From Waste Stream To Protein!

Closed Loop Mushroom Production on 100% Waste Stream Substrate

Free *Workshop and Presentation*

Asheville Fungi

A local project funded by a Southern SARE Research and Education Grant

GROWING MUSHROOMS ON 100% RECYCLED WASTE SUBSTRATE

Sunday March 1st 2015 5-7 pm

VILLAGERS

hosted by VILLAGERS

278 Haywood Road, Asheville, NC 28806

SOUTHERN SARE Sustainable Agriculture Research & Education

OBJECTIVES OF THE STUDY

- To develop substrate formulations that utilize readily available waste stream products for growing edible mushrooms.
- To compare the yields of waste stream substrates to that of the “industry standard” commercial substrate formulation.
- To compost spent mushroom bags for use as a nutrient rich fertilizer, thus closing the loop

WHY IS THIS STUDY VALUABLE?

- Thousands of pounds of waste stream products are discarded into landfills every day in every city in the world.
- Many of these products may be suitable as substrates for growing edible and medicinal mushrooms.
- This study will determine the feasibility of using these substrates in commercial mushroom production.

Meet Pleurotis ostreatus
The tree oyster!

The Industry Standard Formulation (20 % enriched)

- 40 lbs of compressed hardwood fuel pellets (the lignin source)
- 8 lbs of Bran (the Nitrogen source)
- 1.5 lbs of Gypsum (provides sulfur, which fungi require for growth)
- 7 gallons of water (hydrate to carrying capacity)

Advantages of Using This Formulation

- Convenient, tried and true!
- Pellets are semi-pasteurized by extrusion process.
- High Yield.
- Easy to get hydration just right (almost) every time.
- Ingredients readily available most of the year.

Disadvantages of Using This Formulation

- You must buy the ingredients.
- You must pay shipping costs if delivered.
- Certain ingredients may be unavailable in certain geographic locations or at certain times of the year.
- Depending on sourcing, certain ingredients may not be environmentally friendly.

WS Partner Number One: Bee Tree Sawmill

- Bee Tree Provided the Carbon and Lignin Source In The Form Of Mixed Sawdust. The Sawdust Came From Numerous Species.
- How is this different from hardwood fuel pellets?

BEE TREE HARDWOODS

Waste Substrate Partner Number Two: Spent Coffee Grounds from Clingman Cafe

Spent coffee grounds are high in nitrogen and replace
The bran in the mix.
How is it different from the bran?

Clingman Café
River Arts District • Asheville

WS Partner Number Three: Soy husks and Dust from Smiling Hara Tempeh Co.

- The soy waste product is high in nitrogen and replaces the bran in the mix.
- How is it different from the bran?

Smiling Hara Tempeh™
a living food.

WS Partner Number Four: Cacao Shells From French Broad Chocolate Factory.

- Cacao Shells are high in nitrogen and are a waste product of the chocolate making process. They replace the bran in the mix.
- How are Cacao Shells different from bran?

WS Partner Number Five: "Fines and Beards" from River Bend Malt House

- Fines and beards are a waste product of the malting of grain. They replace the bran as an enriching agent and nitrogen source.
- How is it different from bran

RIVERBEND
MALT HOUSE
BARLEY • WHEAT • RYE
20 NORTH CAROLINA 10

RECIPES, RECIPES, RECIPES, RECIPES, RECIPES

- The sawdust from Bee Tree was used in all WS recipes as a lignin source
- Recipe one uses spent coffee grounds in place of bran.
- Recipe two uses soy dust and husks in place of bran.
- Recipe three uses cacao shells in place of bran.
- Recipe four uses fines and beards in place of bran.
- All recipes are enriched to approximately twenty percent by weight.

Hydrating and Mixing the Substrate

Bagging, Sterilizing, Inoculating and Sealing.

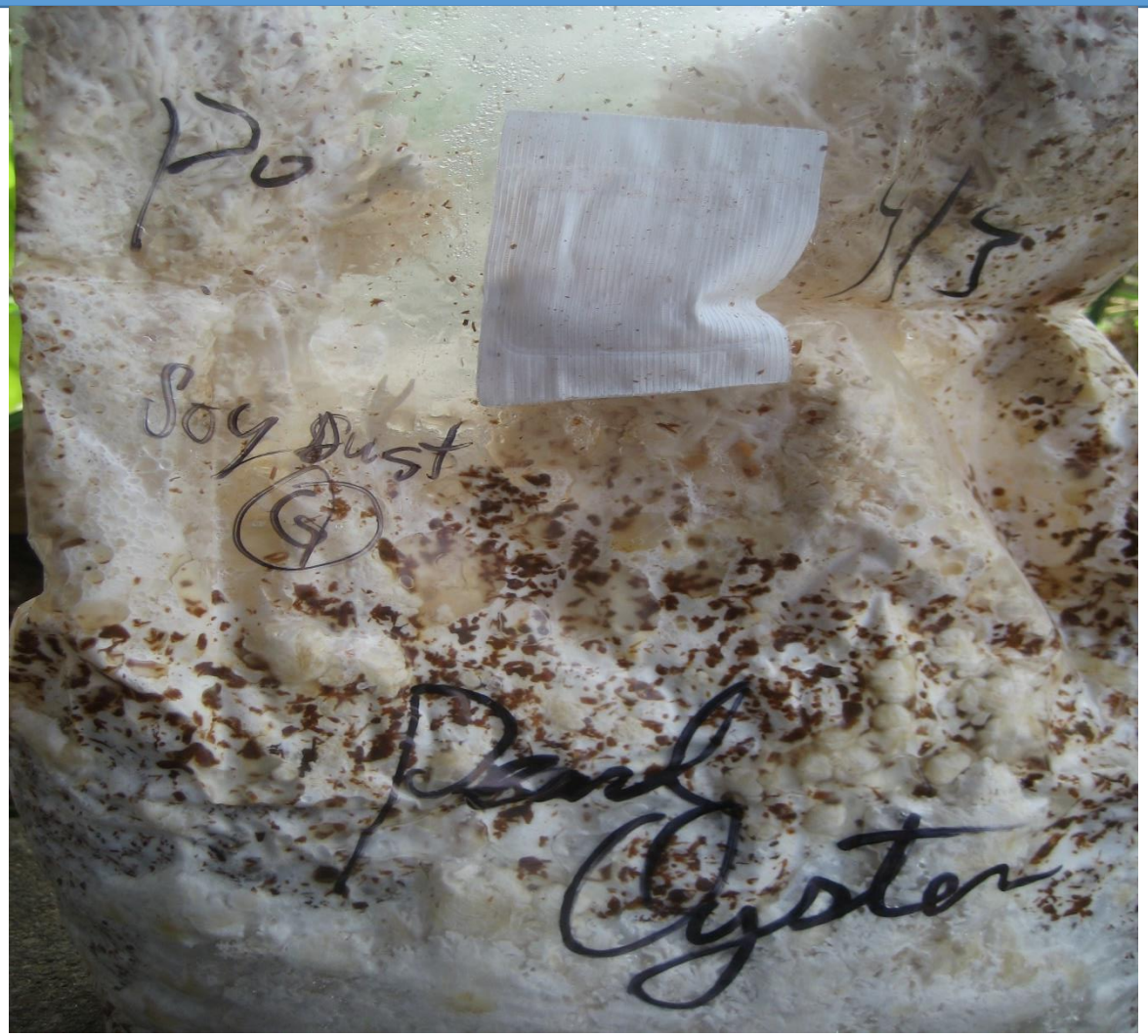
Experimental Controls

- Harvest period- 90 days for all substrate formulations.
- Hydrated bag weight- 5 pounds for all substrate formulations.
- Sterilization- active steam for 8 hours for all substrate formulations.
- Spawn Rate- 250 ml spawn per bag for all substrate formulations.

The Spawn Run on Spent Coffee Grounds

The Spawn Run On Cacao Shells

The Spawn Run on Soy Dust



Fruiting on Coffee Grounds

Fruiting on Soy Dust

Fruiting on Cacao Shells

Fines and Beards: 100 % Contamination

Results: Standard Mix (Control)

- Harvest Period- May 30th to Aug 30th (90 Days)
- Average weight harvested per bag- 2.15 pounds
- Biological Efficiency (wet weight)- 43%
- Biological Efficiency (dry weight)- 107%

Results- Spent Coffee Grounds

- Harvest Period- May 31st to August 31st (90 Days)
- Average weight harvested per bag- .81 pounds
- Biological Effeciency (wet weight)- 16.2 %
- Biological Efficiency (dry weight, estimated) 40.5 %

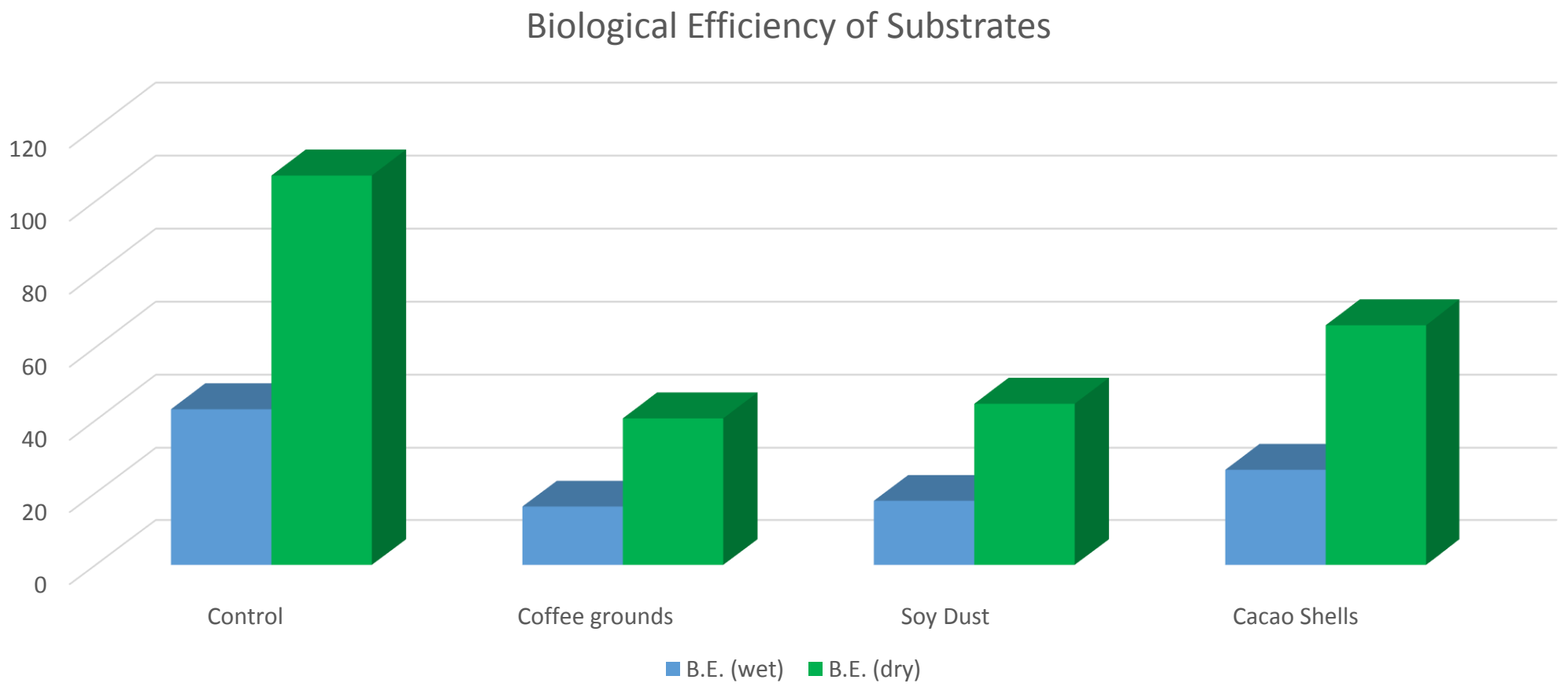
Results- Soy Dust and Husk

- Harvest Period- August 7th to November 7th (90 Days)
- Average weight harvested per bag- .89 pounds
- Biological Effeciency (wet weight)- 17.8 %
- Biological Efficiency (dry weight, estimated)- 44.5 %

Results- Cacao Shells

- Harvest Period- August 30 to November 30 (90 Days)
- Average weight harvested per bag- 1.32 pounds
- Biological Efficiency (wet weight)- 26.4 %
- Biological Efficiency (dry weight, estimated) 66 %

Graphical Data Interpretation



Production Difficulties Associated With WS

- Getting the Moisture Correct: Unlike the commercial formulation, waste substrates vary greatly in moisture content, meaning you have to spend more time mixing to get the moisture to carrying capacity.
- Little control over sawdust species and initial moisture content
- Contamination: Wood pellets are semi-pasturized on arrival because of the extrusion process. Not so with waste subsrates. Overall, WS seemed more prone to contamination issues.
- Spawn run and fruiting time: In general, the spawn run and fruiting took longer for WS than for the commercial formulation.

Experimental Design Flaws

- Control of the fruiting environment (time of year).
- Control of the fruiting environment (location in grow room).
- Difficulty in calculating WS dry weight.

Cost Analysis

Although only about a third as productive on average, waste substrates have one major advantage….

THEY ARE FREE!

- Aside from the cost associated with picking them up.
- Important that they are sourced in close proximity to the grower.
- Typically available year round
- Great for growers on a tight budget

COST ANALYSIS (ACTUAL NUMBERS)

- Cost to run 50 bags of commercial formulation: $110.00
- Cost to run 50 bags of WS: $30-$45

Composting of Spent Bags is Easy!

Soil Test Analysis

A&L Analytical Laboratories, Inc.

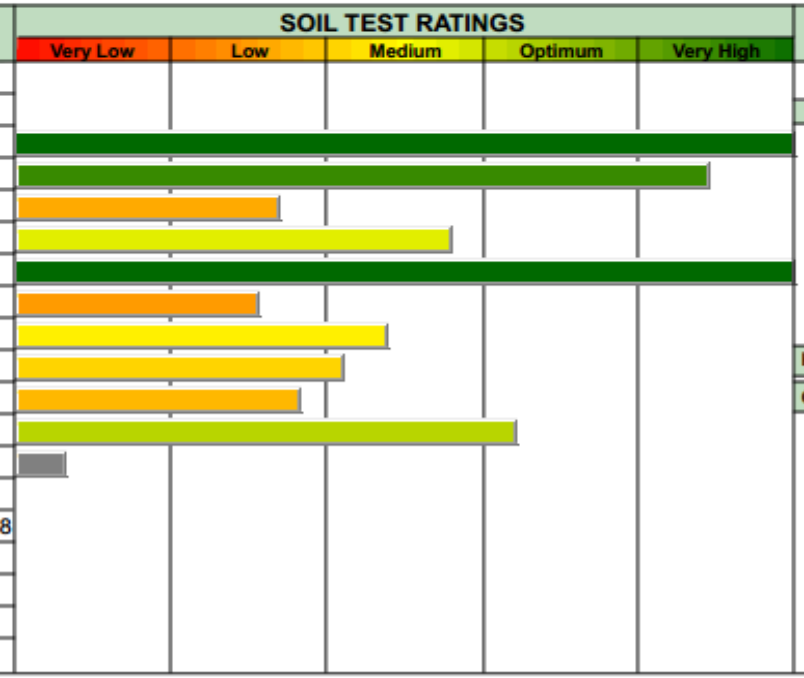
2790 Whitten Rd. Memphis, TN 38133 (901) 213-2400 Fax (901) 213-2440

SOIL ANALYSIS

Client : Joe Allawos 32 Allen St Asheville NC 28806	Grower : Joe Allawos Farm ID: Pointsetta	Report No: 14-349-0831 Cust No: 13899 Date Printed: 12/16/2014 Date Received : 12/15/2014 PO: Page : 3 of 3

Lab Number : 15341 **Field Id :** One **Sample Id :** MC02

Test	Method	Results
Soil pH	1:1	5.0
Buffer pH	BPH	7.19
Phosphorus (P)	M3	130 ppm
Potassium (K)	M3	333 ppm
Calcium (Ca)	M3	1609 ppm
Magnesium (Mg)	M3	195 ppm
Sulfur (S)	M3	738 ppm
Boron (B)	M3	0.3 ppm
Copper (Cu)	M3	1.5 ppm
Iron (Fe)	M3	53 ppm
Manganese (Mn)	M3	23 ppm
Zinc (Zn)	M3	4.2 ppm
Sodium (Na)	M3	29 ppm
Soluble Salts		
Organic Matter	LOI	67.2 % ENR 1388
Nitrate Nitrogen		



Calculated Cation Exchange Capacity

18.1 meq/100g

%Saturation

	%sat	meq
K	4.7	0.9
Ca	44.4	8.0
Mg	9.0	1.6
H	40.9	7.4
Na	0.7	0.1

K/Mg Ratio: 0.56

Ca/Mg Ratio: 4.93

THANKS TO OUR COLLABORATORS