

## Pecan Truffles

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## Truffles (Tuberales)

- Below-ground reproductive structures formed by about 200 species of ascomycetes to produce and disperse spores (There are at least 1000 species of hypogeous fungi)
- Spores not discharged; odor attracts animals
- Gathered for food since before the time of Christ. Some species are among the most sought after delicacies in the world

No chocolate here, but many types of edible fungi associated with pecans



## The Most Expensive Foods You Can Buy

MSN, Jan 2013

“Available from September to December, white truffles are a gourmet indulgence that’ll cost you — around \$200 an ounce, which amounts to about 2 pieces. These special mushrooms, which can only be located by trained pigs or dogs, are found in the Piedmont region of Italy and are becoming increasingly rare every year.”

*Tuber lyonii* – pecan truffle



## Mycorrhizae

(Gr. Mykes = Mushroom + rhiza = root)

- A symbiotic (living together) association between the hyphae of certain fungi and the roots of plants.
- Truffles are ectomycorrhizae, forming a mantle of growth over the root tips (versus endomycorrhizae)

## Ectomycorrhizae

- Root hairs do not develop and the roots are often short and branched
- Widespread in nature on many woody plants such as oaks, beech, willow, pines (and pecans!)
- Most are Basidiomycetes but some, like truffles, are Ascomycetes



## Pecan root with mycorrhizae



## Benefits of Ectomycorrhizae

Hyphae extend into soil to;

1. solubilize minerals
2. improve nutrient uptake
3. protect roots from pathogens
4. produce plant growth hormones

Fungus obtains carbohydrates from plant

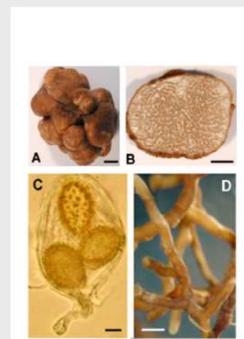
## Pecan truffles

- Originally discovered in Austin, Texas under a pecan tree and described as *Tuber texense* (Heimsch, 1958)
- Found in Georgia in 1987 in a pecan orchard
- Synonymized with *T. lyonii* (Trappe) which extended the known range from Mexico along the SE US up to Quebec, and the host range to include basswood, various oaks, and *Crataegus* sp. (likely subject to further change!)

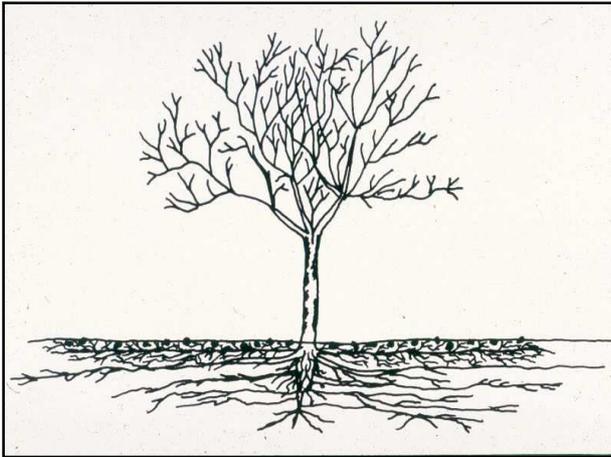
## Do pecans have mycorrhizae?

- Early researchers (Woodruff, 1933) described 7 different ectomycorrhizae
- Nearly all small roots are mycorrhizal
- Cultivation (ie. disking) and drought can destroy them, but they quickly reform

## Pecan Truffle (*Tuber lyonii*)



Bonito, Breneman & Vilgalys, 2011



**Cook Co, Aug 2014 – Results of 2 hours of raking in an unexplored orchard!**



**Could I have truffles in my orchard?**

- Found in many (but not all) pecan orchards, sometimes abundantly, and with particular trees.
- More abundant with sprinkler irrigation and crowded orchards, but grow in many soils
- Occur in upper couple inches of soil (sometimes exposed) and tend to be more prolific on the north-northeast exposure. Edge of herbicide strip is a favored location.

**How do I harvest truffles?**

(I've heard reports of using leaf blowers!)



The hard way, and not as sustainable!



Definitely the best method!

**Sometimes it is easy!**



**First Time Out!**

([www.pecanridgeplantation.com](http://www.pecanridgeplantation.com), Bainbridge, GA)



## Truffle dogs increase the quantity and quality of truffles found



They also occur on other hosts, like oaks and hickories (Where would you rather hunt them?)



## Rank Abundance of Ectomycorrhizal Taxa on Pecans

(Bonito, Breneman & Vilgalys, 2011)

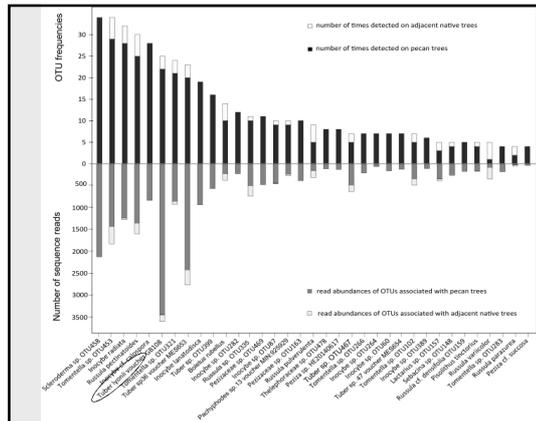
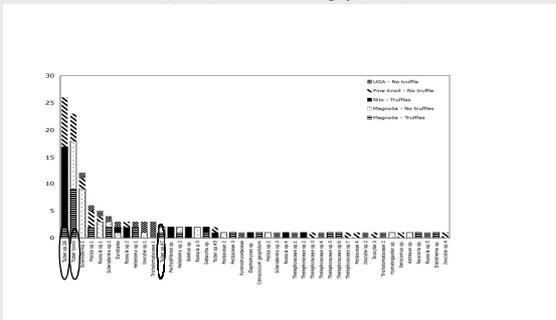


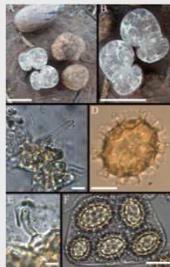
Fig. 2 Frequency and sequence read abundances of the most commonly detected ectomycorrhizal fungi on pecan trees and adjacent native trees based on the

## Two new species

(Grube et al. 2018)

*Tuber brenemanii* sp. 36

*Tuber floridanum* sp. 47



## Are Pecan Truffles Edible?

(Yes, and sell for \$200 - \$400/lb)

(Photo by Rebecca Fyffe)



## Is there a market for these? Yes, but it is still quite small

“Good afternoon Dr. Brenneman, I was born and raised in GA and have lived here all my life. I love what is happening around the state with local foods and I would love to try some "pecan truffles" to see what the characteristics are.”

Chef of a large hotel in Atlanta

## Demand is Great – Why is the Current Supply so Limited?

1. Truffles grow underground so they are hard to find
2. **Cultivating them is not easy**

## Pecan Truffle Menu (five & ten, Athens, GA)

- Frisee salad with pecan truffle vinaigrette and a local poached egg
- Red mule grits custard with shaved pecan truffles and lobster
- Local squash and sage agnolotti with truffled leek crema, sweet leeks and shaved pecan truffles
- Robiolina with Georgia honey and honeycomb, toasted pecans and shaved pecan truffles
- Elizabeth's on 37<sup>th</sup> in Savannah features a creamy rice with bacon, collard's and pecan truffles

## Many fungi in pecan orchards are NOT truffles! (actual samples sent in for ID)



Argentina



Pisolithus tinctorius

## Status of Pecan Truffle Commercialization

- Research is increasing on propagation and biology
- Currently still a very small scale cottage industry
- Clearly there is potential for this to increase. Chefs love them and favorable articles in Southern Living, New York Times, Financial Times of London, AP, and others have stimulated demand far beyond current supplies.

## Field Inoculation of Old Trees not very successful



### Inoculating Roots



Young trees are transplanted and grafted to common commercial cultivars.



*Tuber lyonii* fruiting fall, 2012  
(Trees inoculated January, 2001)



Truffle-inoculated Pecan Trees are just becoming available commercially  
([www.truffletree.com](http://www.truffletree.com))



Commercializing truffle inoculation  
– the key to consistent production



Also need to understand what other factors favor truffle production



Trials in Tifton looking at fumigated planting sites and soil pH effects.

Soil pH and mineral nutrients strongly influence truffles and other ectomycorrhizal fungi associated with commercial pecans (*Carya illinoensis*).

Zai-Wei Ge & Timothy Brenneman & Gregory Bonito & Matthew E. Smith

As with many other truffles, pecan truffles are favored by high pH. How high can you go and not cause major fertility issues?

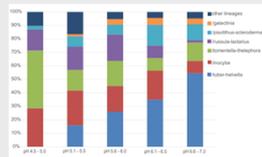


Fig. 4. Relative abundance of truffles in average number of truffles per tree of the dominant ectomycorrhizal fungal species associated with pecan trees. The relative abundance is shown in the columns from left to right but because the dominant fungus in the soil bank is...

## Truffle Meca!



Even inoculating pecan trees with some European truffles such as *Tuber borchii* and *Tuber aestivum* (could open up a whole new market)



## Key Cooperators

- Dr. Rytas Vilgalys – Duke
- Dr. Matt Smith – UFL
- Dr. Greg Bonito – MN

## Is this business for real? Yes

Still much to learn; “trade secrets” have delayed the advancement of our knowledge

Both the pecan and truffle business are for real, truffles already occur naturally and are being sold. I am convinced this system can work. Stay tuned – definitely more to come!

## More Information

- Pecan truffle information at [www.timbrenneman.org](http://www.timbrenneman.org)
- Other US truffle information available at [www.oregonwhitetruffles.com](http://www.oregonwhitetruffles.com)
- Inoculated seedlings from [www.truffletree.com](http://www.truffletree.com)
- North American Truffle Society at [www.natruffling.org](http://www.natruffling.org)

Pecan truffles –  
A fungus with a future!



Photos by Rebecca Fyffe