



University of
Massachusetts
Amherst

Farmer Workshop

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| Authors | Hestrin, Rachel;Yarrow, David;Pulver, Christian;Whitman, Thea |
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Anatomy of a Biochar Trial

FLB001

Christian Pulver (Charchemides)
Kathleen Draper (Chief Charista)

Agenda

10µm

Biochar Trials for Cropping Systems

- Food production
 - Grains & pulses
- Perennial Horticulture
 - Viticulture
 - Hops
- Dairy

Getting Char

- Make vs Buy
- Know What You Sow

U.S. Cropping Systems

Positive

- Common beans
- Cucumbers (clay)
- Oats
- Maize (2nd year)
- Alfalfa



Negative

- Cucumbers (sand)
- Tobacco (1 year)
- Lettuce
- Maize (greenhouse)
- Tomatoes
- Peanuts (1 year)
- Cotton (1 year)

Variability:

1. Trial duration
2. Production parameters
3. Feedstock quality
4. Biochar characteristics
5. Edaphic qualities
6. Trial design
7. Yield ecology



biochar trials

biochar & perennial horticulture

advantages

- high revenue/acre = high impact
- significant on farm waste biomass
- Ability to ameliorate a variety of growing constraints
- Aggregate stability, moisture retention, pathogen suppression

disadvantages

- hard to get char to root zone for established plants
- measuring results is challenging:
 - pruning controls yield
 - some effects may take years to measure



Vine prunings



Rachis



Diseased and/or old vines



Pomace

biochar & viticulture

Possible benefits & uses in viticulture

1. **Reduced seasonal inputs (e.g. carbon additions)**
2. **Improve yield consistency within a vineyard or block.**
3. **Improve hydraulic management of water drainage and water holding capacity of soil.**
4. **Boost YAN.**
5. **Enhance cation exchange capacity and nutrient retention.**
6. **Promote beneficial microbial activity in soils and pathogen suppression**
7. **Healthier root growth and transplant vigor.**
8. **Less labor intensive vineyard floor management**
9. **Better aggregate stability, buffering capacity, bulk density and reduce compaction.**
10. **Neutralize toxins in soils.**

biochar & viticulture



Coconut Husk Twine

Bines

Char Coil!

deBine Char!

biochar & hops

IDEAL GROWING CONDITIONS FOR HOPS

- pH: 5.7 – 7.5
- Irrigation needed in most places.
- 16 gallons per plant per week!
- Hops do not thrive in heavy, waterlogged soil.
- Annual removal per acre:
 - N: 100 lbs
 - P: 20 – 30 lbs
 - K: 80 – 150 lbs



Land preparation for new bines includes the following activities in the fall:

- Plowing rows – up to 6" depth
- Row is tilled 1 – 2 times
- Compost & manure added
- Row is tilled at least 1 more time

biochar & hops



SOIL PROFILE

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|-----------------|----------------------------------------------------|--------------|----------------|
| 48B | Arkport fine sandy loam, 3 to 8 percent slopes | 26.5 | 11.2% |
| 128B | Palmyra gravelly sandy loam, 3 to 8 percent slopes | 42.2 | 17.7% |



Benefits & Uses for Dairy Operations

- 1. 1% biochar addition into feed as binding agent**
 - Improve feed conversion ratio
 - Reduce methane emissions
 - Reduce odors from manure
- 2. Combine biochar with manure**
 - Retains more nutrients during composting
 - Stable C and enhanced nitrogen cycling
 - Reduces nutrient leaching into eco-system
- 3. Use in anaerobic digestion to boost methane production**
- 4. Help treat dairy wastewater**
- 5. Neutralize toxins from footbaths (e.g. copper)**

biochar & dairy

making char



Feedstock Options, Attributes & Considerations

| Possible Feedstock Options (NY) | Cherry Pits | Grape seeds | Nuts | Forestry Slash | Tree Mulch | Pallets | Pomace | Vine & Orchard Trimmings |
|---------------------------------|----------------|---------------------|--------|----------------|------------|----------|----------------|--------------------------|
| Moisture content | med | low | low | med | med | low | high | med |
| Particle Size | small | small | s - m | m - l | med | large | varies | varies |
| Density/BTU | high | high | | | | | | |
| Fuel Shape | uniform | varies | varies | varies | varies | varies | | |
| Quantity | 2T/wk | plentiful | small | plentiful | plentiful | | plentiful | plentiful |
| Alternate Uses | craft, heating | nutri- ceutical? | | biofuel | biofuel | | grape seed oil | org matter for soils |
| Drying | yes | yes | yes | maybe | maybe | no | yes | prob no |
| Chipping | no | no | no | yes | no | yes | no | yes |
| Acquisition Cost | | high | ? | free | free | | free | free |
| Seasonality | Jul | S - O | J - O | all year | all year | all year | seasonal | seasonal |

making char

buying char



know what you sow

| | Black wattle | Vineyard Prunings | Sugar cane bagasse |
|-----------------------|-----------------|--------------------|--------------------|
| MACRONUTRIENTS | | | |
| Phosphorus (P) | 397±4 | 1,989±102 | 451±32 |
| Calcium (Ca) | 13,783±120 | 17,177±1367 | 2,181±128 |
| Magnesium (Mg) | 1,349±73 | 3,908±255 | 1,158±71 |
| Potassium (K) | 5,670±42 | 15,746±982 | 3,463±271 |
| Sodium (Na) | 2,205±15 | 672±18 | 289±9 |
| MICRONUTRIENTS | | | |
| Iron (Fe) | 24±2 | 102±7 | 3,953±192 |
| Aluminum (Al) | 82±3.5 | 83±11 | 2,955±102 |
| Manganese (Mn) | 10±0.3 | 78±8 | 162±8 |
| Zinc (Zn) | 7±0.3 | 179±20 | 42±4 |
| Copper (Cu) | b/d | 1.37±0.3 | 9±0.2 |
| Cobalt (Co) | 0.02±0.004 | 0.06±0.01 | 1.9±0.1 |
| Molybdenum (Mo) | 0.1±0.003 | 0.02±0.01 | 0.01 |

**If possible,
map growing
constraints to
char characteristics**

**Importance to
Viticulture
Management**

Very
important

Somewhat
important

Not too
important

questions?

Biochar Can Do It!



Finger Lakes
biochar
Plant Waste Wisely 



CHARpe
Diem!