

Hairy Vetch Green Manure in Organic Grain Systems; Influence of Termination Method on Earthworm Populations

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Introduction

- Soil degradation caused by agriculture is a major concern worldwide
- With the earth's growing population to feed, concerns about soil health are only going to be exacerbated
- Soil health can be improved by using green manures
- **What is a green manure?**
 - A crop grown in a crop rotation to be incorporated into the soil rather than have the biomass removed (i.e. harvested)
 - Can be a nitrogen fixing crop to return nitrogen to the soil (Figure 1) – beneficial to an organic system
- They are traditionally terminated by tillage (intensive plowing)
- Tillage can be detrimental to soil health, causing erosion and loss of organic matter and soil carbon
- **Objective: What are the consequences for soil health of applying different levels of tillage intensity to terminate a green manure?**



Figure 1. Hairy Vetch green manure (left) and no-till termination using a crop roller (right)

Methods

- Experiment is a split-plot design with 3 replications established in 2012 at the Dalhousie Agricultural Campus in Truro, Nova Scotia, Canada.
- Comprises a fully-phased 4yr rotation: green manure (hairy vetch), followed by wheat, followed by fall rye, then soybean. Sub-plot treatment is crop rotation phase.

Methods cont'd

- Main plots are tillage level used for green manure termination
 - **Full tillage** – tilled in fall and spring (standard)
 - **Spring tillage** – tilled in spring (reduced tillage)
 - **No-till** – crop rolled only (Figure 1)
- Surface mulch levels in no-till plots in spring 2014 averaged 4.90 t/ha (Figure 2) .
- Soil is sampled 4 times during each of the first 3 years of the rotation. Soil is also sampled from nearby undisturbed 'reference' field margin sites for comparison
- Earthworms were sampled as indicators of overall soil system health in June 2014



Figure 2. Mulch remaining after no-till termination (left) vs. tilled plots (right) in the spring of 2014

Results

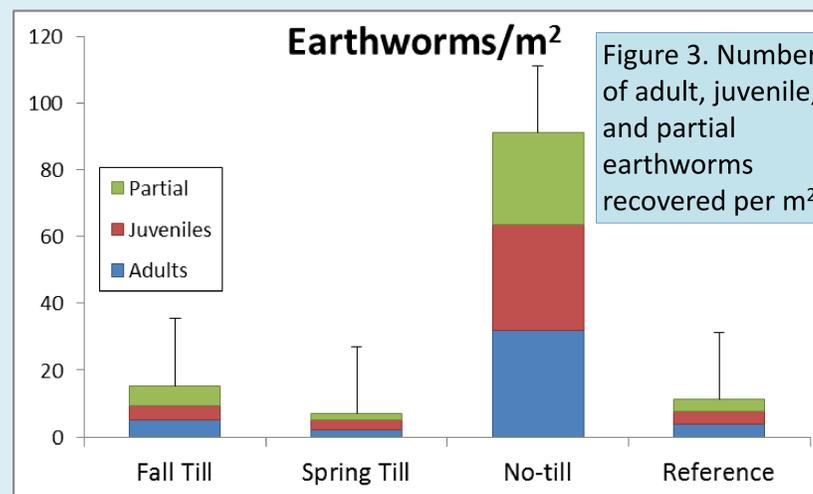


Figure 3. Number of adult, juvenile, and partial earthworms recovered per m²

Results cont'd

- Earthworm numbers were highest in the no-till plots, followed by fall tillage, then the reference soil, and spring tillage had the lowest values (Figure 3)
- Once soil began to thaw in the spring the no-till plots were cooler than tilled plots and retained more soil moisture (Figure 4)

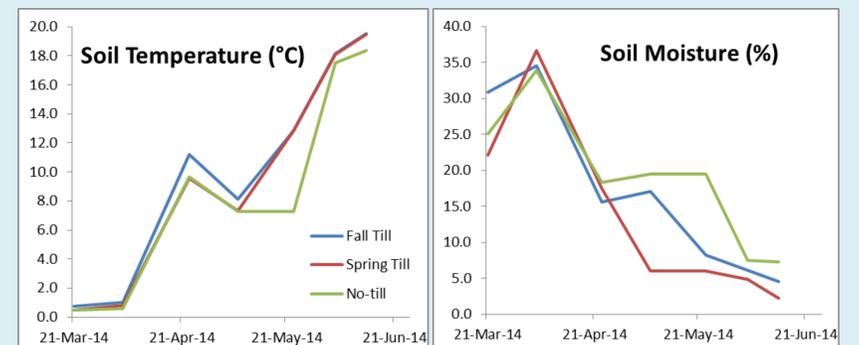


Figure 4. Soil temperature (left) and moisture (right) from March until June 2014

Conclusions

- While tillage is expected to be detrimental to earthworms due to the physical disturbance, earthworm counts in the no-till treatment were substantially higher than all other treatments, including the undisturbed soil
- The no-till plots were cooler and had more moisture, conditions which are favorable to earthworms
- **The environmental conditions created by the mulch in no-till green manure termination, in combination with the lack of physical soil disturbance, may both be contributing to increased earthworm numbers**

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