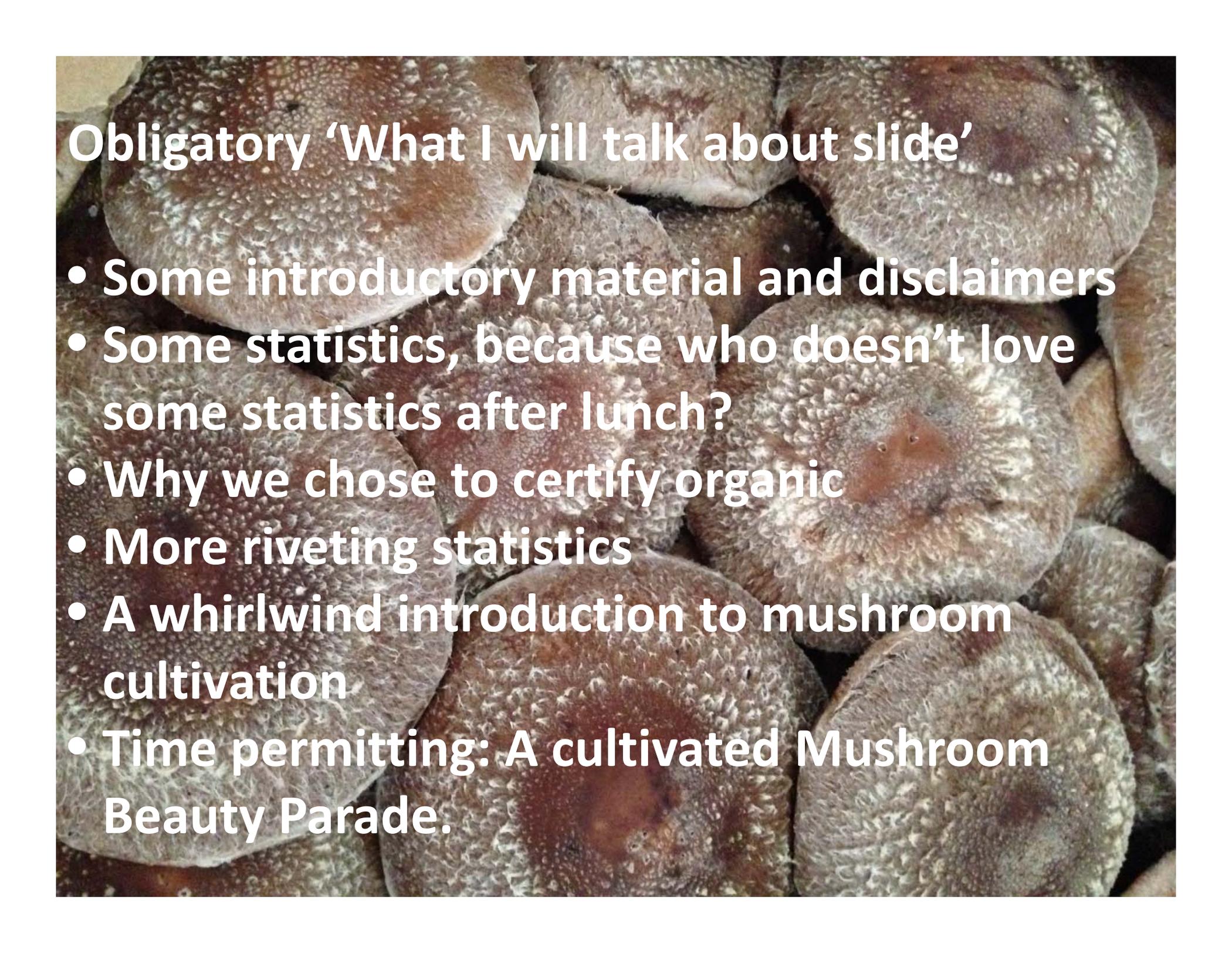




Mushrooms and Organic Mushrooms: A Specialty Within A Specialty

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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 know about mushrooms and mushroom production

What we know we don't know ...and what we don't know that 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

A still life composition of various food items including bread, cheese, vegetables, and fruits. The scene is set against a dark background, highlighting the textures and colors of the food. In the foreground, there's a woven basket filled with chestnuts, a bunch of red radishes, and a yellow squash. To the right, there are several carrots and a cucumber. In the middle ground, a whole red fish is prominently displayed. Behind it, there's a loaf of bread, a small bottle of milk, and a jar of pickled vegetables. In the background, there's a large piece of cheese, a bunch of asparagus, and a sack of grain. The overall lighting is warm and focused, creating a rich and appetizing scene.

Food

Crops

Specialty Crops

Mushrooms

This is
where we
live

Specialty Mushrooms

Organic 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?

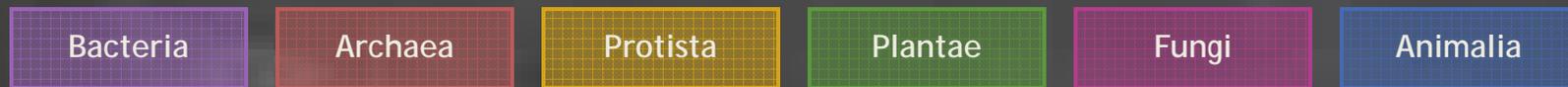
Generally, any mushroom except the white button mushroom.

Kingdoms and Domains

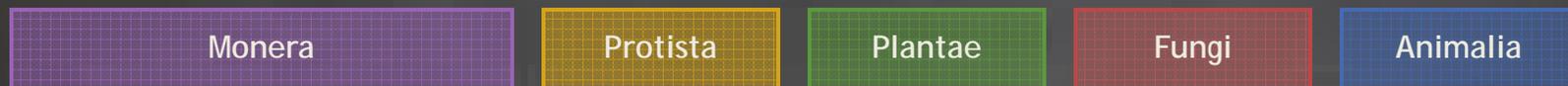
The three-domain system



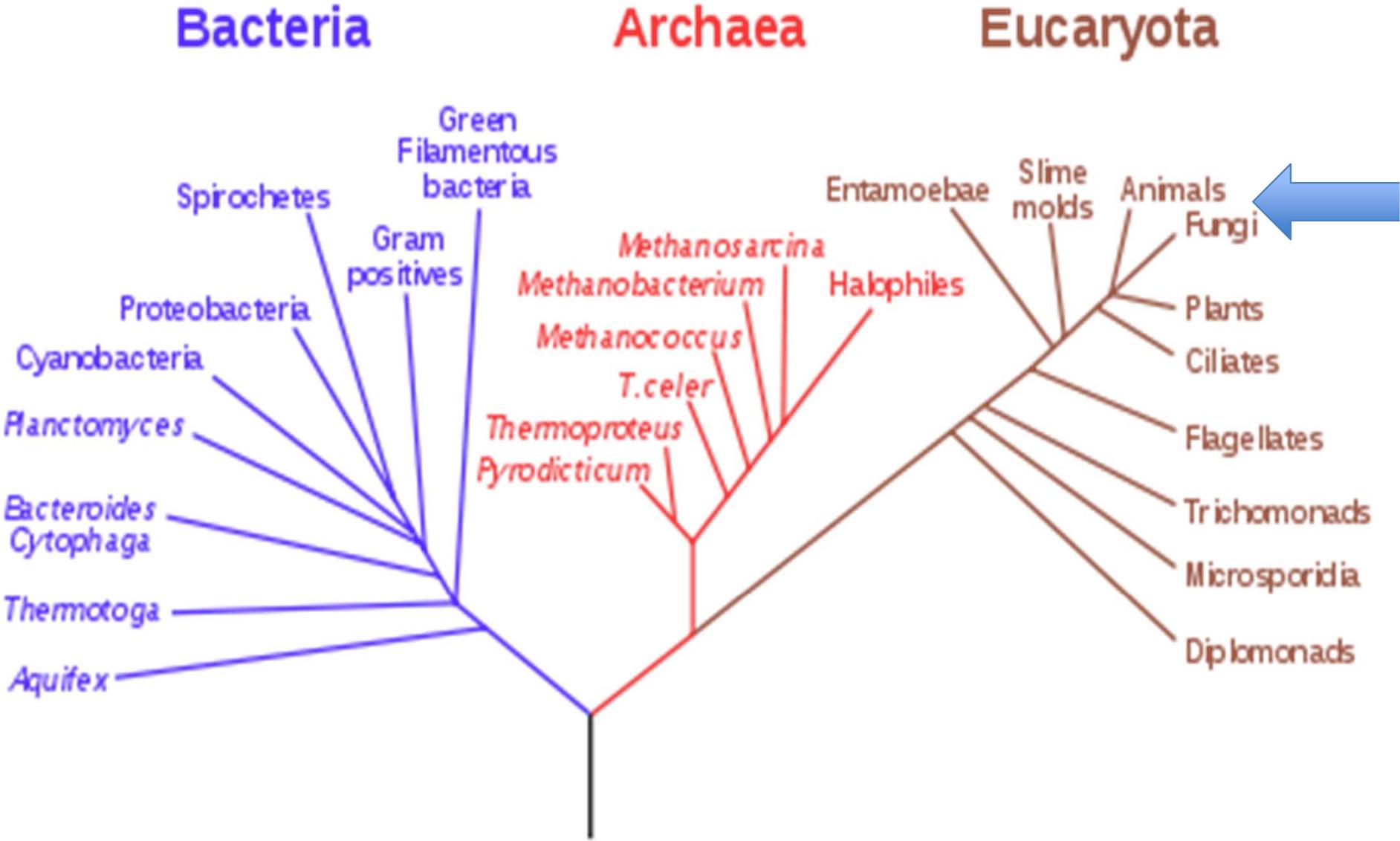
The six-kingdom system



The traditional five-kingdom system



Phylogenetic Tree of Life





Mushrooms:

Plant or animal?

Crop or livestock?

A close-up photograph of several white mushrooms with gills. The mushrooms are the central focus, with their gills clearly visible. The lighting is soft, highlighting the texture of the gills and the smooth surface of the mushroom caps. The background is slightly blurred, showing more mushrooms.

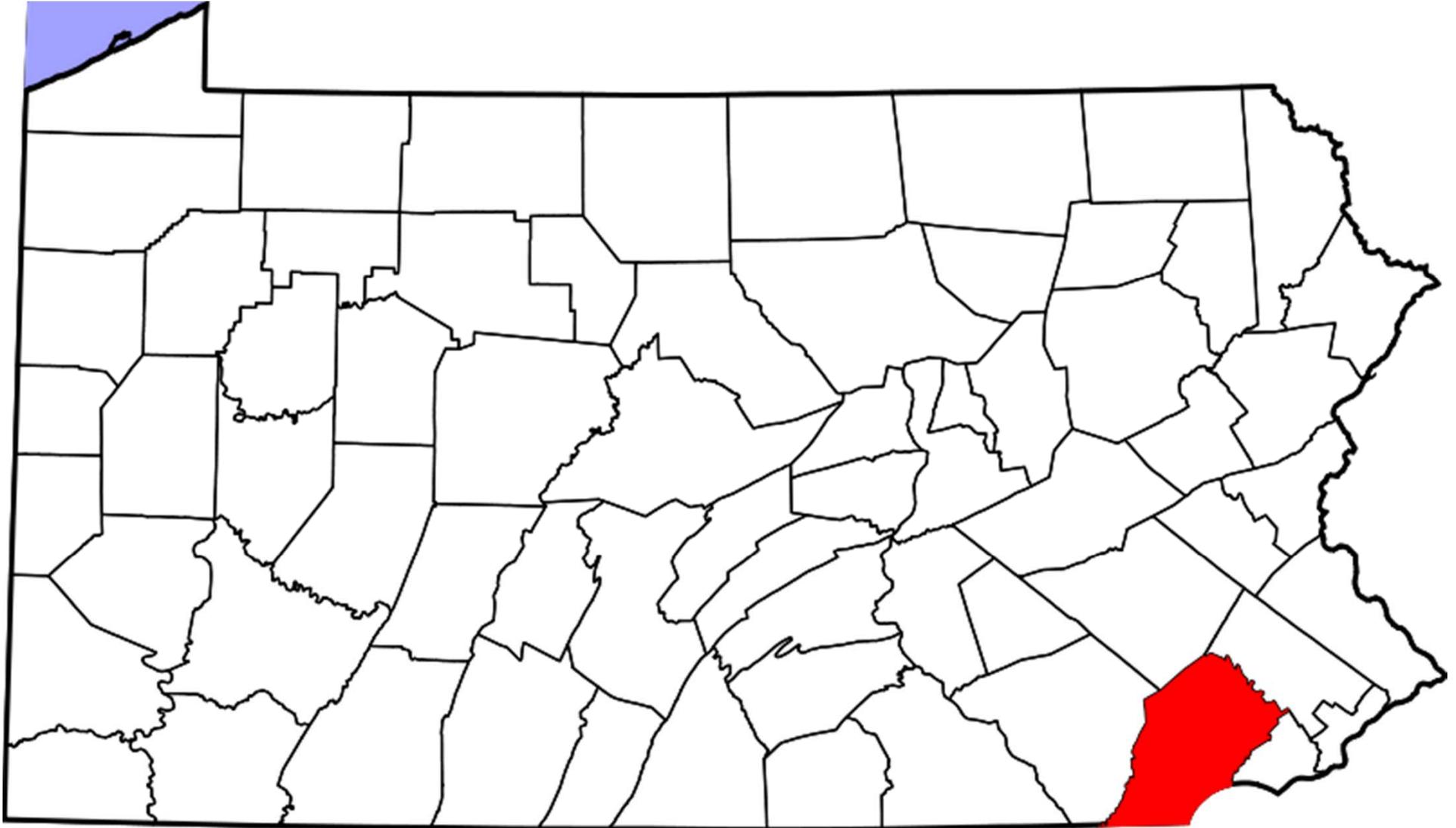
Mushrooms are Fungi.

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



*Mushroom Capital
of the World*



**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?



A photograph of a stage with red curtains. The curtains are drawn back, revealing a wooden floor. The text "Setting the Stage" is overlaid in the center. The stage is lit from below, and the curtains have a decorative valance at the top.

Setting the Stage

PHILLIPS MUSHROOM FARMS

THE LARGEST GROWER OF SPECIALTY MUSHROOMS IN THE UNITED STATES



Our Farm



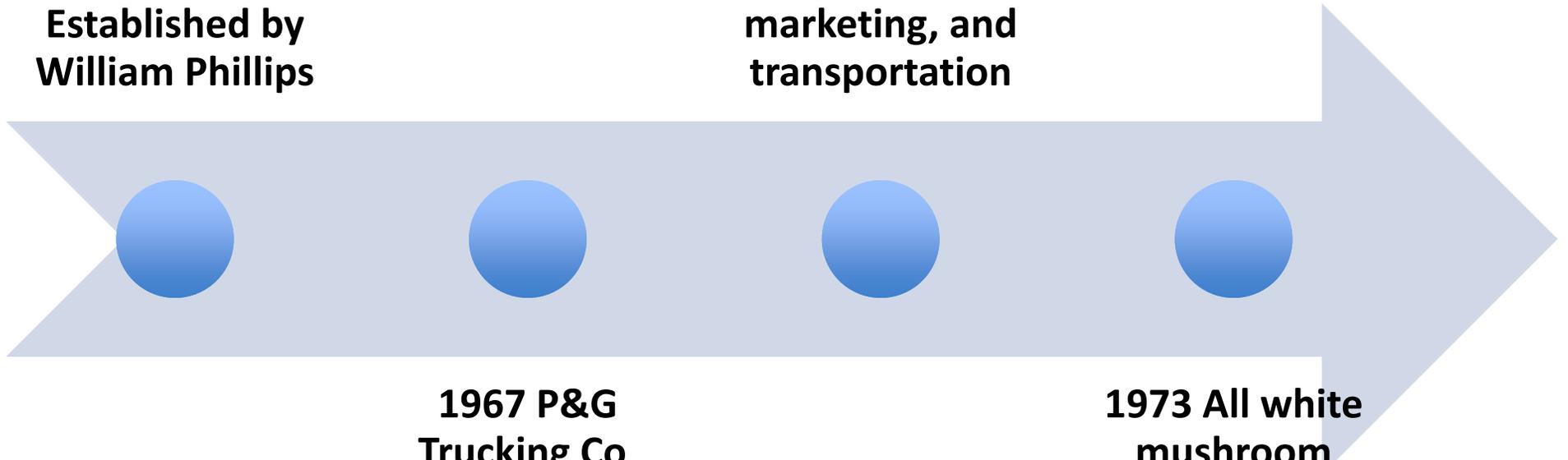
We've been cultivating mushrooms since 1927

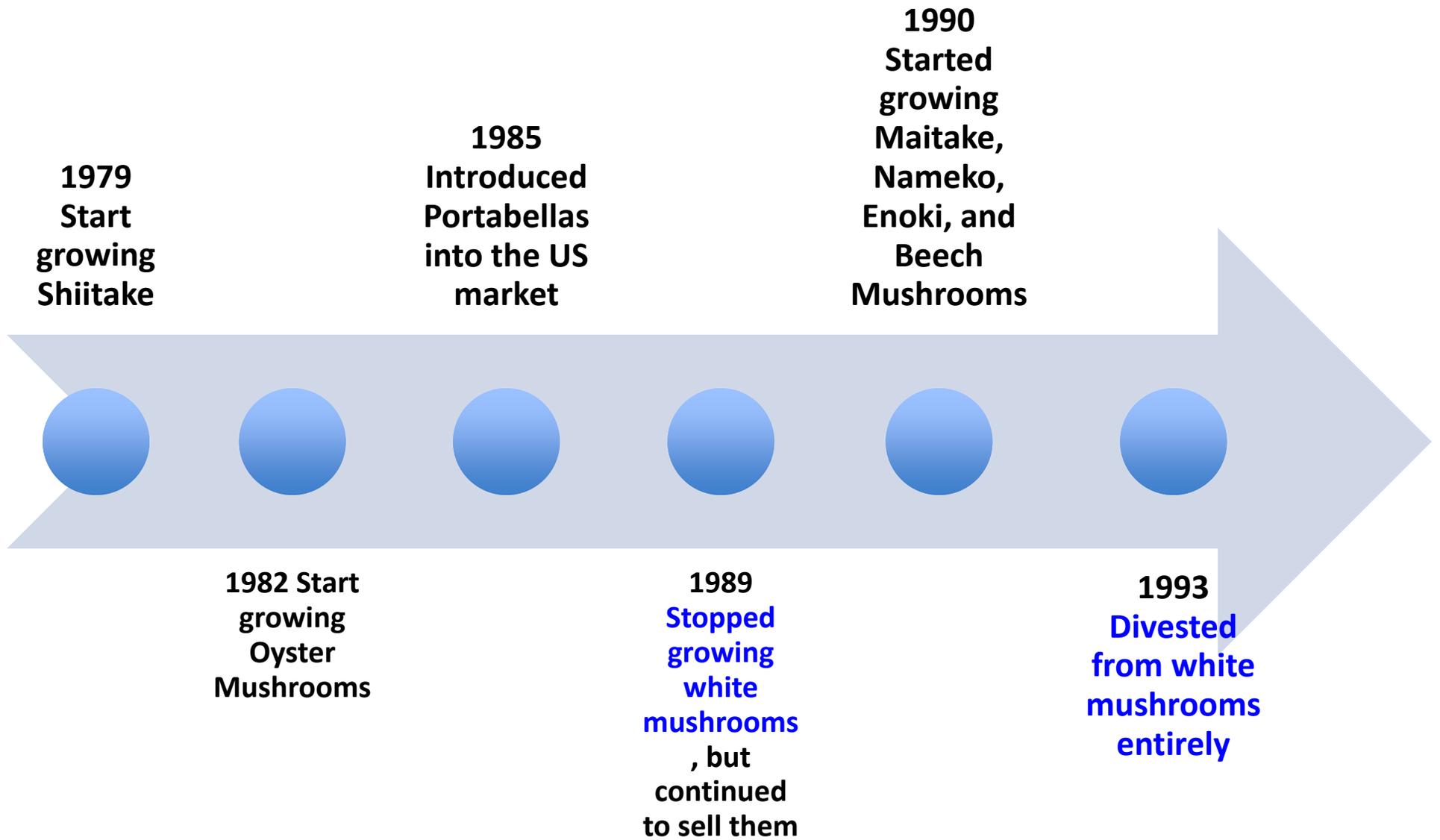
1927 PMF
Established by
William Phillips

**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**





**1996 Started the
Organic
Certification
Process** and
started growing
Pom-pom, Royal
Trumpet and
Woodear

**1998 Built
a facility
for
Shiitake**

**1997
Certified
Organic**

**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

2011 Expanded in Maryland

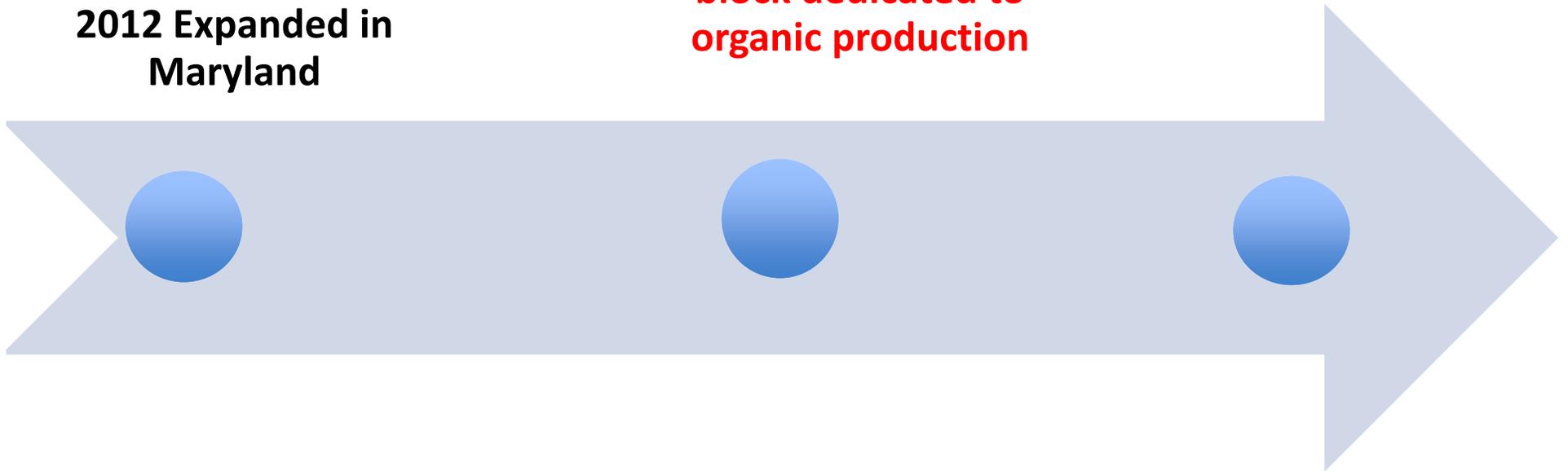
2010 First white mushrooms for sale from Maryland Facility



**2012 Expanded in
Maryland**

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

**2016 ~700 Employees
and 6 locations**



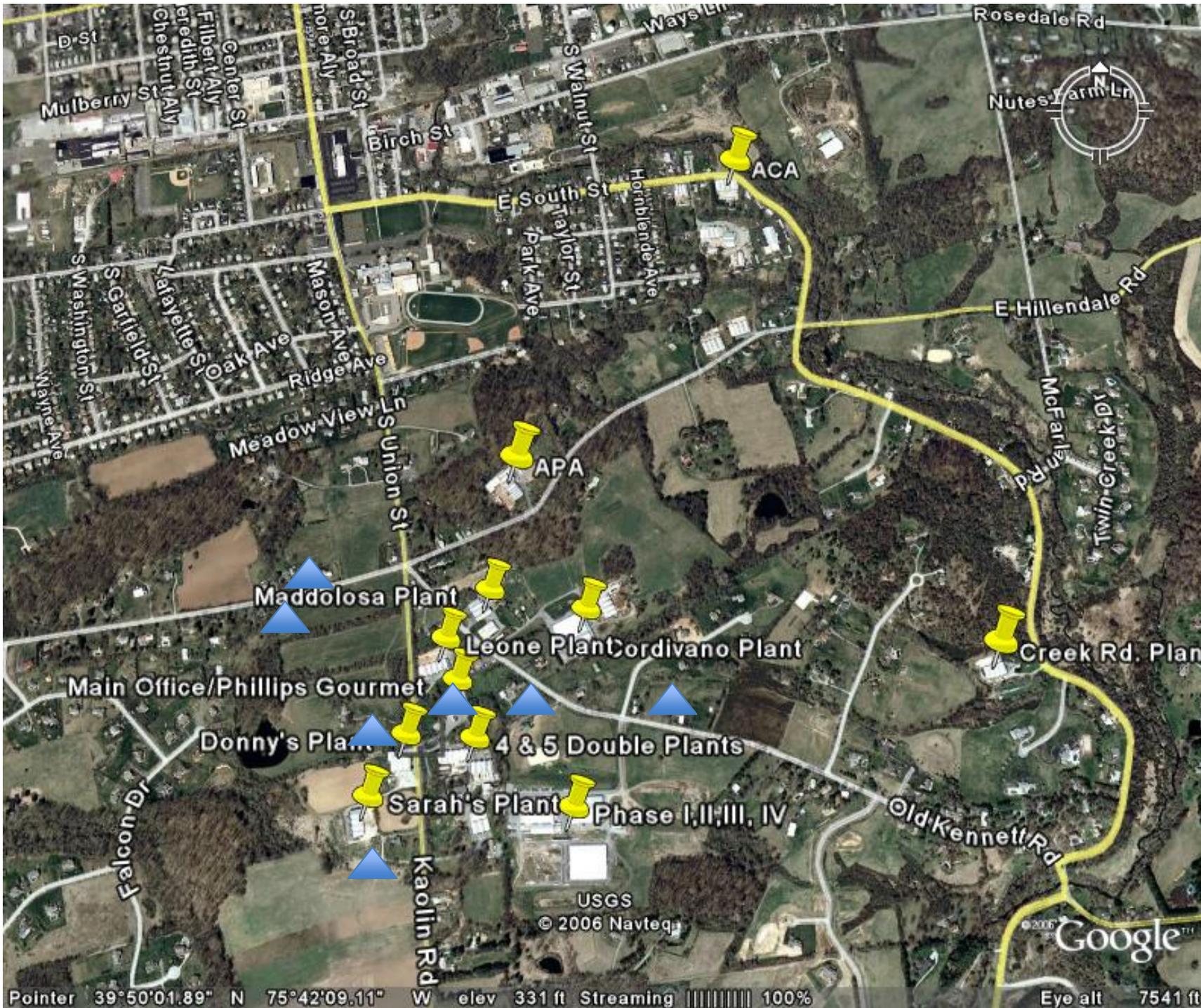


Short Answer:

**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



Pointer 39°50'01.89" N 75°42'09.11" W elev 331 ft Streaming 100% Eye alt 7541 ft

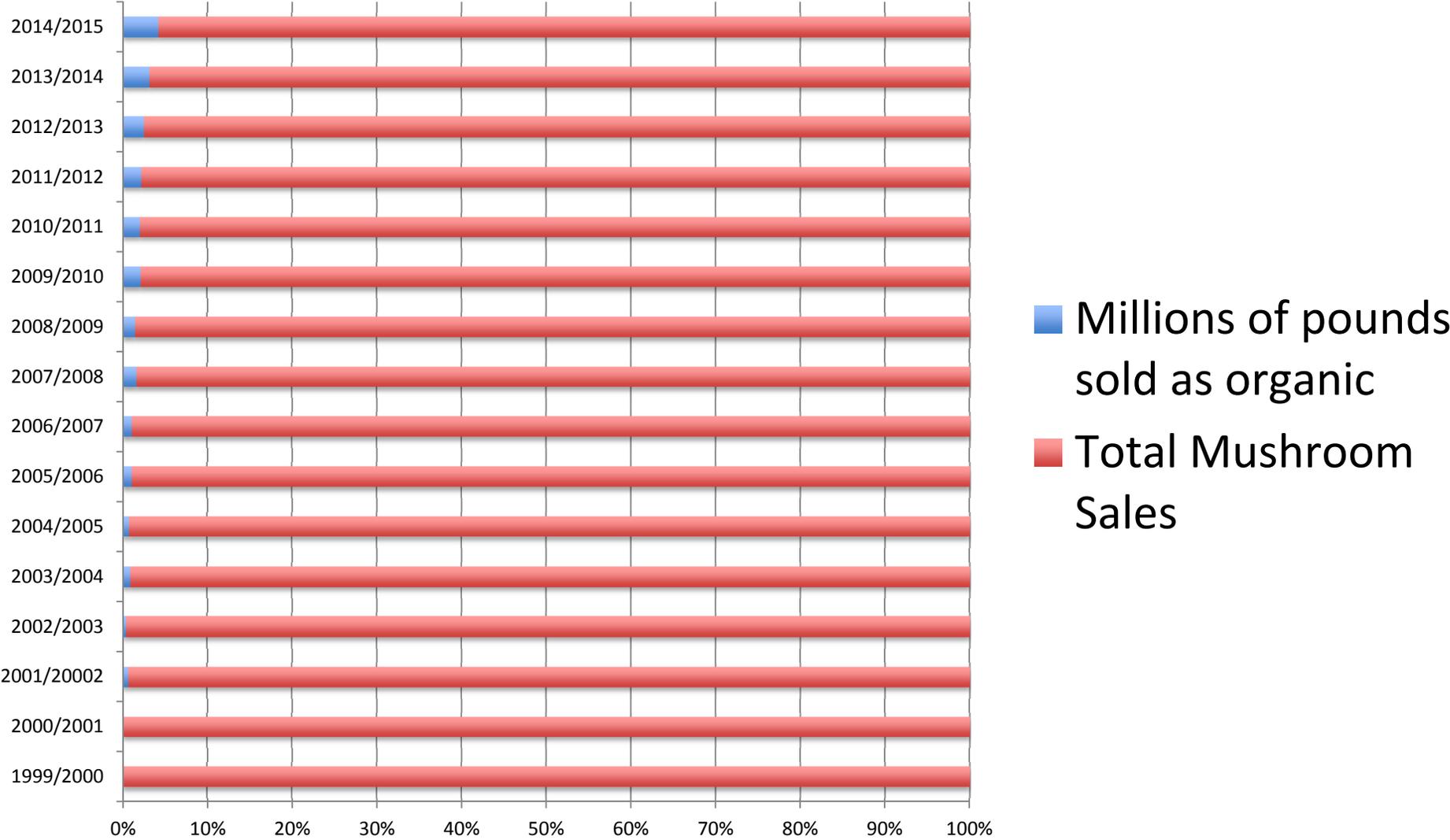
And frankly, growing organic mushrooms makes us better growers of mushrooms.

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

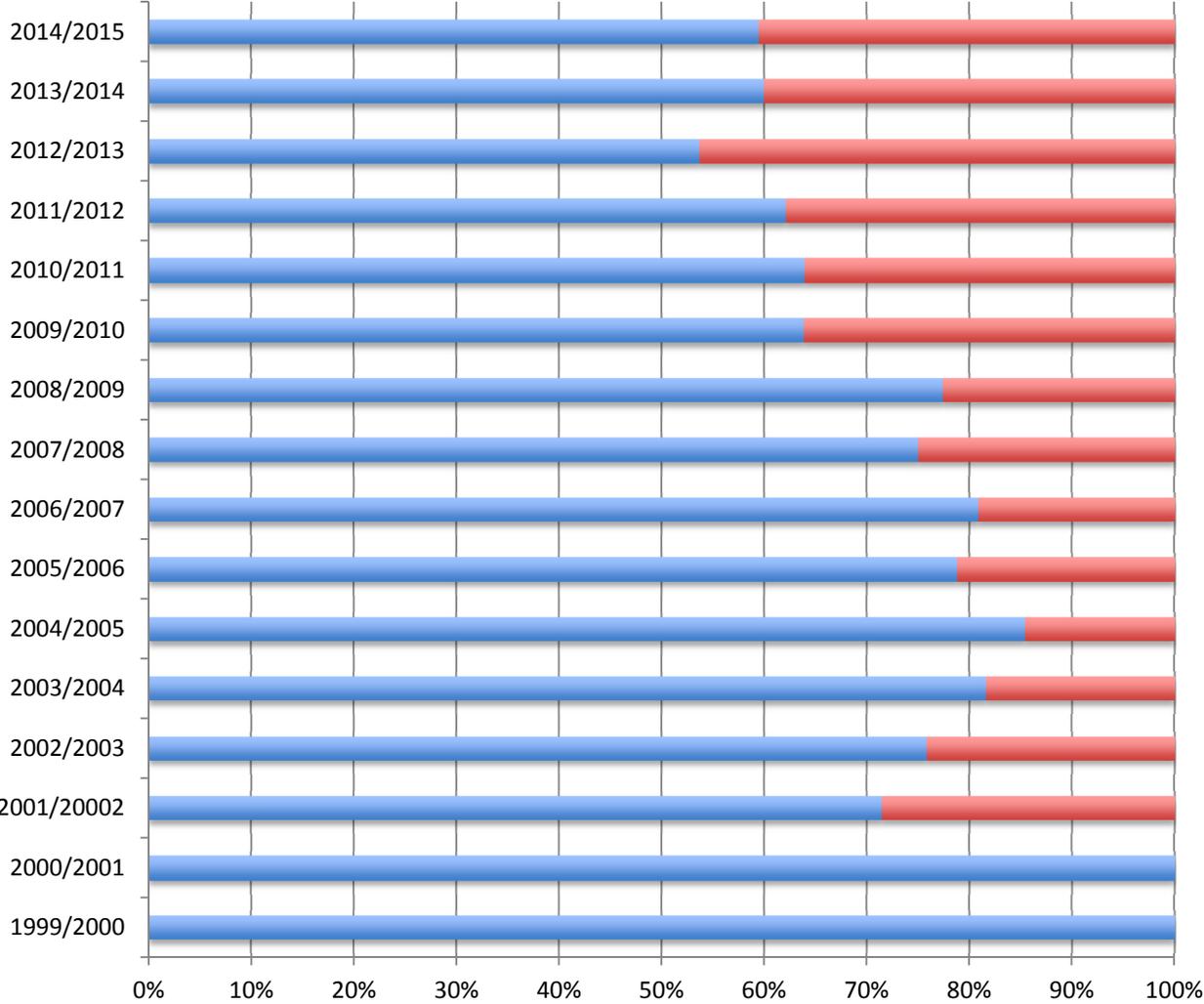
This is not easy, and it has made us better growers-we tend to apply the lessons we learn from our organic production to all production, because it's just better.



Organic Sales vs. All Other Mushroom Sales

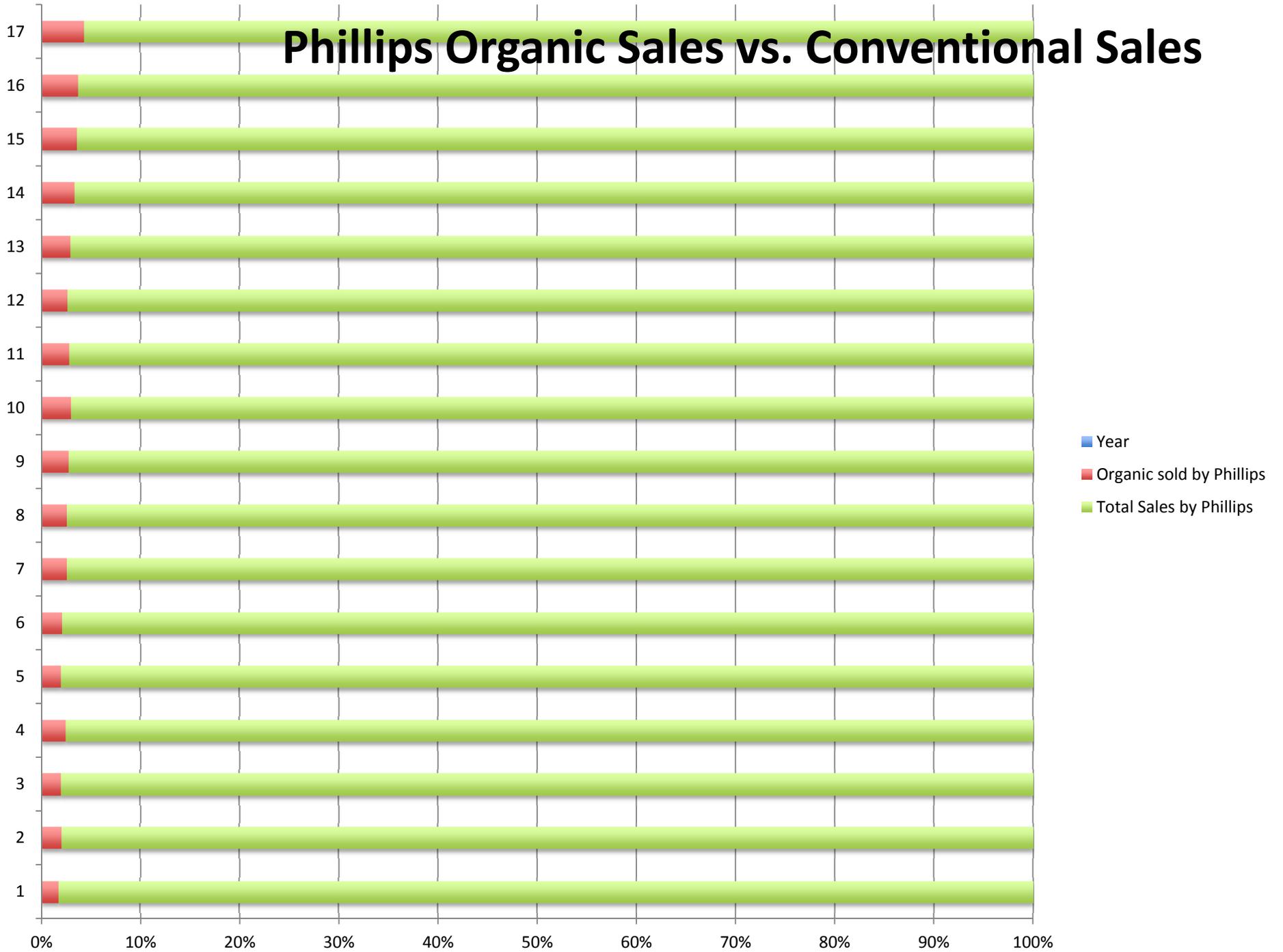


Organic Production vs. Organic Sales

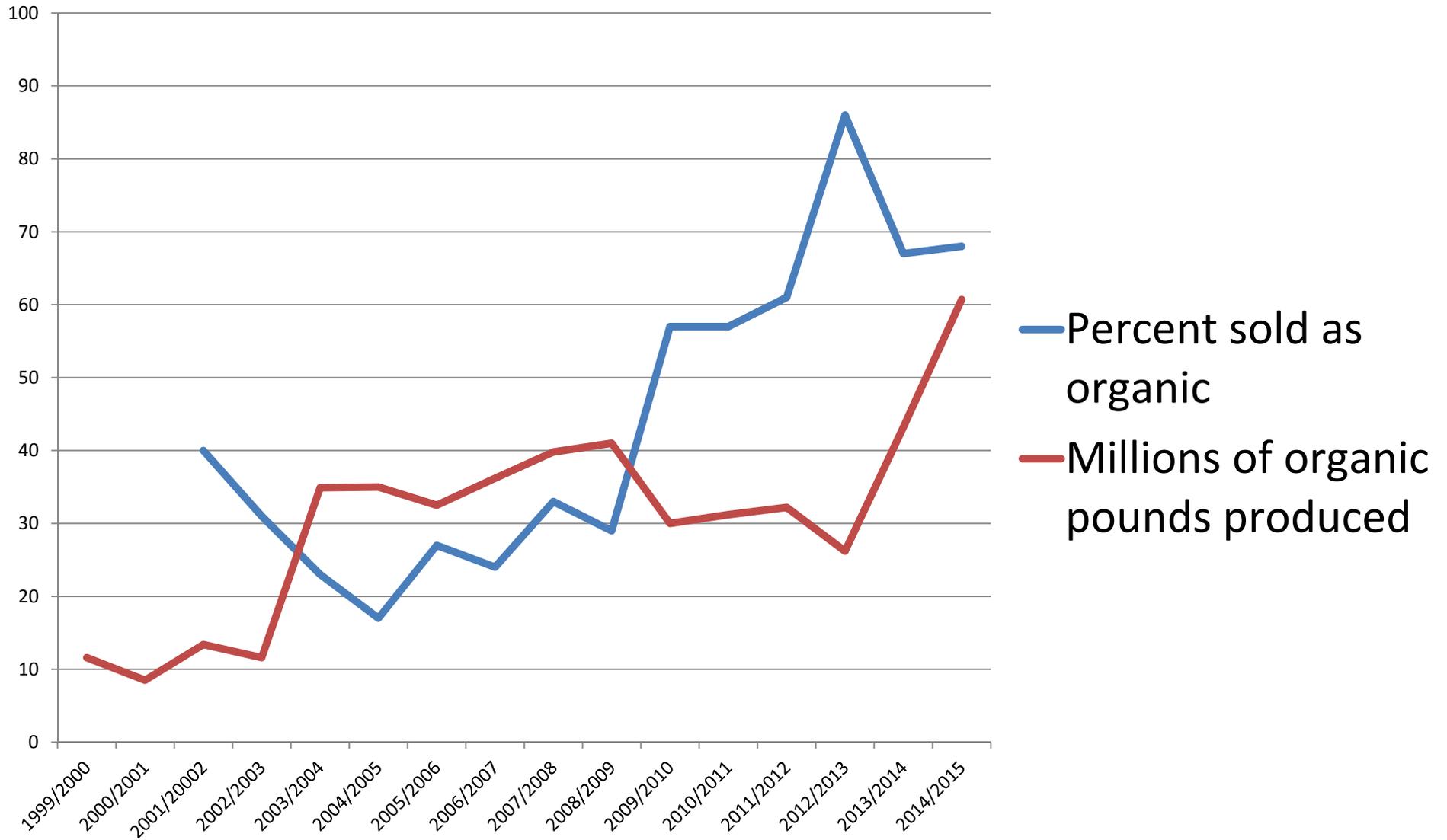


- Millions of organic pounds produced
- Millions of pounds sold as organic

Phillips Organic Sales vs. Conventional Sales



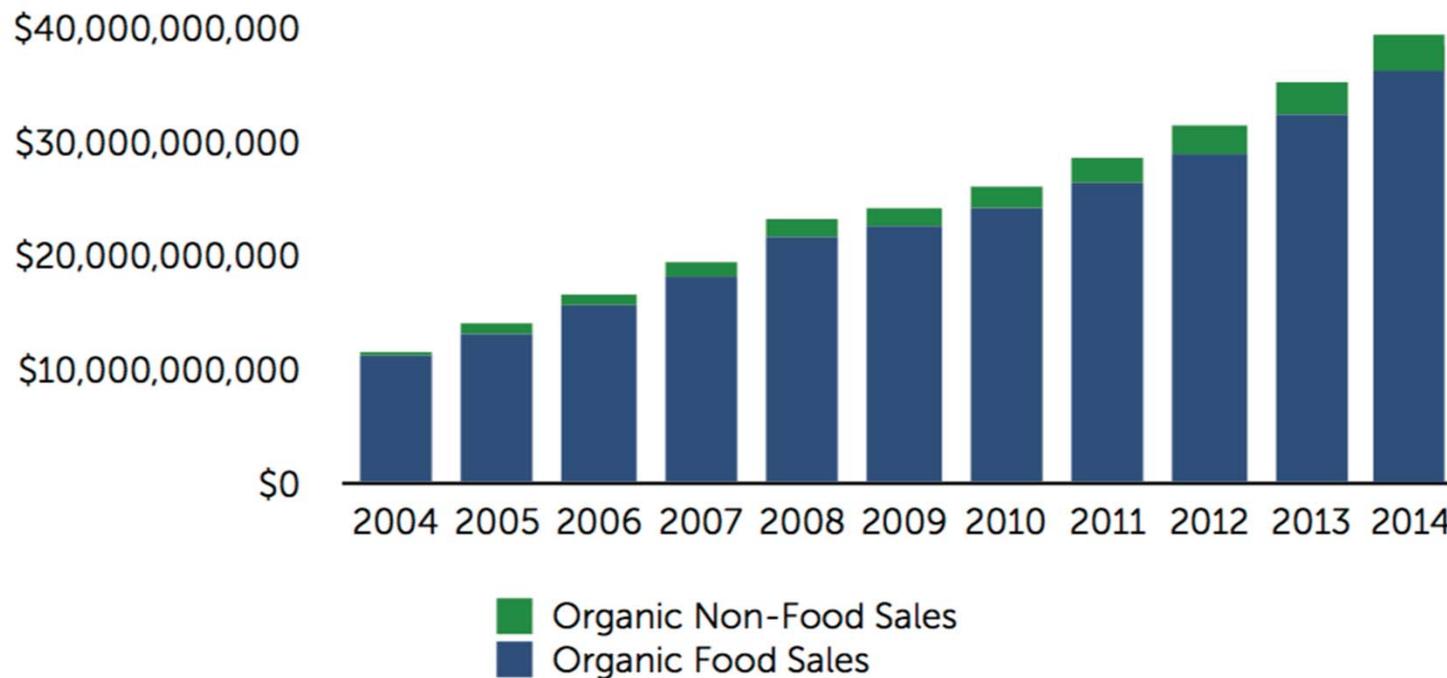
Organic Produced Vs. Sold As Organic



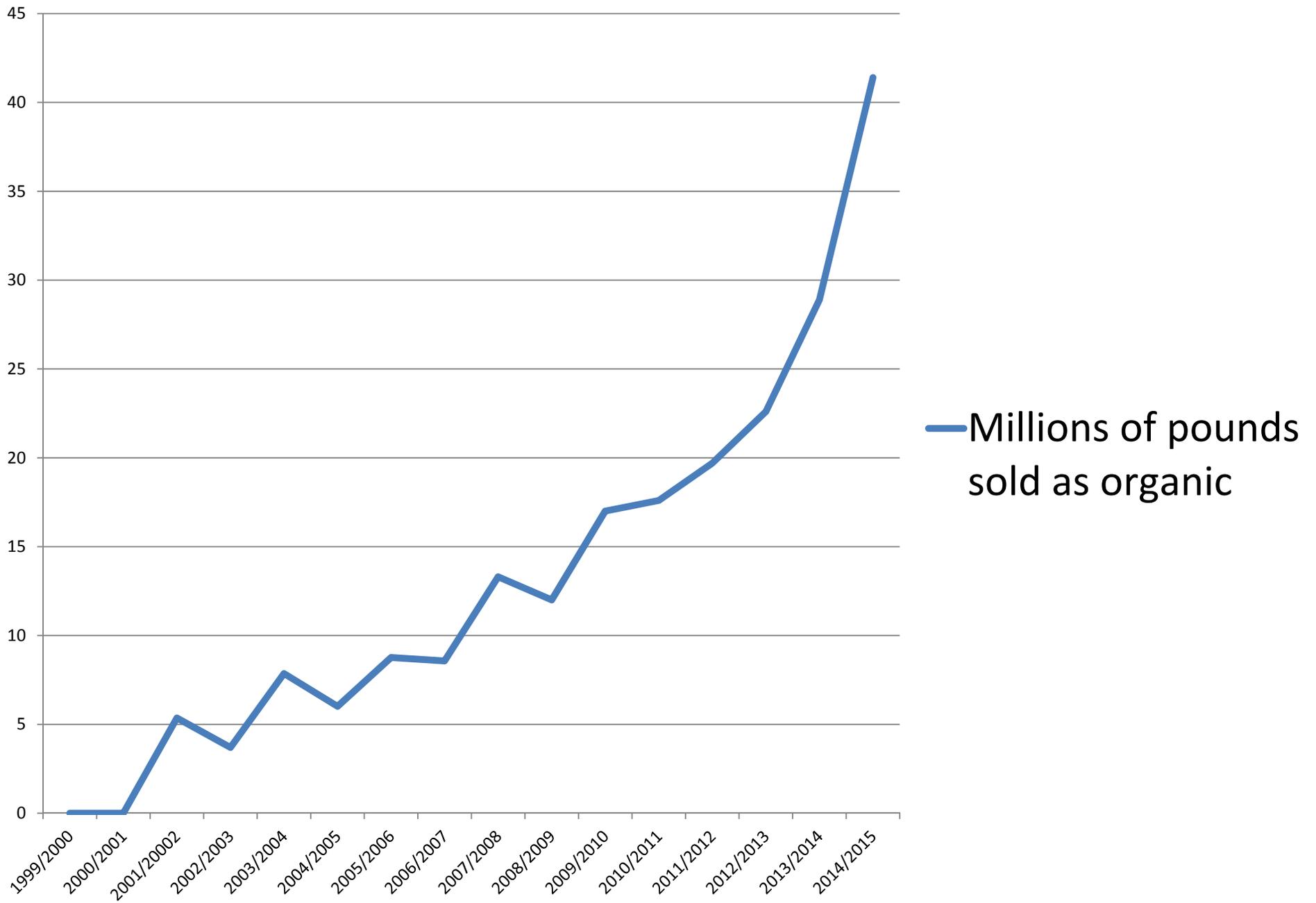
National Data from the Organic Trade Association website

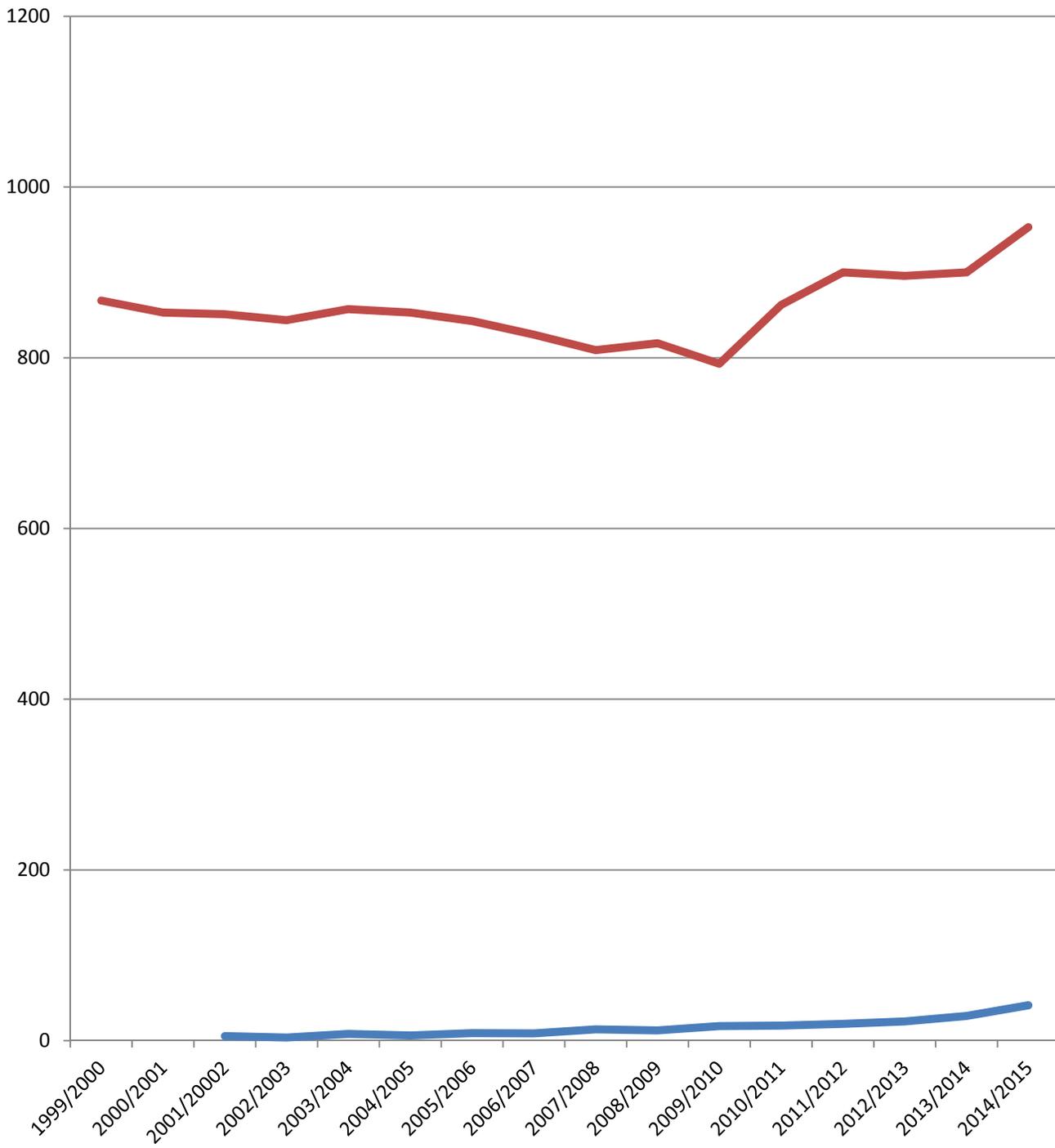
Consumer demand has grown by double-digits every year since the 1990s—and organic sales increased from \$3.6 billion in 1997 to over \$39 billion in 2014.

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



Millions of pounds sold as organic





— Millions of pounds sold as organic

— Total Mushroom Sales

§205.202 Land Requirements

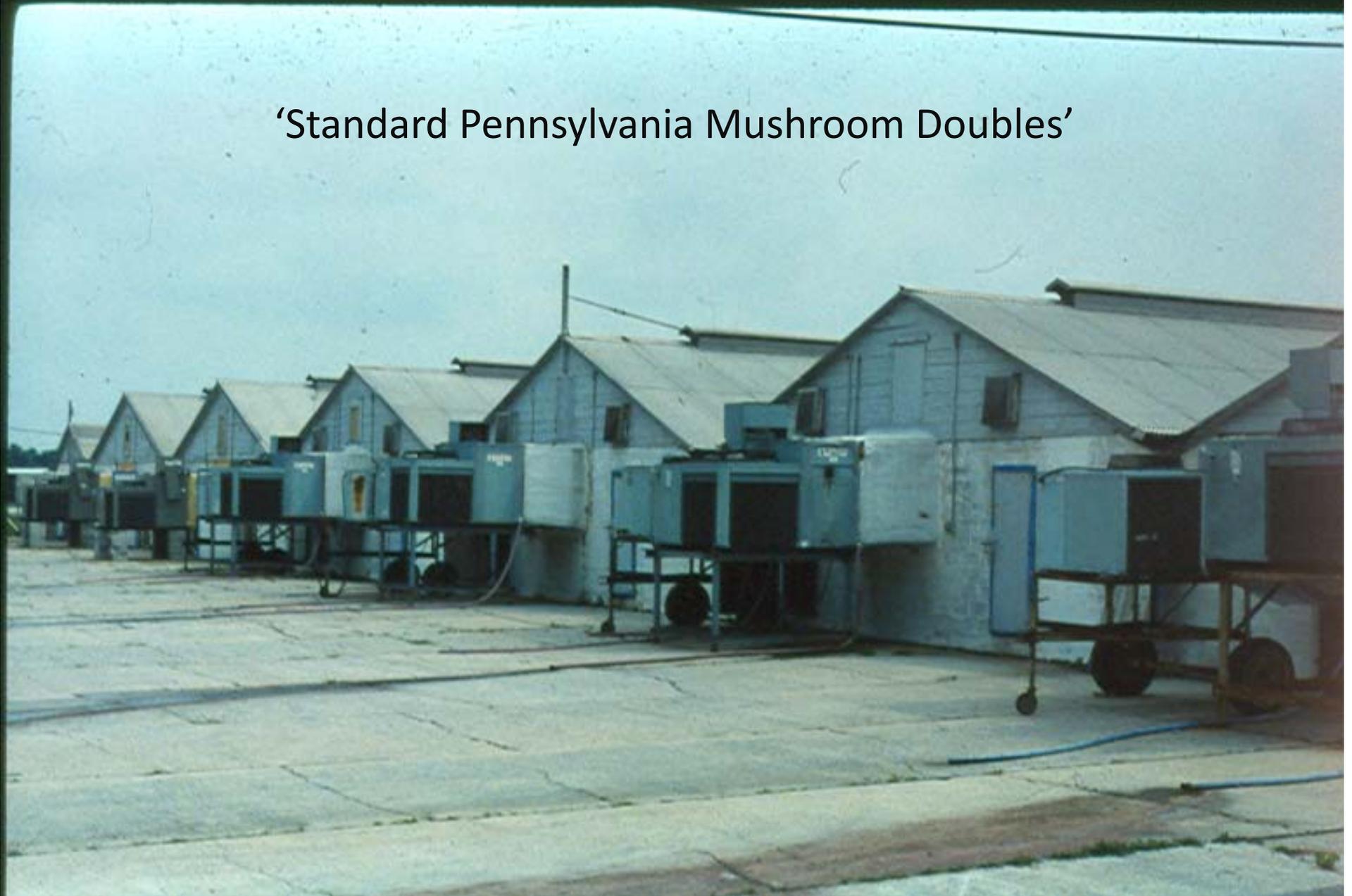
- (a) Have been managed in accordance with the provisions of §§205.203
- (b) Have had no prohibited substances, as listed in §205.105, applied to it for a period of 3 years immediately preceding harvest of the crop; and
- (c) Have distinct, defined boundaries and buffer zones such as runoff diversions 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

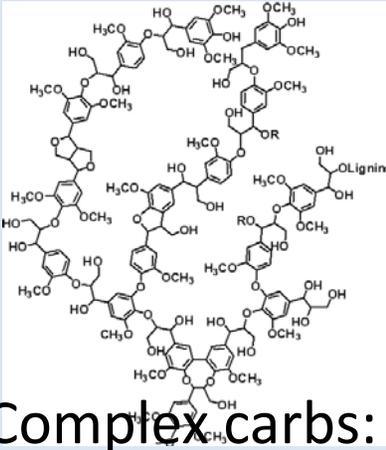
Successions of organisms are grown in order to grow Agaricus.

- ✧ Bacteria
- ✧ Actinomycetes
- ✧ Yeasts
- ✧ Other fungi

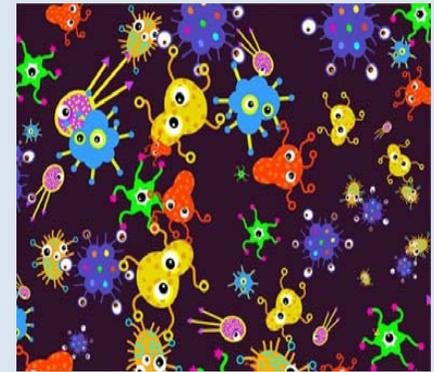
In just one batch of mushroom
compost tested:

330 fungal species, 66% not
identified

32,114 different strains of bacteria,
96% not identified!



Microbes



More Microbes!

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 hard and pinning







Grow
mushrooms.....

It's fun!



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

A large pile of brown mushrooms, likely Agaricus bisporus, is shown. The mushrooms are of various sizes and are piled together. Several mushrooms are sliced, showing their gills and stems. The background is dark, and the mushrooms are the main focus. The text is overlaid in red.

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

A close-up photograph of several Pleurotus citrinopileatus mushrooms. The mushrooms are a vibrant yellow color and have a distinct, wavy, ruffled appearance. They are arranged in a cluster, with some in the foreground and others slightly behind, creating a sense of depth. The lighting is soft, highlighting the texture of the gills and the edges of the caps. The background is dark, making the yellow mushrooms stand out prominently.

Pleurotus citrinopileatus

Pleurotus eryngii aka Royal Trumpet, King Oyster, Poor Man's Porcini





Pleurotus florida



Pleurtoous sajor-caju



*Pleurotus
cornucopiae*



Pleurotus flabellatus



Pleurotus salmoneo stramineus

Pleurteous djamor





Pleurotus columbinus

Pleurotus nebrodensis or White Ferula Mushroom





Pleurotus cystidiosus



Pleurotus ferulae

Volvariella volvacea
aka Paddy Straw Mushrooms

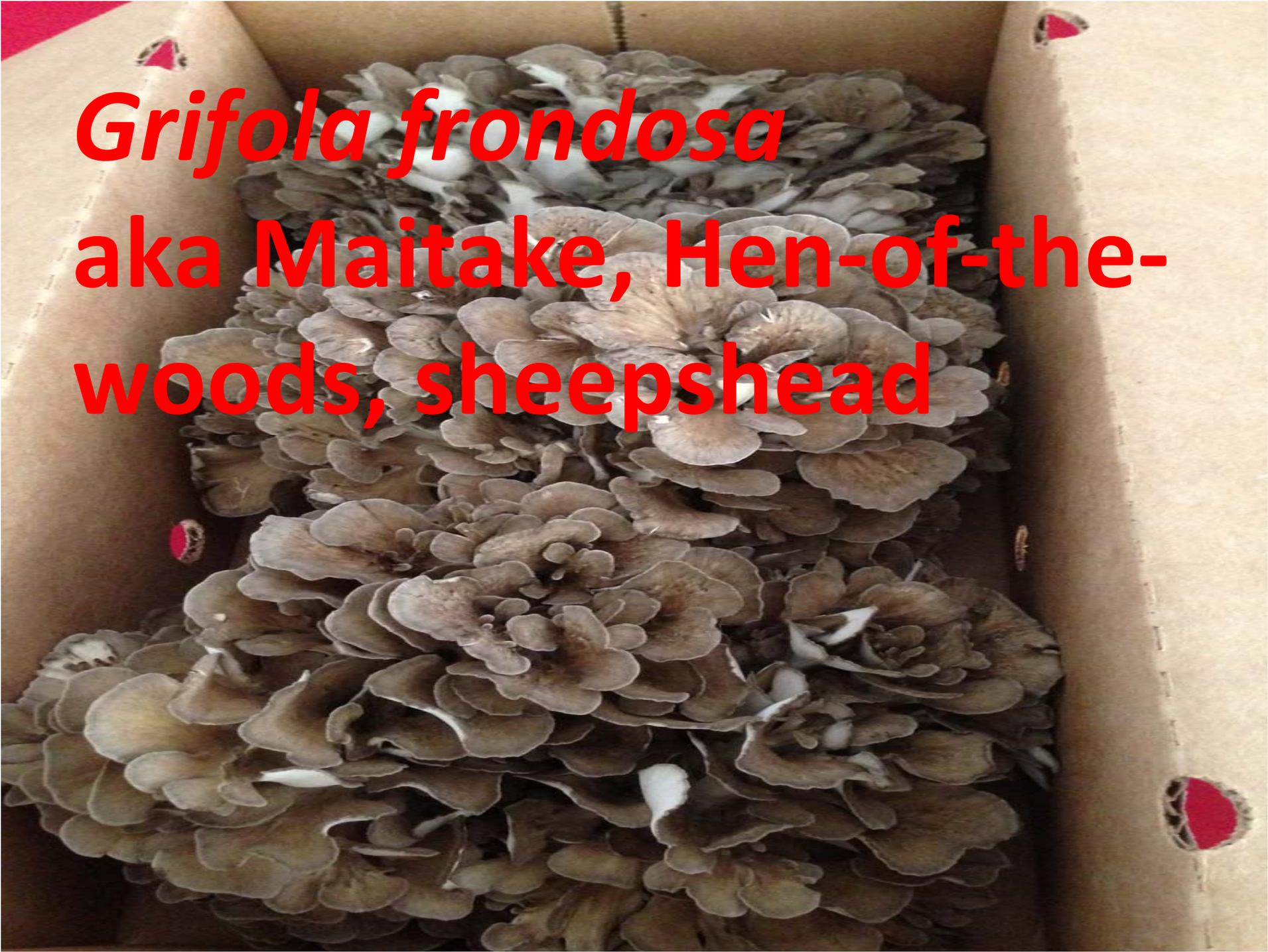




Pleurotus tuberregium



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



Hysizygyus 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!

