

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 CO₂ e/Mg Nf
- Nf Manufacturing: 1951
- Soil N₂O 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:
 $1,227 \text{ Mg Nf} \times 3553 \text{ kg CO}_2 \text{ e/Mg Nf} =$
 $4,359,000 \text{ kg CO}_2 \text{ e/y in WA}$



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

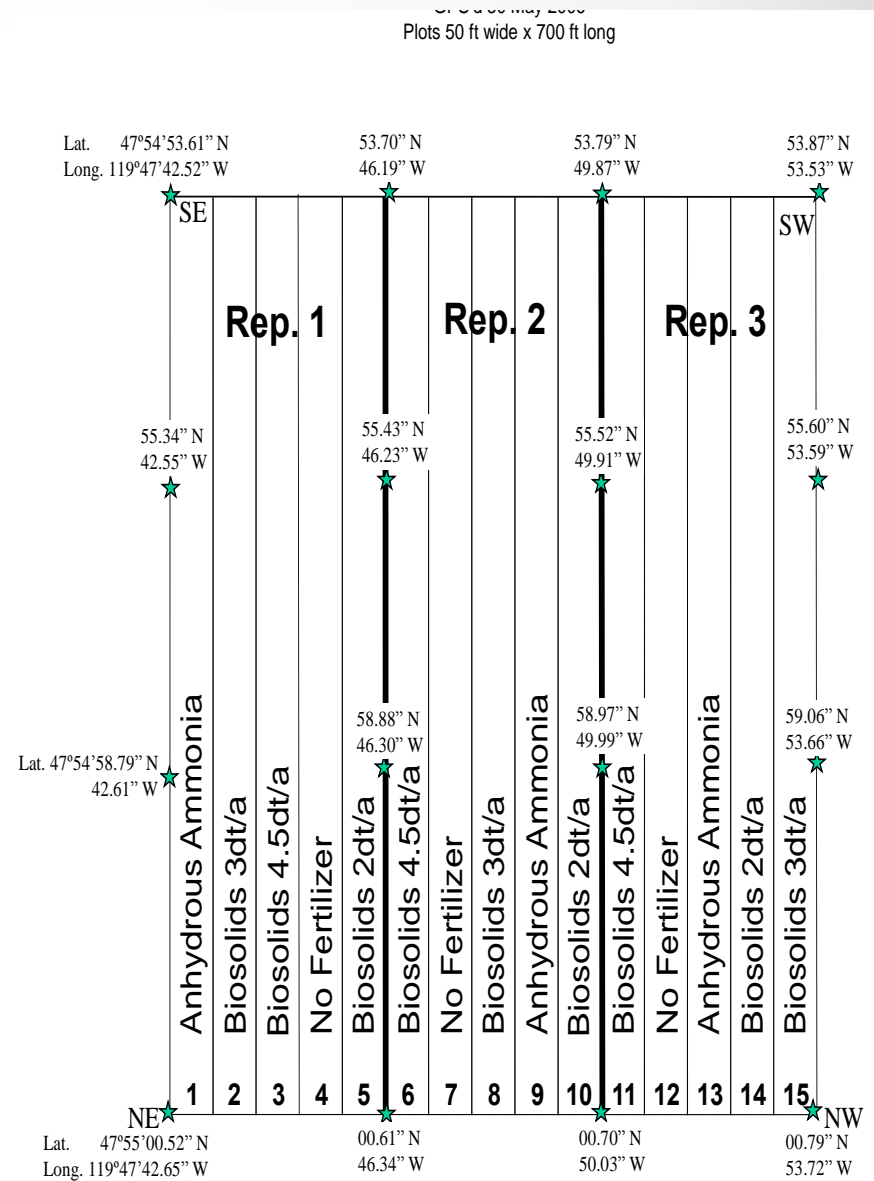
Background



- Plots est. 1994 in Waterville Plateau, Douglas County
 - Lat. $47^{\circ} 55'$, long. $119^{\circ} 48'$ 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.
- King County biosolids
- 5 treatments
 - Anhydrous ammonia (AA), biosolids, no fertilizer, in wheat-fallow rotation.
- three replications
- Addition of biosolids in fallow years: 1994, **1998, 2002, 2006**, 2010, 2014
- 0-10 cm: 68% sand, 27% silt, 5% clay

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

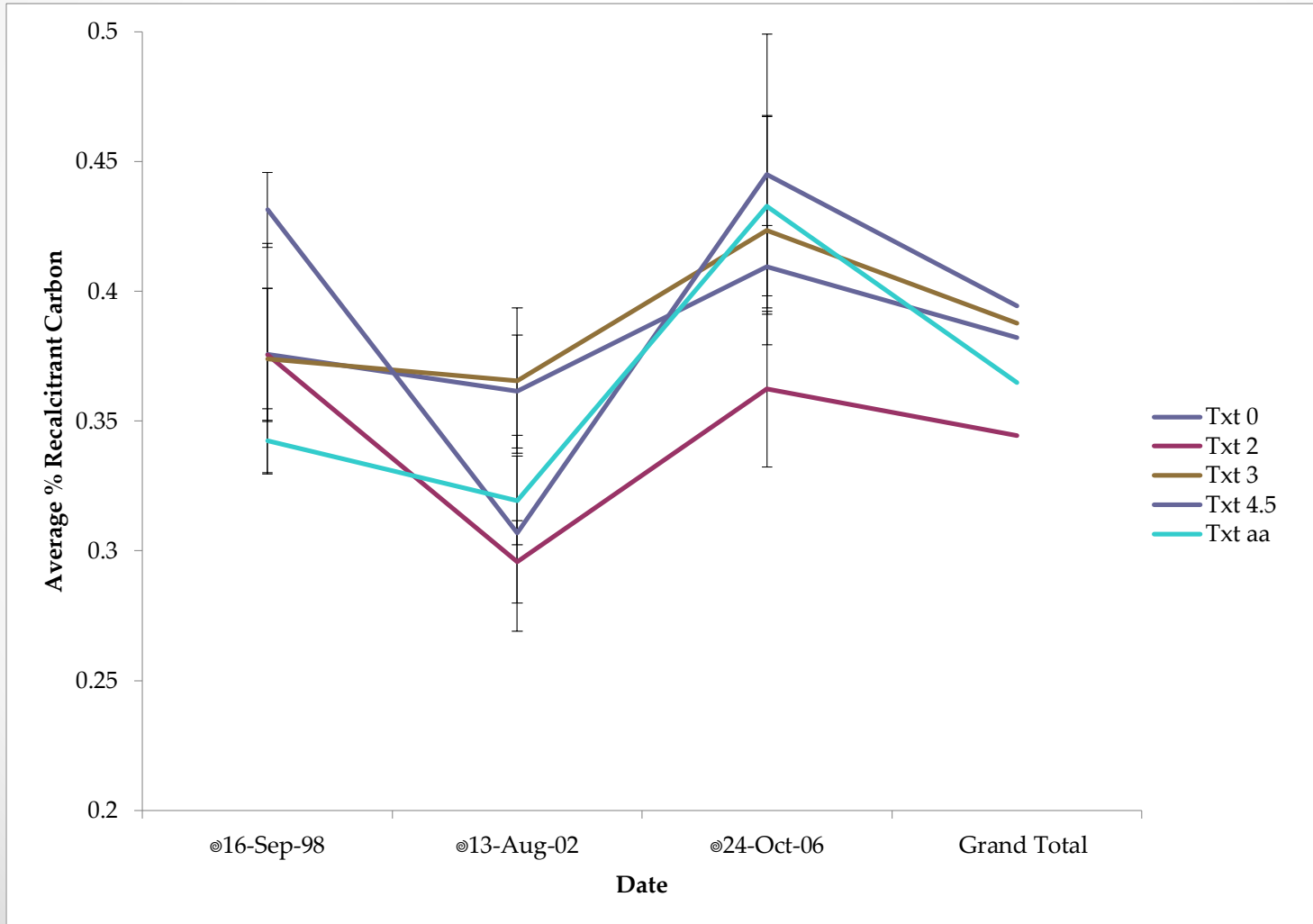
- 0-10 cm soil, sieved, dried, hand ground
- ~0.2 g pre-AH Truspec LECO w/o treatment for total carbon

Treatment

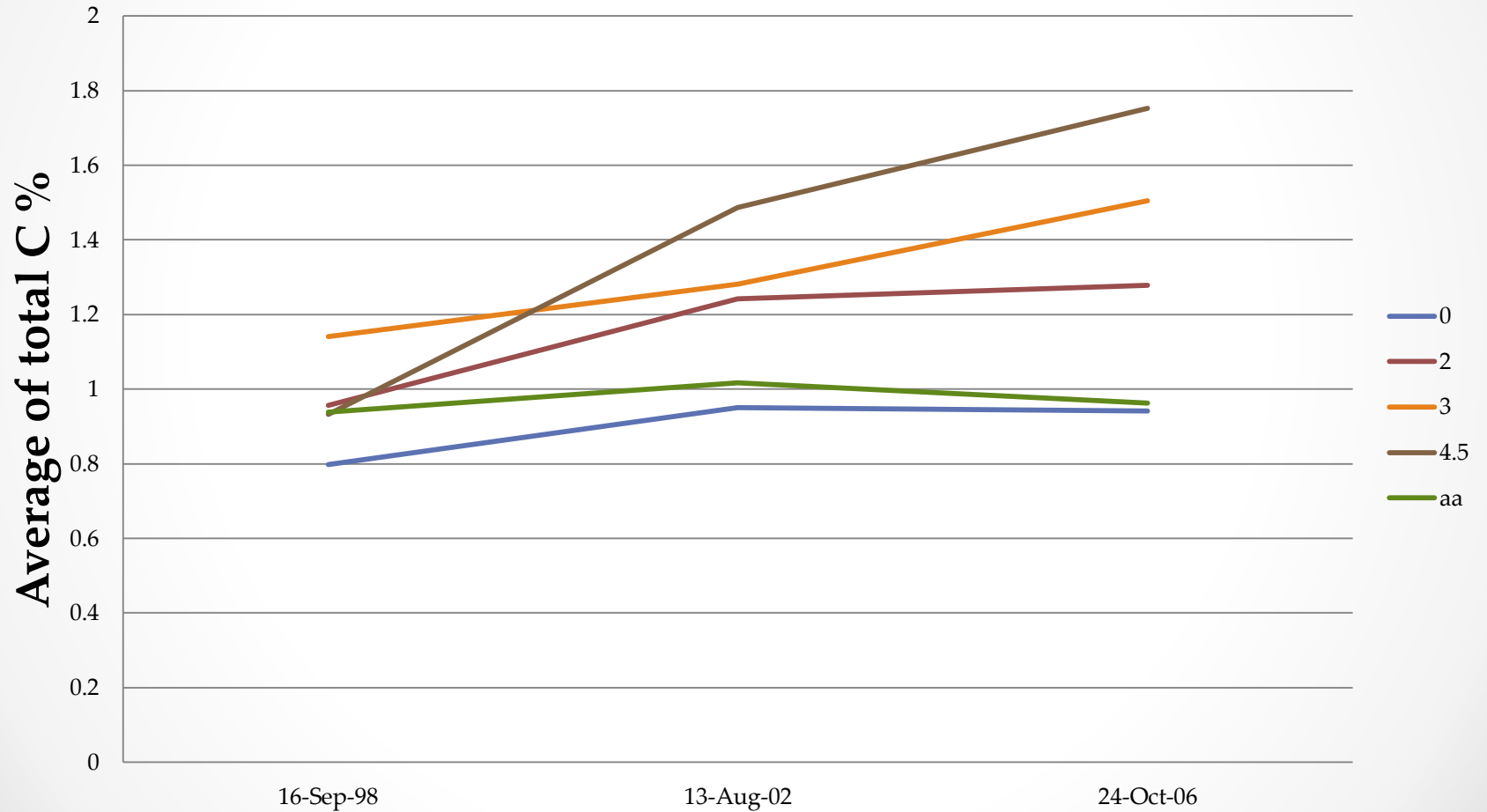
- ~1.0 g soil into digester tube w/ 25 mL 6 M HCl
- Covered w/ marble, boil at 115°C for 16 hr
- Supernatant pour off problem
- Soil were filtered out
- Dried
- LECO for recalcitrant C%



% Recalcitrant Carbon



% Total Carbon



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 muffle 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

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