On-Farm Assessment of the Effects of Recommended Management Practices on Potential Soil Carbon Losses in Northwest Ohio

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INTRODUCTION

The management of agricultural systems has the opportunity to provide a significant carbon sink in the landscape through adoption of recommended management practices (RMP's). Specifically, soil management practices that build soil organic carbon concentrations must minimize soil disturbance, maximize crop residue on the soil surface, and maximize water/nutrient use efficiency. Some RMP's that adhere to these characteristics include conservation tillage, cover crops, and nutrient management. Soil structure is a very important factor in the ability of soil to support biological processes and influence the environment through carbon sequestration. Soil structure plays an important role in many soil properties including water retention, infiltration, erosion, crust prevention, nutrient cycling, root penetration, and crop yield.

This research focused primarily on the characterization of key soil physical properties and water erosion in order to gain understanding of the effects that RMP's have on soil resources in northwest Ohio.

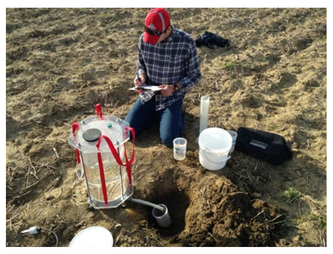
Objectives:

- Determine effects of RMP's on soil structure
- Quantify effects of RMP's on soil and carbon losses by water erosion

MATERIALS & METHODS

Study sites were located in northern Darke/Shelby county, Ohio. All soil samples and measurements were taken from the Blount Silt loam series and in the spring just before planting or tillage took place.

Management Practices
Conventional till
No-till
No-till and manure application
No-till and cover crops (cereal rye)



(Infiltration experiment in tilled field, 2014)

(Soil collection for bulk density and carbon measurements, 2014)

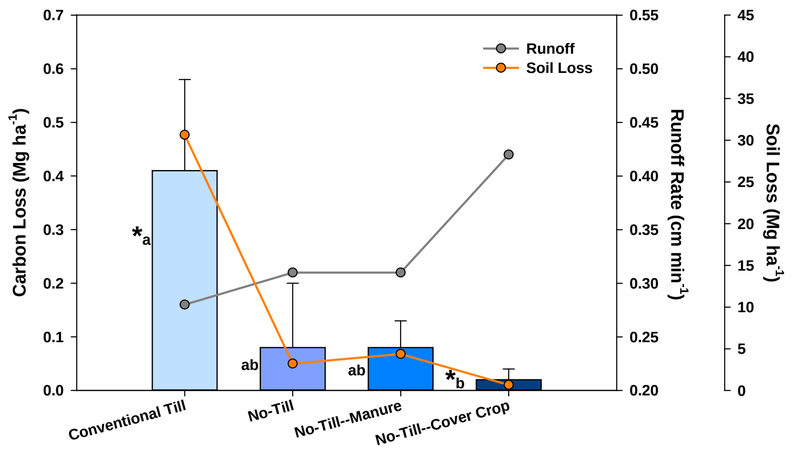
Measured Properties
Dry bulk density
Water stable aggregation
Steady state infiltration and runoff rate
Soil and carbon losses (calculated from sediment load in runoff)

(Runoff sample, 2014)

RESULTS & DISCUSSION

Figure 1.
Carbon loss, runoff, and soil loss.

- *Error bars* = standard deviation
- *Graphed lines* = trend only
- *Average simulated rainfall intensity* = 0.45 cm min^{-1}
- *Duration of rain event* = 15 min.

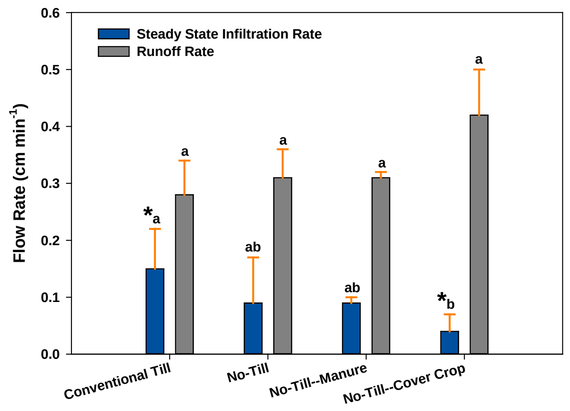


- *Significant difference found between Conventional Till and No-Till--Cover Crop treatments ($P \leq 0.1$) for both carbon and soil loss

Photographs display Conventional Till, No-Till, and No-Till--Cover Crop from left to right.

Figure 2.
Infiltration vs. runoff

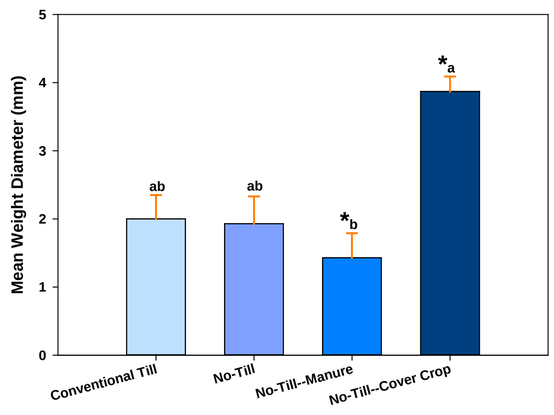
- *Error bars* = standard deviation
- *Average simulated rainfall intensity* = 0.45 cm min^{-1}
- *Duration of rain event* = 15 min.



- *Significant difference found between Conventional Till and No-Till--Cover Crop treatments ($P \leq 0.1$)
- No significant differences observed among runoff data, while infiltration decreased with addition of cover crop and no-till practices

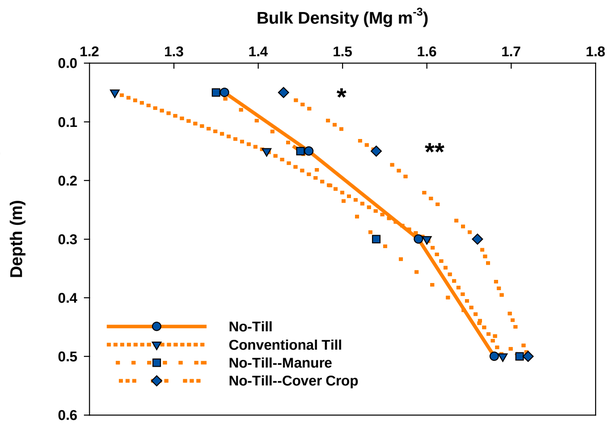
Figure 3.
Mean weight diameter

- *Error bars* = standard deviation



- *Significant difference found between No-Till--Cover Crop and No-Till--Manure treatments ($P \leq 0.1$)

Figure 4.
Dry bulk density



- */**Significant difference found at the 0-0.1 and 0.1-0.2 m depth between Conventional Till and No-Till--Cover Crop treatments ($P \leq 0.1$)
- Plowing done to a depth of 0.2 m in conventional till treatment

CONCLUSIONS

- Practices such as no-till and cover cropping, which enhanced soil aggregation, were expected to reduce soil carbon losses from soil erosion via runoff.
- The largest soil carbon losses were observed under tillage. Despite having the highest infiltration rates (Figure 2) and porosity (Figure 4), tilling left the soil more vulnerable to rain drop impact and detachment by removing plant residue from the surface.
- Incorporation of cover crops into no-till management increased soil aggregation compared to non-cover crop systems.

RECOMMENDATIONS

- **Adoption of cover crops after bean crop to increase residue on surface and reduce soil losses by water erosion.**
- **Adoption of RMP's which are known to increase soil organic carbon concentrations to build soil aggregation.**

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