

RESEARCH PROTOCOL: SOIL HEALTH 2018

Efficacy of Biochar in Orchards

Farmer-researcher

Val Steinmann, Heartwood Farm & Cidery

This document outlines the steps that Val will follow to execute her research project, *Efficacy of Biochar in Orchards*, including design, execution, data collection and data sharing. It also serves as a Memorandum of Understanding between Val and EFAO.

Background

Val is curious to know if biochar has a chance of helping her head in right direction, with respect to soil organic matter and carbon storage on her farm.

Given the lack of established protocols for biochar in orchards, Val is testing the rate and method of amendment (root feeding) offered by a farmer-friend who has had experience and success with biochar amendments. Although reliant on specialized equipment, she feels this method will give biochar the best chance of having a positive impact in her orchard.

Experimental Design

For the trial, Val is using 4 scion varieties grafted onto 2 semi-dwarf root stock varieties (Table 1). Each scion variety will be grafted to ~ 1/2 of each rootstock. Half of each variety will be assigned to biochar or no biochar. In this way, the design is a **paired design with 4 replicates**.

Table 1. Cider apple varieties for grafting. Val grafted each scion variety onto two semi-dwarf rootstocks, Geneva 935 and Geneva 202 at the beginning of May. Val planted four rows, one scion variety per row with alternating rootstocks in the middle of May.

| Row | Scion Variety | Approximate Quantity |
|-----|---------------|----------------------|
| 1 | Jonagold | 50 |
| 2 | Northern Spy | 50 |
| 3 | Golden Russet | 50 |
| 4 | Cortland | 50 |



Figure 1. Aerial photo of Heartwood Farm & Cidery. The red star indicates the alley where 5 rows of cider apple trees will be established using the design described in this protocol.

| | ~ 25 trees | ~ 25 trees |
|-------|------------|------------|
| Row 1 | | |
| Row 2 | | |
| Row 3 | | |
| Row 4 | | |

Figure 2. Diagram of the experimental design at Heartwood Farm & Cidery. Treatment (biochar) and controls were randomly assigned to half of each row of trees. Grey is treatment (amendments + biochar) and white is control (amendments only).

Predictions

Biochar will enhance the soil health and performance of cider apple seedlings and trees. We will be able to run statistics to calculate the probability that growing apple trees with biochar is better or worse than without biochar. We will *not* be able to determine if specific varieties are better or worse since this design does not have replicates of varieties. Further, if varieties differ a lot in their response to biochar, we may not have the statistical power to detect any effect of biochar, whether or not it exists. All this said, we hypothesize that biochar amendment will either improve growth for all or none.

Methods and Measurements

Val sourced biochar from Whole Village in Alton, which was charged, or inoculated, with urine and/or cow manure. Given the lack of established protocols for biochar amendments, Val is using recommendations from a farmer-friend who has experience using biochar in orchards. At Owen's recommendation, Val will amend the orchard at 20 lb/acre of charged biochar.

For the trees receiving biochar amendments, Val will pulverize the biochar and mix it with other amendments based on soil tests to form a liquid suspension. For application, Val will use a root feeder and pump the mixture into the soil soil in 4-6 holes around the perimeter of the root zone of the tree. All the trees were mulched with cardboard and straw when they were planted, and irrigated as required (or as practical).

Measurements

- Water infiltration measurements in collaboration with the Soil Health Coalition
- Woody growth, yield (in future years)
- Soil respiration (Solvita in field test)
- Tea test experiment

Statistical test

Paired t-test of control (no biochar) vs treatment (biochar) for the different measurements. See note under Experimental Design about statistical limitations.

Materials and Research Expense Budget. Prices are approximate; NA or in-kind for any materials that you already own or have access to. Please indicate if you intend to give any of the supplies to EFAO's Tool Library for others to use after you are finished with them.

| Material | Quantity | Unit | Total Cost | EFAO's Tool Library (Y/N) |
|--|---|--------|------------|---------------------------|
| Biochar | 20 | \$5/lb | \$100 | N |
| Equipment rental for biochar injection | | | | |
| Amendments | Seaweed Molasses Compost Minerals/micronutrients | | | |
| Soil tests | | | | N |
| Total | | | | |

Deadline for data and photo submission

October 31, 2018

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Collaboration

Soil Health Coalition - Erin Chapter

Memorandum of Understanding

Please refer to efao.ca/research-mou for Memorandum of Understanding.

Contact

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