
- ~0.2 g pre-AH Truspec LECO w/o treatment for total carbon

Treatment

- ~1.0 g soil into digester tube w/ 25 mL 6 M HCl
- Covered w/ marble, boil at 115°C for 16 hr
- Supernatant pour off problem
- Soil were filtered out
- Dried
- LECO for recalcitrant C%
% Recalcitrant Carbon

![Graph showing the average % recalcitrant carbon over different dates with lines for different text types: Txt 0, Txt 2, Txt 3, Txt 4.5, and Txt aa. The dates are 16-Sep-98, 13-Aug-02, 24-Oct-06, and Grand Total. The graph includes error bars for each data point.](image)
% Total Carbon

Average of total C %

- 0
- 2
- 3
- 4.5
- aa

Dates:
- 16-Sep-98
- 13-Aug-02
- 24-Oct-06
Methodology: Light Fraction

- Fresh humified organic matter
  - Liable carbon
- Samples: sieve, dried,
- 22.5 g sample + 2.5 g water
- 1.7 s.g. 50mL NaI and shaken
- Poured into erlenmeyer flask, set for 24 hr
- Light fraction removed and filtered
- Pumice
Methodology: Light Fraction

- Half sample in muffler furnace, 375°C for 12 hours
- ~.1 g LECO combustion
- Sample still being analyzed
Conclusion/ Future Work

• Not significant change in recalcitrant carbon.
• Notable change in labile carbon
• 2013 samples
• Analyze LF samples of labile C
• Look at N values
• Continue sampling every 4 years
Works Cited

• Dou, F., Wright, A.L., Hons, F.M., Sensitivity of Labile Soil Organic Carbon to Tillage in Wheat-Based Cropping Systems
• http://www.futurity.org/earth-environment/as-planet-heats-up-fertile-soil-isn%E2%80%99t-guaranteed/
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