Mushrooms and Organic Mushrooms: A Specialty Within A Specialty

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Obligatory ‘What I will talk about slide’

- Some introductory material and disclaimers
- Some statistics, because who doesn’t love some statistics after lunch?
- Why we chose to certify organic
- More riveting statistics
- A whirlwind introduction to mushroom cultivation
- Time permitting: A cultivated Mushroom Beauty Parade.
I am a mushroom geek.
What is a mushroom?

• A fungus that produces a macroscopic fruiting body.
Geek
Noun informal

“an unfashionable or socially inept person.

• A person with an eccentric devotion to a particular interest.”
What we know we don’t know about mushrooms and mushroom production.
10,000-50,000 described species of 1.5 to 5.1 million fungi estimated in the world produce Fruiting bodies that are large enough to be considered mushrooms
Food Crops

Specialty Crops

Mushrooms

This is where we live

Organic Mushrooms

Specialty Mushrooms

Organic Specialty Mushrooms
What is an organic mushroom?

One that is certified organic by a USDA NOP accredited certifying agent.

Grown in compliance with the USDA NOP Organic Crops Standard.
What is a specialty Mushroom?

Generally, any mushroom except the white button mushroom.
Kingdoms and Domains

The three-domain system
- Bacteria
- Archaea
- Eukarya

The six-kingdom system
- Bacteria
- Archaea
- Protista
- Plantae
- Fungi
- Animalia

The traditional five-kingdom system
- Monera
- Protista
- Plantae
- Fungi
- Animalia
Mushrooms: Plant or animal? Crop or livestock?
Mushrooms are Fungi.

But not all fungi are mushrooms.

Why?
63% of US Mushroom Production came from PA in 2015
43% of the nations mushroom production came from Chester County, PA in 2015
Kennett Square is ALSO the Mushroom Disease Capital of the World!
Growing organic mushrooms in Chester County, PA requires Constant vigilance!
So why do we do it?
Setting the Stage
PHILLIPS MUSHROOM FARMS
THE LARGEST GROWER OF SPECIALTY MUSHROOMS IN THE UNITED STATES

Our Farm

We've been cultivating mushrooms since 1927
1927 PMF
Established by William Phillips

1961 Don and Marshall Phillips form partnership and expand into packaging, marketing, and transportation

1967 P&G Trucking Co.

1973 All white mushroom fresh sales ~30 employees
1979
Start growing Shiitake

1982
Start growing Oyster Mushrooms

1985
Introduced Portabellas into the US market

1989
Stopped growing white mushrooms, but continued to sell them

1990
Started growing Maitake, Nameko, Enoki, and Beech Mushrooms

1993
Divested from white mushrooms entirely
1996 Started the Organic Certification Process and started growing Pom-pom, Royal Trumpet and Woodear

1997 Certified Organic

1998 Built a facility for Shiitake

2000 Built a facility for oyster, pom-pom, maitake, and Royal Trumpet
2008 Bought a farm in Maryland to build a state-of-the-art *Agaricus* production facility

2010 First white mushrooms for sale from Maryland Facility

2011 Expanded in Maryland
2012 Expanded in Maryland

2014-15 Expanded in Maryland including a block dedicated to organic production

2016 ~700 Employees and 6 locations
Short Answer: Organic Certification fits with our company culture and with our customers.
We are a full service mushroom supplier with over 200 different individual fresh items and about a dozen dried. We also have a processing division - Phillips Gourmet
And frankly, growing organic mushrooms makes us better growers of mushrooms.

We manage pests and diseases in the mushroom (disease) capital of the world with great management, dedicated employees, and tools allowed for organic production.

This is not easy, and it has made us better growers—we tend to apply the lessons we learn from our organic production to all production, because it’s just better.
Organic Sales vs. All Other Mushroom Sales

![Chart showing organic sales vs. all other mushroom sales for each year from 1999/2000 to 2014/2015. The chart displays millions of pounds sold as organic and total mushroom sales for each year.](chart.png)
Organic Production vs. Organic Sales

- **Blue** represents Millions of organic pounds produced.
- **Red** represents Millions of pounds sold as organic.
Organic Produced Vs. Sold As Organic

- **Percent sold as organic**
- **Millions of organic pounds produced**
Consumer demand has grown by double-digits every year since the 1990s—and organic sales increased from $3.6 billion in 1997 to over $39 billion in 2014.

**Total U.S. Organic Sales and Growth, 2004–2014**

- Green: Organic Non-Food Sales
- Blue: Organic Food Sales
Millions of pounds sold as organic

- Millions of pounds sold as organic


Y-axis: Millions of pounds sold as organic, ranging from 0 to 45
Millions of pounds sold as organic

Total Mushroom Sales
§205.202 Land Requirements

- (a) Have been managed in accordance with the provisions of §§205.203
- (b) Have had no prohibited substances, as listed in §205.105, applied to it for a period of 3 years immediately preceding harvest of the crop; and
- (c) Have distinct, defined boundaries and buffer zones such as runoff diversions to prevent the unintended application of a prohibited substance to the crop or contact with a prohibited substance applied to adjoining land that is not under organic management.
“Good fences make good neighbors.”

Robert Frost
‘Standard Pennsylvania Mushroom Doubles’
Modified Greenhouses
New ‘Dutch’ style farm in Maryland
A Quick Tour of *Agaricus* Production
Agaricus bisporus
Common Cultivation Systems

• Beds
• Trays
• Blocks
• Bags
Agaricus mushrooms grow in compost.

Not soil.

Not manure.
Steps In *Agaricus* Cultivation

✧ Phase I Composting
✧ Phase II Composting
✧ Inoculation
✧ Spawn Run (aka Phase III)
✧ Casing
✧ Pinning
✧ Picking
Agaricus Cultivation
Phase I
Purposes of Phase I Composting

To make a selective substrate of *Agaricus* by:

- Making the compost selective and suppressive
- Create ammonia which is a disinfectant
- Reduce soluble carbohydrates to discourage ‘weed’ molds
- Incorporate plenty of water
Partial list of Agaricus compost ingredients:

- Hay
- Straw (wheat, rye, oat, etc.)
- Horse manure
- Poultry Manure
- Corn cobs
- Corn stover
- Switch grass
- Cotton seed hulls
- Spent brewers’ grain
- Cocoa hulls
- Soy bean meal
- Cotton seed meal
- Grape pumice
- Canola meal
- Gypsum
- Calcium carbonate, etc.
Agaricus Cultivation
Raw Materials
Raw Materials
Agaricus Cultivation
Raw Materials
Agaricus Cultivation
Raw Materials
Agaricus Cultivation
Raw materials
Agaricus Cultivation
Phase I
Recipe for *Agaricus* compost

- 21 tons of hay
- 50 tons straw bedded horse manure
- 800 lbs of soybean meal
- 1200 lbs cottonseed hulls
- 6 ½ tons of cottonseed meal
- 3 tons of gypsum
- 3 tons of cocoa bean hulls
- 10 tons of wet spent brewers' grain
Successions of organisms are grown in order to grow *Agaricus*.

- Bacteria
- Actinomycetes
- Yeasts
- Other fungi
In just one batch of mushroom compost tested:

330 fungal species, 66% not identified

32,114 different strains of bacteria, 96% not identified!
Complex carbs: Cellulose/Hemicellulose/Lignin

-Microbes break down complex carbs to provide food for themselves by releasing enzymes into the compost
-They require nitrogen for growth provided by manure or urea/ammonium
-Different microbes prefer different foods
>succession of different microbes and enzymes during composting
Phase II Composting

Two Main Purposes:

1. Final conditioning of compost so that it becomes mushroom specific.

2. Pasteurization to kill off competitor molds and pathogens.
Spawn

Pure *Agaricus* mushroom culture expanded on many different substrates including (but not limited to):

- Millet
- Rye
- Milo
- Mineral and grain powders
Agaricus bisporus in culture
Spawn Run
>also called Phase III
Done in beds, bags, blocks, or trays.
Agaricus Cultivation
Casing
Case hold and pinning
Grow mushrooms......

It’s fun!
Cultivated Mushroom Beauty Parade
Cultivated Mushrooms can be divided into:

- Soil or compost inhabiting mushrooms
- Wood decay mushrooms
- Plant pathogens
Soil Inhabiting Mushrooms
Agaricus bisporus

White Button Mushrooms
Agaricus bisporus

Crimini

Roman Brown

Cremini

Italian Brown

Swiss Brown

Chestnut
Agaricus bisporus

Portobello
Portabella
Portobella
Portabello
Blewits (Lepista nuda) are less common
Tuber malanosporum-Black Truffle
Morchella spp. Aka Morels
Wood Inhabiting Mushrooms

Grown on all kinds of lignocellulosic wastes in addition to wood.
Lentinus edodes aka Shiitake
Pleurotus ostreatus
Pleurotus pulmonarius
Pleurotus citrinopileatus
Pleurotus eryngii aka Royal Trumpet, King Oyster, Poor Man’s Porcini
Pleurotus florida
Pleurtous sajor-caju
Pleurotus flabellatus
Pleurotus salmoneo stramineus
Pleurtous djamor
Pleurotus columbinus
Pleurotus nebrodensis or White Ferula Mushroom
Pleurotus cystidiosus
Pleurotus ferulae
Volvariella volvacea
aka Paddy Straw Mushrooms
Pleurotus tuberregium
Pleurotus tuberregium
Grifola frondosa aka Maitake, Hen-of-the-woods, sheepshead
Hericium erinaceus aka Pom Pom, Lion’s Mane, Satyr’s Beard, Hedgehog
Pholiota nameko
Flammulina velutipes
AKA Enoki Enokitake Winter Mushroom Velvet Stem
Stropharia rugosa annulata aka Wine Cap or Garden Giant
Ganoderma lucidum aka Reishi, Lingzhi
Agrocybe aegerita aka Pioppini, pioppini, Black Poplar Mushroom, Chestnut Mushroom
Hysizygus tessulatus
Aka Beech Mushrooms
Hon shimeji
Buna shimeji
Clamshell mushroom
Auricularia auricula
Aka
Wood ear
Tree Ear
Tremella fuciformis aka Snow Fungus, Silver Ear Fungus, White Jelly Mushroom
Sparassis crispa or Cauliflower Mushroom
Plant Pathogen
Grow Mushrooms------It’s Fun!