



University of
Massachusetts
Amherst

Farmer Workshop

Item Type	event;event
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Download date	2026-03-16 08:08:18
Link to Item	https://hdl.handle.net/20.500.14394/3647



Anatomy of a Biochar Trial

FLB001

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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!