

Garden Alchemy....
Transforming Biochar into
Tomatoes

Presented by Mike Flynn

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Who We Are in Real Life

- Own and Operate 2 Wisconsin Companies
- Bio Specific, LLC, www.WeAreBioSpecific.com
- Green Quest LLC, www.OnaGreenQuest.net

BioSpecific

- Works with medium & large scale leafy green growers in California, who grow conventionally and/or organically
- Designs, formulates and manufactures organically certifiable pest repellent products and plant & soil adjuvants.



Red & Green Lettuce



Electrostatic Spray Trial Done in March 2016

GreenQuest

- Manufactures input products that assist with repelling pests and improving soil health
- Markets to gardeners and small plot farms
- Operates GreenQuest Gardens Micro Farm

GreenQuest Gardens Micro Farm

- Grows specialty garlic for local restaurants



GreenQuest Gardens Micro Farm

- Grows Aquaponic Lettuce for local restaurants
- Collects supply chain data on consumer satisfaction and bag life in the kitchen



Aquaponic Lettuce on Floating Boards

The lettuce facility provides a year round product development & improvement platform for BioSpecific



System

GreenQuest Gardens Micro Farm

- The soil-based portion of GreenQuest Gardens serves as a development center for creating new approaches and products for growing great vegetables
- Like TOMATOES!



Tomatoes Growing at GreenQuest Gardens MicroFarm

Your Workshop Expectations

- 1.Enrichment of BioChar with chemical or biological additives;
- 2.Use of BioChar with compost and/or vermicompost;
- 3.Use of BioChar with compost tea;
- 4.Real world applications & benefits of Biochar;
- 5.Learning more about BioChar in general;
- 6.Learning more about BioChar production;
- 7.Learning about the business case for BioChar;

A Form Follows Function Moment

- After reading your feedback on expectations I realized I needed to revise the FORM of the workshop to fulfill your “expectation” FUNCTION
- Workshop focus:
 - The application of BioChar on tomatoes
in a small plot garden
- New Title:
 - BioChar Intensive Gardening
“B.I.G”

Workshop Organization

- Section 1 discusses BioChar and how it can be combined with other materials to build a BIG Toolkit
- Section 2 provides an example of how to apply this BIG Toolkit for growing great tomatoes
- Time for questions after each section

What Can BioChar Do For Us?

- In our applications we want BioChar to do two things: carry & deliver stuff and/or take up space
- BioChar then is either the FedEx Delivery truck...
 - ... or a rock in the stream

We use BioChar in 4 Physical Forms

- BioChar Powder: small uniform fine particle
- BioChar Particulate: varied sized particles from fines to less than $\frac{1}{4}$ inch
- BioChar Pellets: wood pellets that have been pyrolyzed into biochar pellets that hold their shape
- BioChar Chips: pieces of biochar that are greater than 1 inch in size.

BioChar Powder

- We use BioChar Powder as a component in soil drenching and foliar applications
- Can also be used as a component in a seed coating

BioChar Particulate

- Can be both FedEx truck or rock in the stream
- Use as top dressing (delivery truck)
- Use in planting hole (rock in the stream)



Top Dress around Tomato Seedling



BioChar in Planting Hole



BioChar pellets applied to garden soil for carrot planting

How do we build a BIG Tool Kit?

We approach building our tool kit similar to the way folks approach “food pairing.”



Green Sand and BioChar Powder

- Green Sand, also known as Glauconite or Iron Potassium Silicate, is a mined soft rock mineral from ancient ocean deposits.
- A great source of easily mineralized iron. Potassium, and a range of other trace minerals.
- A blend of green sand and BioChar works well both as a top dress & in the planting hole

Using Green Sand and BioChar Blend as top dress and in planting hole



Gypsum, Green Sand & BioChar Powder

- Gypsum, or Calcium Sulfate, is a great source of calcium for the soil
- We use the BioChar Powder/Green Sand blend in equal volumes with Gypsum as a top dressing in the garden beds before placing our compost bins.

Wild & Known Microbes

- Wild microbes can be obtained from sources such as vermicompost, compost, plant roots or garden soil
- Which group of wild microbes are present is based on the parent feed stock.



Duckweed Floating in Pond

Known Microbes Can be purchased commercially based on what they do:

- ✓ Enzyme production (cellulase, chitinase)
- ✓ Produce & excrete a chemical compound, like an organic acid
- ✓ Perform a function, like fix nitrogen

Using Wild and Known Microbes

- At the GreenQuest Gardens MicroFarm we favor the combined use of wild and known microbes for within season applications
- For season-to-season soil health wild microbes can do the job made from high quality starting materials

Introducing Microbes onto BioChar

- Can be done many ways, but for today we will focus on the soaking method
- We use compost and vermicompost, as parent materials

Compost or Vermicompost Extract

- Mix 1 part solids with 5 parts water, stir thoroughly
- Allow suspension to extract for 24 hours, stirring periodically
- After 24 hours, filter out the solids
- This extract liquid contains dormant microbes

Extract Liquids v. Compost Tea

- Both liquids begin as extracts
- If you add nutrients, air and time you will eventually end up with a living compost tea
- A *compost extract* is a static dormant liquid
- A *compost tea* is a dynamic living liquid

Our Extraction Protocols

- We use extracts and then “wake them up” into dynamic living liquid after application to soil.
- We validated our extraction method awhile back, including method verification, using 3rd party testing performed by one of Elaine Ingham’s Soil Food Web labs.

You Cannot Extract Quality into a Liquid Extract

- The liquid extract will directly reflect the quality of the parent material
- On our microfarm we define quality as “fitness for use”

BioChar Particulate & Pellet Soaking

- Mix 1 part BioChar particulate or pellet in 9 parts compost or vermicompost extract
- Soak for 24 hours with periodic stirring
- After 24 hours, filter out the solids
- Allow solids to air dry for at least 24 hours before use

Uses for Bioprimes BioChar

- Can be part of a compost or vermicompost blend, or applied directly to the soil
- How much to add to the soil or blend is based on what the application goals are and what can be executed
- Extract liquid left over can be poured over plant material in compost bins

BioChar Powder Soaking to Make a Sprayable Liquid for Foliar Application

- Mix 1 part BioChar powder in 100 parts compost or vermicompost extract
- Soak for at least 4 hours, stirring periodically
- Prior to spraying, strain suspension through a filter

Nutrient/Organics Priming BioChar

- ✓ to slow the release of organics into the soil environment
- ✓ to provide a nutrient nugget for the microbes to grow onto
- ✓ to introduce a more residual aroma into the immediate environment

Examples

- Some of the organics we use for imbining BioChar powder are extracts of garlic, yeast, humic acid and kelp
- We use these suspensions as either foliar sprays or soil drenches

ReCap of Section 1

- Described the different forms of BioChar that we use & why & how we use them
- Discussed pairing BioChar with other materials to build our BIG Tool Kit
- Provided different recipes to make different types of liquid extracts
- Questions????

Section 2

How We Apply the BIG Tool Kit to Grow Great Tomatoes and Great Soil

Growing Tomatoes in a BIG Way:
An Evolving Approach

Each Evolution was Prompted by an issue we needed to solve:

- ✓ Looking for a vermiculite substitute we discovered BioChar, its production process and people who make it much better than we can
- ✓ Looking for ways to improve soil health we learned about Remineralization and the use of rock dusts, like Green Sand, as soil additives

An Evolving Approach

- ✓ Looking for a simple irrigation system we learned about an ancient subsurface irrigation method called “Clay Pot Irrigation”
- ✓ Looking for the perfect tomato cage we figured out how to make one using 2 metal posts and a ball of wool yarn

An Evolving Approach

- ✓ To improve on clay pot irrigation we developed “Water Cooler Irrigation”
- ✓ And the evolution continues...



This is a view of tomatoes in our 2015 garden. This is the result of a multiple- step evolution process over the years—an ongoing, never ending cycle

New This Year

- We added regal red tiles to see if this color improves tomato production
- This idea is based on reading about university trials using red plastic mulch
- Still collecting data on this idea: 92 pounds of tomatoes harvested from 8 plants so far by 8/21! More tomatoes on the vine to ripen....



**Tomatoes in the 2016 GreenQuest Gardens
MicroFarm**

Benefits of the BIG Approach

- Clay Pot Irrigation reduces watering efforts
- Tomato production goes up because plants always have enough water
- Use of primed BioChar in the root zone keeps subsurface soil moist

Benefits of the BIG Approach

- The tomato cage is 6 feet tall- great for indeterminate tomatoes.
- You build the cage as the plant grows so it's always just right
- Steel posts/wool yarn cage system makes it easy to prune tomatoes

An Example of BIG on a Small Scale: How Clay Pot Irrigation Works

- ✓ The plant leaves transpire water
- ✓ The plant roots suck water from the soil
- ✓ The soil sucks water from the clay pot

Demonstration of Water Porosity of Kilned, Unglazed Clay Pots

- The water in the small clay pot wicks from the inside to the outside clay wall
- This is why it's so hard to grow container plants in clay pots—they dry out!
- Clay Pot Irrigation uses this natural wicking tendency to our advantage

- Clay Pot Irrigation creates a moisture gradient zone within the adjacent soil horizon, from the outside wall of the pot to the plant stem
- Plant roots grow towards the clay pot and eventually encircle the pots from top to bottom



Cucumber Roots



Earthworm Among the Cucumber Roots

The soil environment around the clay pot appears the place to be seen this season...

Introducing BioChar into the System:

a three step process

- First, we broadcast a bioprimered BioChar blend at the bottom of the excavated hole where we will place the clay pots and transplants
- This bioprimered BioChar acts as a Delivery Truck for microbes and moisture



Introducing BioChar into the System: a three step process

- Second, we add particulate BioChar to the excavated garden soil and mix it in. We use ½ cup of BioChar to 5 gallons of garden soil
- This soil blend will be returned to the planting hole
- This non-primed BioChar will act both a Delivery Truck for moisture and a Rock in the Stream to lighten the soil

Introducing BioChar into the System: a three step process

- Third, we add a bioprimered BioChar based blend as a top dress around the stem of the plant.
- This bioprimered BioChar is a Delivery Truck for microbes



Tomatoes produce roots all along their stem if in contact with soil, so we plant our seedlings deep to take advantage of this trait



Tomato seedling placed in the planting hole



Tomato plants with clay pots on June 3, 2016.



The same tomato plants on July 22, 2016



Tomato Plants August 1, 2016

Note the build-as-go tomato cage and pruning of excess foliage



Amish Paste Tomato



Beefsteak Tomatoes



Manyel Tomatoes



Sanabel Tomatoes

Session 2 Re-Cap

- We showed how a BIG approach can be used for growing tomatoes
- We described how BioChar can be integrated with other methods to create synergisms and grow great tasting tomatoes



This is Why We Grow Tomatoes!

Getting Ready to Make Salsa



This is why we grow tomatoes!!
Prepped for roasting for homemade sauce

Information Included in this Workshop:

- What forms BioChar can take
- How the different forms of BioChar are important/useful
- What BioChar can be paired with for synergistic effects
- How to go BIG on tomatoes

Go BIG When You Go Home!

- Questions?
- Feel free to contact me at mikethewormguy@aol.com
- Thank You!