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Intro to Truffles

& Truffle Farming

Organic Growers School
4th Annual
Harvest Conference

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Carolina Truffiéres, LLC
Fletcher, North Carolina

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What is a truffle?

- A truffle is the fruiting body of specific fungi from the *Ascomycete* Phylum of Fungi, usually from the genus *Tuber*; but can be from *Leucangium* and *Terfezia*.
- Truffle fungi are ***ectomycorrhizal***, thus grow under the soil surface in close (symbiotic?) association with the host tree
- There are roughly 180 species of *Tuber* in the world
- Of these, about 6 +/- are commercially significant

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Tuber melanosporum

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Tuber borchii

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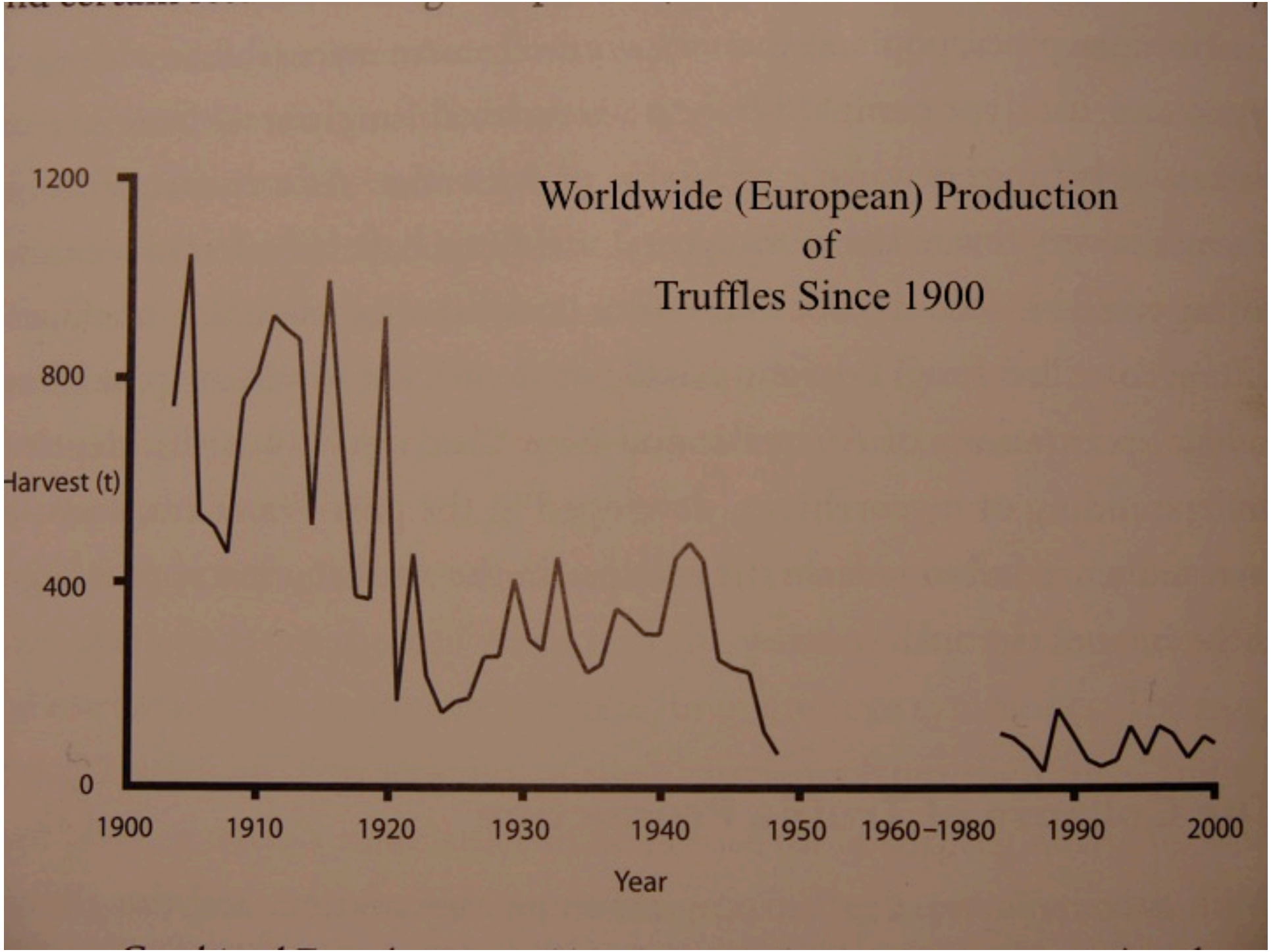
Why are truffles special?

- Truffles possess a very distinctive, unique, unusual taste (and smell); and are therefore highly prized for culinary flavoring
- Aside from flavoring; truffles are high in protein, amino acids, and are historically considered an effective aphrodisiac
- Lengthy history and tradition in Europe

Fresh black truffle with peas


Worldwide (European) Production
of
Truffles Since 1900
1200
800
Harvest (t)
400
0
1900
1910
1920
1930
1940
1950
1960–1980
1990
2000
Year

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Truffle Species in Commerce

- *Tuber melanosporum* - Black or Perigord Truffle
- *Tuber aestivum var. aestivum* - Summer Truffle
- *Tuber aestivum var. uncinatum* - Burgundy Truffle
- *Tuber borchii* - Bianchetto Truffle
- *Tuber lyonii* - Pecan Truffle
- *Tuber indicum* - Black Truffle
- *Leucangium carthusianum* - Oregon Black Truffle

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Historical Markets:

- Spain, France, and Italy were (and are) the primary producers of truffles
- 1000 - 2000 tons per year were produced prior to WWI and WWII; mostly wild collected and consumed in Europe
- Europe now produces less than 100 tons per year; mostly consumed in Europe and North America

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Emerging Markets:

- Spain – emerging as leader in industry, 40% of market
- Chile – 1st harvest 2009, 300 hectares, adding 40 hect./yr.
- South Africa – 1st harvest in 2014; natural lime soils
- New Zealand – about 60 orchards on 150 acres; since 1993
- Australia – est. circa 1993; 200 highly productive orchards, primarily sold in the Asian markets
- United States – est. circa 1990; hit and miss, limited harvest
- China – primarily *T. indicum*; future?

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Market Potential in U.S.

- High demand
- High prices
- Very limited domestic supply in United States
- Suitable areas exist in the U.S. for domestic production
- (better) Information becoming available to growers
- NATGA – North American Truffle Growers Association

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Challenges

- Limited industry success to date in U.S.
- Steep learning curve for growers – unlike other crops
- Uninformed consumer
- Supply chain not fully established
- FDA considerations
- NATGA – young trade association

a
b
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Which Species Should I Grow?

- ***Tuber melanosporum* - Black or Perigord Truffle**
- ***Tuber aestivum var. aestivum* - Summer Truffle**
- ***Tuber aestivum var. uncinatum* – Burgundy Truffle**
- *Tuber borchii* - Bianchetto Truffle
- *Tuber lyonii* – Pecan Truffle
- *Tuber indicum* – Black Truffle
- ***Leucangium carthusianum* – Oregon Truffle***

Tuber melanosporum

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Tuber melanosporum

- most prized truffle by chefs – the 'black diamond of the kitchen'
- taste & aroma - cheese, garlic, brandy, nuts, earthy; phenyl
- harvest from late November to early March
- requires soil pH of 7.5 – 8.0 for fruiting to occur
- least aggressive species of commercially produced truffles
- well drained soil
- host trees include oaks and filberts

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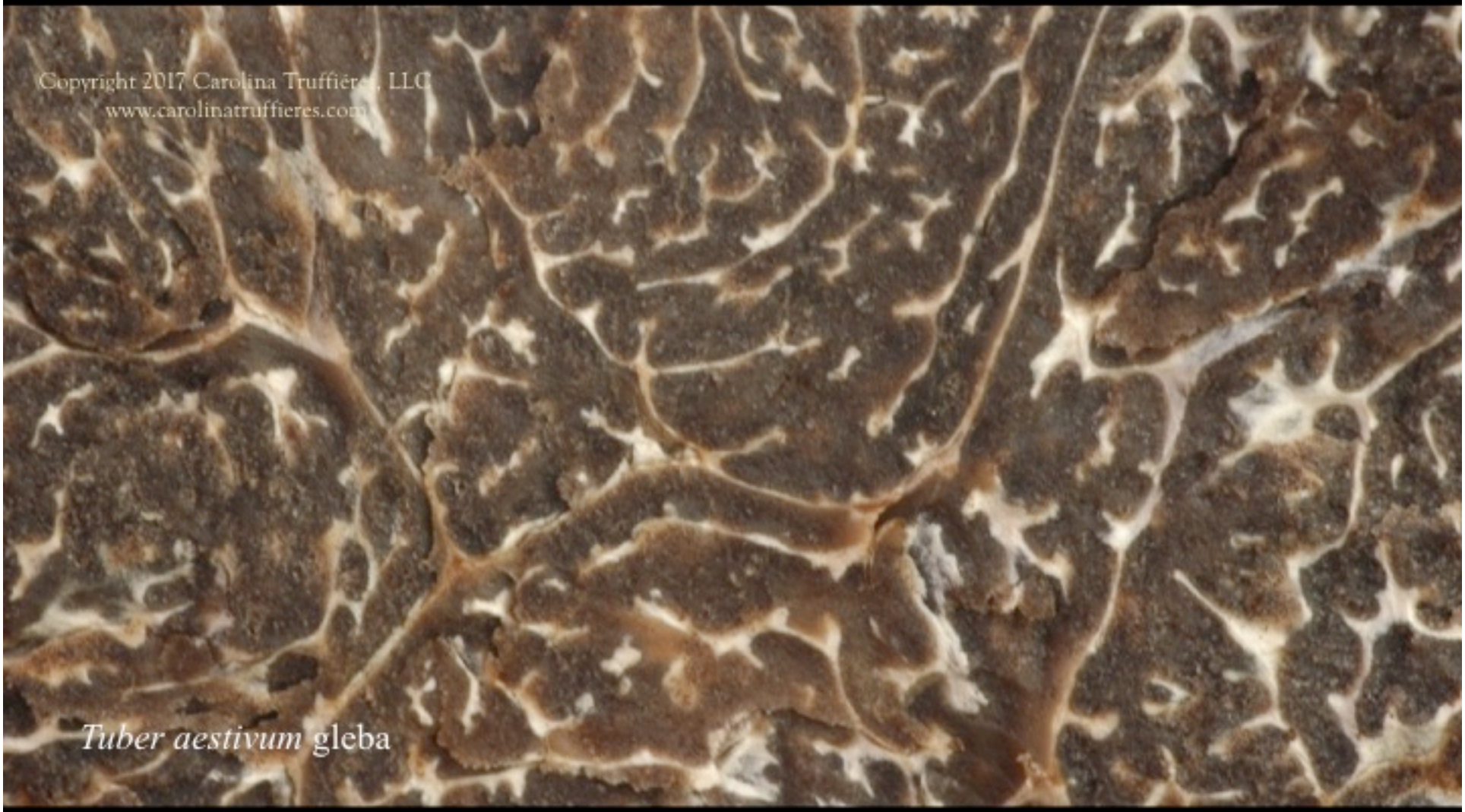
Tuber aestivum var. uncinatum



Tuber aestivum gleba

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Tuber aestivum

- Burgundy Truffle (*T. aestivum var. uncinatum*) - harvest September to early winter
- Summer Truffle (*T. aestivum var. aestivum*) – harvest from May to August; generally considered inferior to Burgundy
- 2nd most prized species by chefs; taste reminiscent of hazelnuts
- Requires well drained soils; denser canopy (shade), tolerant of lower pH
- Host trees include filberts, oaks, and chestnuts

Leucangium carthusianum

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Leucangium carthusianum

- Harvest late fall well into spring
- Excellent quality truffle, but relatively unknown which means low prices
- Fruity aroma & taste; pineapple, green apple, floral, & chocolate
- Native to PNW – Northern California, Oregon & Washington in young Douglas Fir forests
- Primarily wild collected; thus there is relatively little information about cultural requirements and commercial production requirements

established, productive orchard outside of Teruel, Spain

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Which Host Tree?

- Ectomycorrhizal species?
- Compatible host for desired truffle species?
- Cold and/or heat tolerant of your location?
- Water requirements compatible with your location?
- Tolerant of higher soil pH?
- Slow or moderate grower? Fast grower?

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Tuber melanosporum mycelium

HOST TREE	*Tuber melanosporum*	*Tuber borchii*	*Tuber aestivum / uncinatum*
Holm oak *Quercus rotundifolia*	√	√	√
Portuguese oak *Quercus faginea*	√		√
English oak *Quercus robur*			√
Beech *Fagus sylvatica*			√
Kermes oak (bush) *Quercus coccifera*	√		
Cork oak *Quercus suber*		√	
Hazel Dundee *Corylus avellana × colurna*	√	√	√
Stone pine *Pinus pinea*		√	
Radiata pine *Pinus radiata*		√	
Scots pine *Pinus sylvestris*		√	

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Mycorrhized *Quercus ilex ssp. rotundifolia* seedlings at Carolina Truffieres, LLC

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Quercus ilex ssp. rotundifolia
inoculated with Tuber melanosporum

Corylus avellana cv. – NCSU Waynesville, NC research station

Eastern Filbert Blight
on *Corylus avellana*

Eastern Filbert Blight in *Corylus avellana* orchard

powdery mildew on *Quercus robur*

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Host Trees to Consider:

Tuber melanosporum:

Corylus colurna – Turkish Filbert/Hazel

Corylus heterophylla – Asian Filbert

Quercus faginea – Portuguese Oak

Quercus ilex ssp. rotundifolia – Roundleaf Holly Oak

Leucangium carthusianum

Pseudotsuga menziesii – Douglas Fir

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Host Trees to Consider:

Tuber aestivum & Tuber aestivum var. uncinatum

Castanea x 'Dunstan' or similar - Chestnut

Corylus colurna – Turkish Filbert/Hazel

Corylus heterophylla – Asian Filbert

Quercus faginea – Portuguese Oak

Quercus ilex ssp. rotundifolia – Roundleaf Holly Oak

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www.carolinatruffieres.com
Corylus heterophylla

Corylus colurna
STOP

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Quercus ilex ssp. rotundifolia

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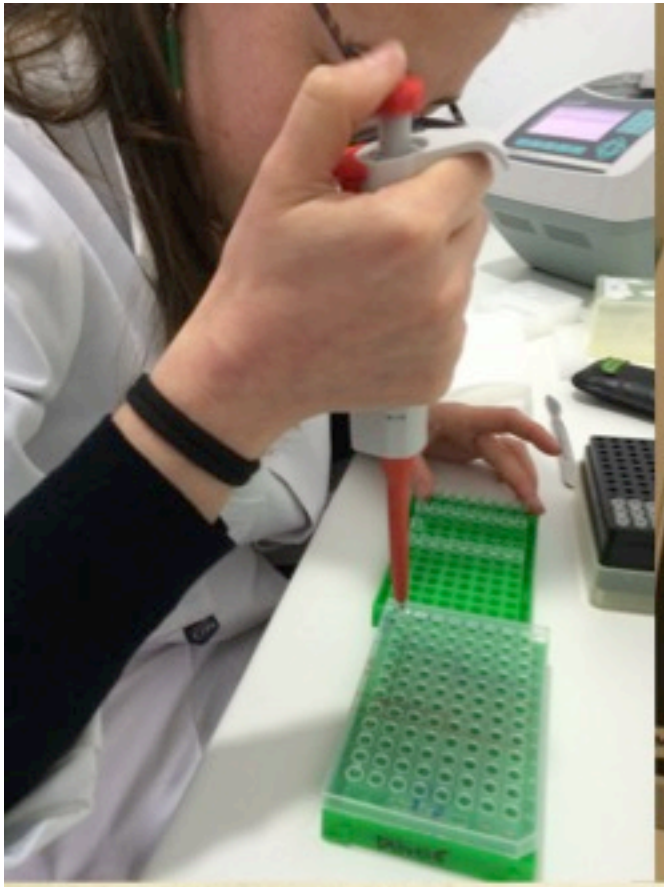
Quercus faginea ssp. faginea

mixed species orchard near Teruel, Spain

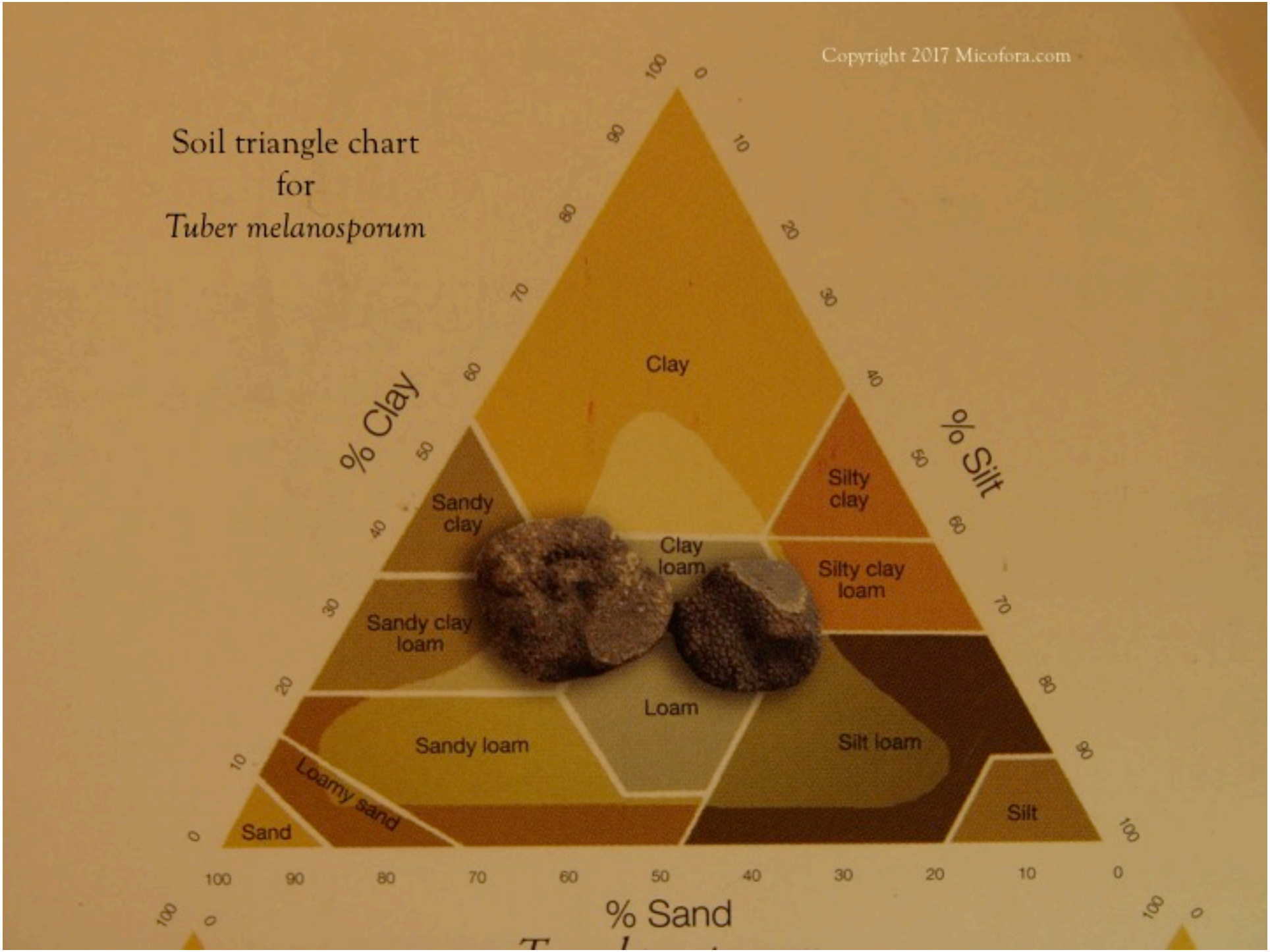


Seedling Standards

Rate of mycorrhization – what % is acceptable?

Confirmation of correct truffle species – visual v. DNA

Size and health of seedlings


Soil triangle chart
for
Tuber melanosporum
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% Clay
% Silt
% Sand
Clay
Silty clay
Sandy clay
Clay loam
Silty clay loam
Sandy clay loam
Loam
Sandy loam
Silt loam
Loamy sand
Sand
Silt

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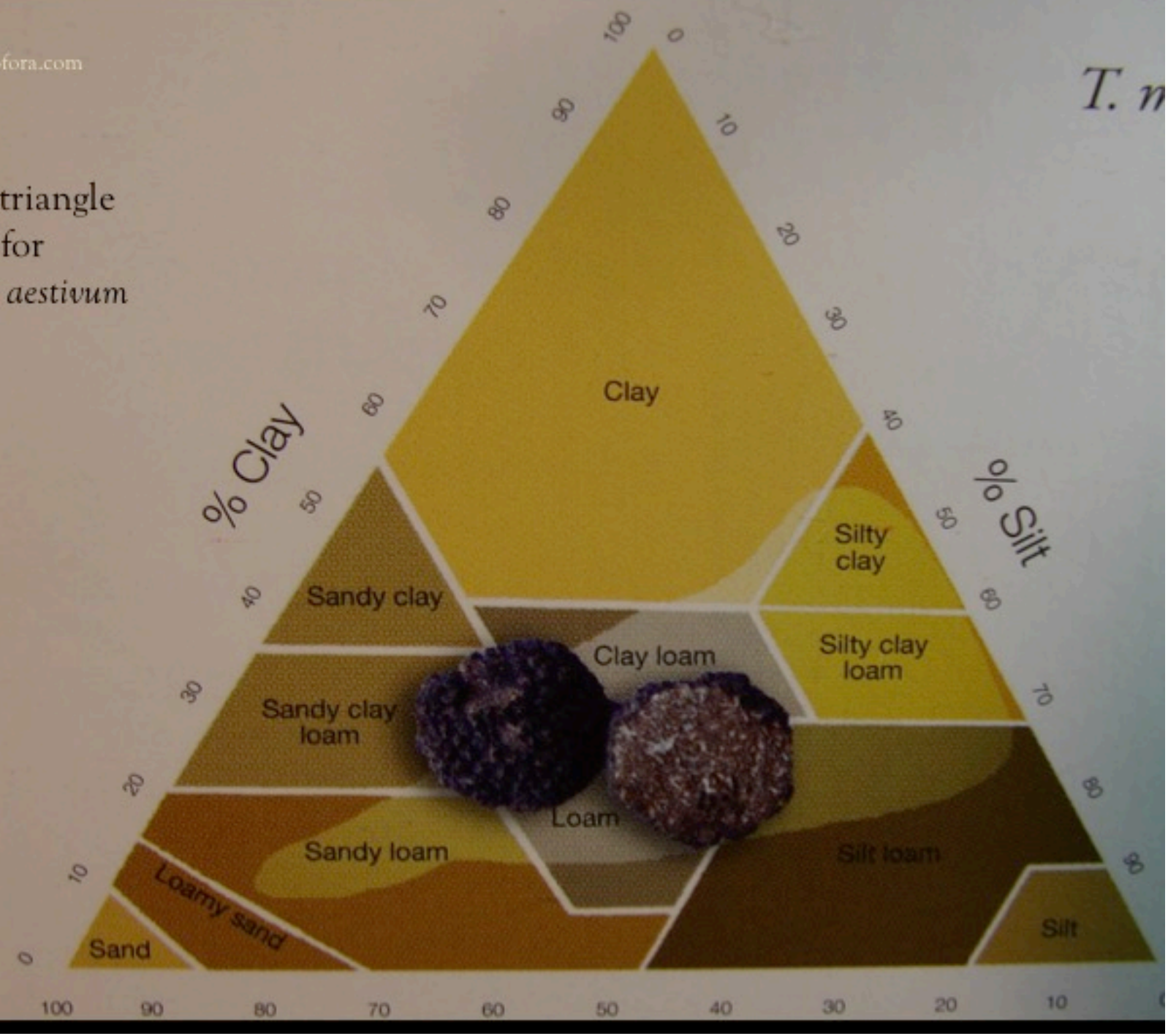
Soil triangle
for
Tuber aestivum



lime application to adjust pH levels

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100
200
300
200
300
3/4 TIP
1/2 TIP
DO NOT
EXCEED
SOIL
COMPACTION
TESTER
GLASS

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Copyright 2017 Microfoto.com
6x6m parcela
575 árboles

6x6m N-S
567 árboles

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Recently planted orchard

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micro irrigation in field planting

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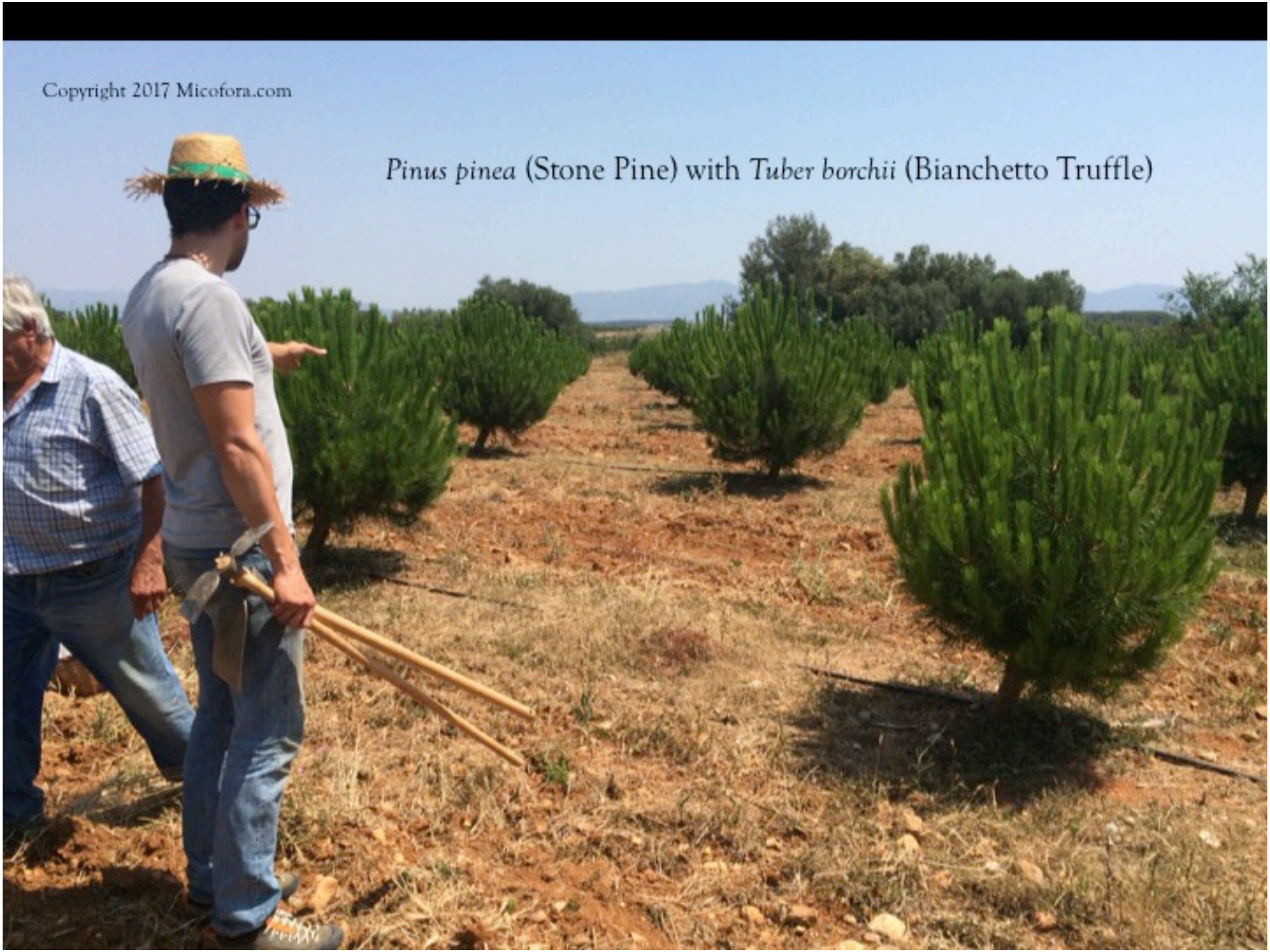
Re-inoculation of orchard with Spanish Well™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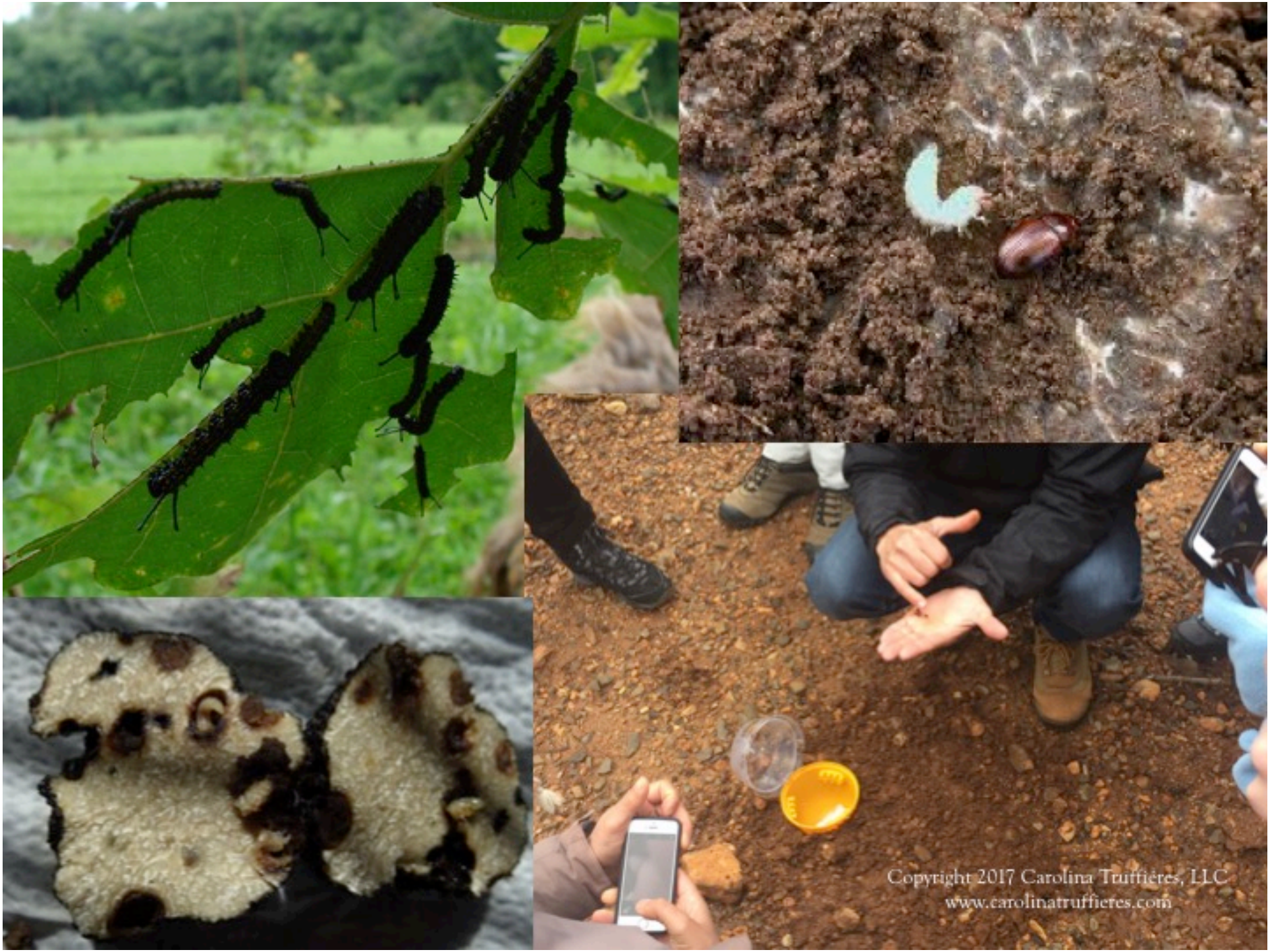
Pinus pinea (Stone Pine) with *Tuber borchii* (Bianchetto Truffle)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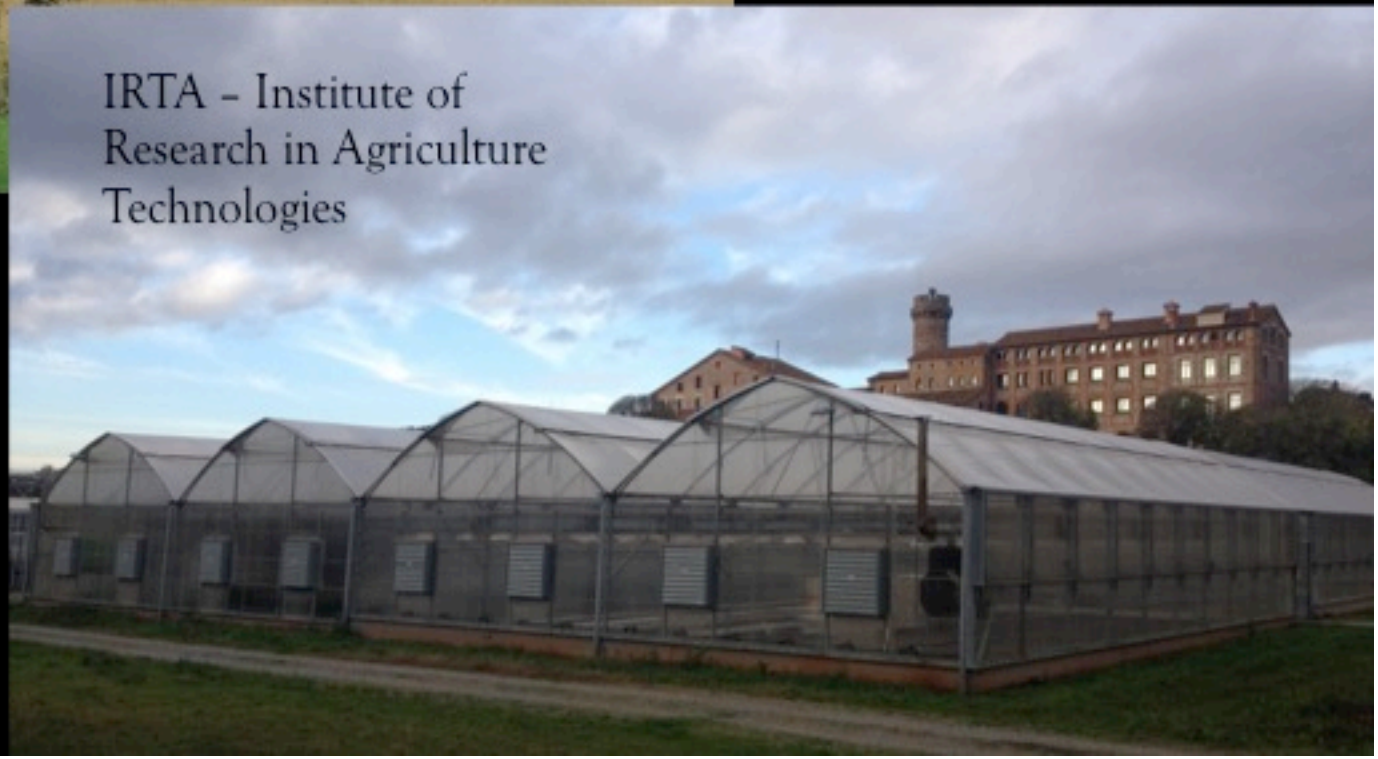
IRTA - Institute of
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Technologies

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North Carolina
Truffle Study
Formerly funded by a USDA Specialty Crop
Block Grant/NCDA&CS
USDA

North Carolina
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Service
Mountain
Research Station
NCSU • NCDA

brule in abandoned orchard, Spain
16 3 2002

brule in orchard
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Sales & Distribution

- Truffles and truffle products

  fresh, frozen, freeze dried

  Truffle products – infused oils, pate, spreads, etc.

- Direct sales to consumers, restaurants, and/or grocers
- Sales to brokers
- Sales to industrial food processors

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CON TRUFA 250 ML
12 €
MANJARES
DE LA TIERRA
Reducción de vinagre balsámico
con aroma de trufa negra
BRANDY CON TRUFA
9,50 €
CAPRICHO DE TRUFA
10,50 €
DELICIA DE TRUFA
10,50 €
TRUFA NEGRA

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Trufados
6
Huevos
Trufados
VALLEDEYERRI
Los huevos adquieren el inconfundible aroma
de la trufa a través de los poros de la cáscara.

TRUFFLE FARMING TODAY

a Comprehensive World Guide

Marcos Morcillo, Mónica Sánchez and Xavier Vilanova

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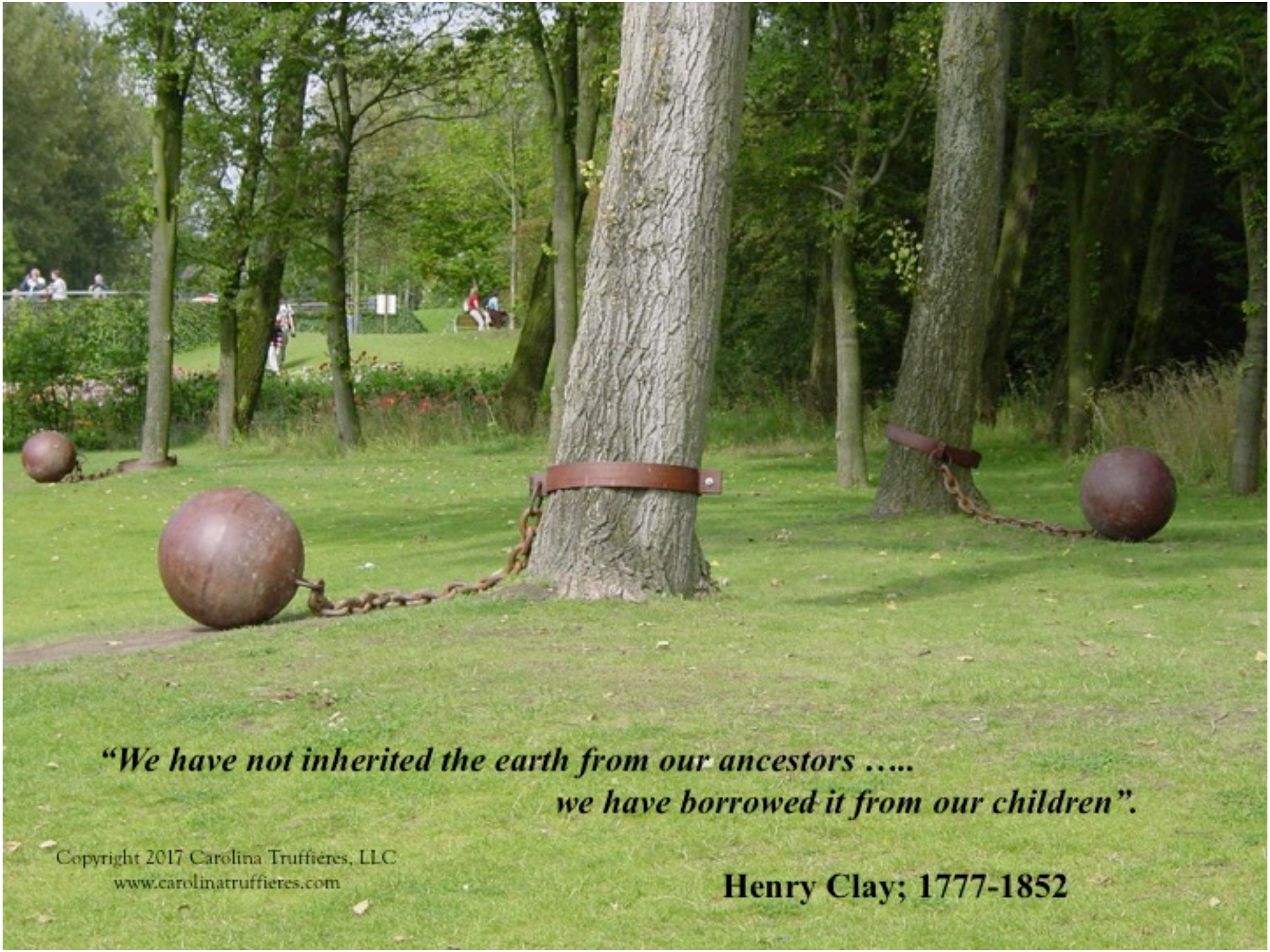
Resources

- NATGA – www.trufflegrowers.com
- Micologia Forestal & Aplicada – www.micofora.com
- Carolina Truffiéres, LLC – www.carolinatruffieres.com
- Truffle Farming Today – Morcillo, Sanchez, & Vilanova
- Taming the Truffle – Hall, Brown, & Zambonelli


"We have not inherited the earth from our ancestors …..
we have borrowed it from our children".
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Henry Clay; 1777-1852