Effects of Traditional Field Retting of Industrial Hemp (*Cannabis sativa* L.) on Soil Carbon and Soil Microbial Community Dynamics.

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Introduction

Resurgence of Hemp in Kentucky

•Recent legislation defines industrial hemp production standards
- •KRS 260.850-260.959 in 2013 - Kentucky
- •2014 Farm Bill (section 7606) – Federal
  - •**<0.3% Δ9-THC**

Kentucky Industrial Hemp Pilot Program

Statewide Acreage authorized for planting
(Academic and Civilian)
2014 – 33 acres
2015 – 1500 acres
2016 – 4500 acres
2017 – 12, 800 acres

Industrial Hemp in Sustainable Systems

•Soil organic carbon (SOC) is a key component of soil quality in agroecosystems. (Weil and Magdoff, 2004)
- •SOC Impacts
  - •Fertility
  - •Nutrient holding & Cycling
  - •Soil Microbes & Biodiversity
  - •Soil Structure
  - •Air and Water Dynamics

Figure 1. Industrial hemp at Kentucky State University's Harold R. Benson Research and Demonstration farm, grown as part of the Kentucky Industrial Hemp Pilot Program in 2016.

Traditional Field Retting of Hemp for Fiber

•Partial decomposition of stalks in field (Figure 2)
- •Enables separation of fibers from woody core
- •Dependent on soil microorganisms
- •Byproducts become SOC and microbial substrate

Research Question

Given that harvesting hemp for fiber requires removal of most plant biomass, possibly depleting SOC (Martens, 2000), how does the traditional field retting process influence SOC and soil microbes?

Figure 2. Industrial hemp crop being field-retted as part of this experiment conducted at Kentucky State University's Harold R. Benson Research and Demonstration farm in 2016.

Materials and Methods

•Field plots arranged in a Randomized Complete Block Design

•Two Locations
1) 2015 at St. Catharine College, St. Catharine, KY
2) 2016 at Kentucky State University, Frankfort, KY

•Four Field Retting Treatments
1) Experimental Control – No Hemp, No retting (CON)
2) Hemp production, No Retting (H-NR)
3) Hemp production, Low density Retting (H-LR)
   - 2270 kg / ha (2025 lbs / ac)
4) Hemp production, High density Retting (H-HR)
   - 4540 kg / ha (4050 lbs /ac)

•Soil Tests Conducted
1) Total organic Carbon (TOC)
2) Permanganate Oxidizable C (POXC)
   - (Weil et. al., 2003)
3) Microbial Fatty Acid Biomarkers
   - (Schutter and Dick, 2001)

Thank you to the Kentucky Department of Agriculture for administering the *Kentucky Industrial Hemp Pilot Program*.

Results

- Significant differences were seen in soil C parameters between retting treatments (See Figure 3)
- In 2015 no microbial parameters showed significant differences, but non-significant trends similar to those seen in soil C parameters were observed. (Fig. 3)
- 2016 microbial data is still in process.

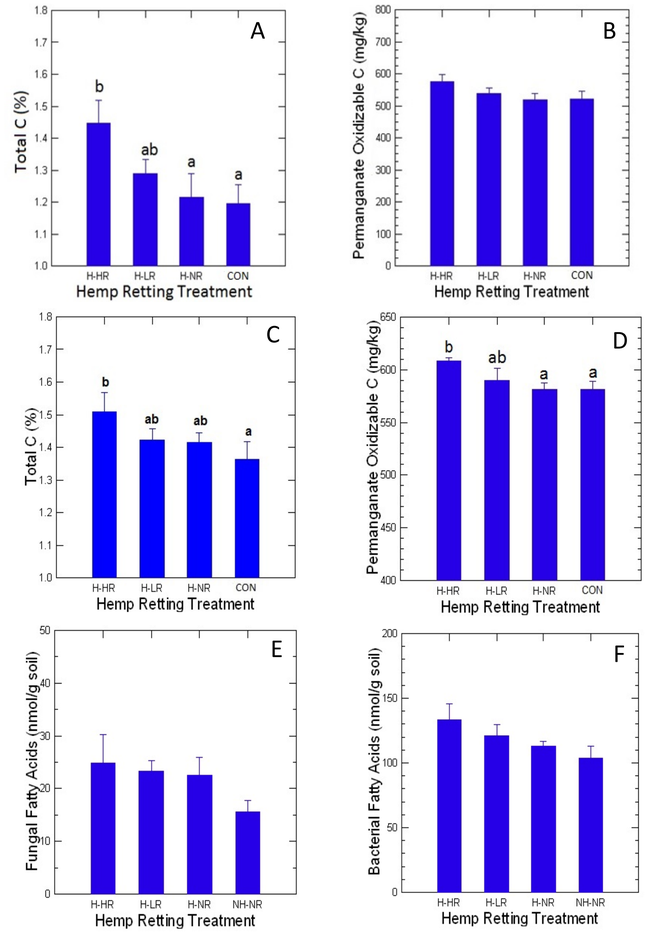

Figure 3. Effects due to retting treatment seen in soil carbon and microbial parameters: (A) TOC in 2015; (B) POXC in 2015; (C) TOC in 2016; (D) POXC in 2016; (E) Fungal FAME biomarker; (F) Bacterial FAME biomarker. Different letters over bars in the graph indicate significant differences at α = 0.05.

Conclusions

•Traditional field retting of hemp probably contributes to carbon sequestration in soil and may mitigate C losses due to residue removal.

•Traditional field retting may also increase microbial biodiversity and activity. More work needs to be done.

References
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