

From Forest Nursery Notes, Winter 2010

69. Truffles and oak selection. Fitzpatrick, N. International Plant Propagators' Society, combined proceedings, 2008, 58:91-93. 2009.

Truffles and Oak Selection[®]

Noel Fitzpatrick

Department of Horticulture and Environment, Swinburne University TAFE Wantirna

Email: nfitzpatrick@swin.edu.au

INTRODUCTION

To survive many natural stresses, such as low soil fertility, drought, and temperature extremes, most plant species have over time established a symbiotic partnership with a unique group of soil organisms called mycorrhizal fungi.

This family of beneficial fungi lives in and around the roots of 90% of the earth's plant species, effectively working as a secondary root system, extending themselves out into the soil. Mycorrhizae extract mineral elements and water from soil for their host plant, and in turn, live off the plant's sugars. Trees and plants with thriving "mycorrhizal roots" systems are better able to survive in stressful environments.

The name "mycorrhiza" means "fungus root" and this is derived from the close association of the fungi with plant roots. There are four kinds of mycorrhizal fungi: arbuscular, ectomycorrhizal, ericoid, and orchid.

Ectomycorrhizal fungi are one of the more unique groups of fungi as they are largely external in nature. These are the fungi that form a symbiotic relationship with a plant by forming a sheath around the root tip of the plant. The fungus then forms an inward growth of hyphae (fungal cell growth form) which penetrates the plant root structure to facilitate the two way transfer of nutrients and sugars.

In excess of 4000 species of fungi form ectomycorrhizal associations, predominantly with woody plants, including trees such as oaks, beeches, birch, eucalypts, and poplars. Among the many popular edible mushrooms produced by this group of fungi are of course, the mysterious, powerfully aromatic subterranean truffles.

HISTORY

The history of truffles in Europe is certainly a very long one, with anecdotes and sketchy records on the many edible varieties and their use going back hundreds of years. In earlier times when truffle was harvested annually in relative abundance from the natural forests it was largely regarded as peasant food. It wasn't until the 14th century when the aristocracy began to purchase and use large amounts of truffle, that this rather mysterious tuber began its elevation in status in the culinary world.

The natural forests of southern France and middle to northern Italy have over time, and for a number of reasons, dramatically reduced their annual yield creating a situation where supply can no longer meet demand, driving prices paid for fresh truffle into the stratosphere. In response to this decline in natural production, man has been attempting to discover the secrets of growing truffle successfully in cultivation for almost 200 years now.

Between the science of mycology, and the trial and error by those willing to invest land, time, and money, some progress has been made in unlocking the mystery. However, despite the research carried out over such a long period, there is still much to be learned about the effective inoculation of host trees, the parameters of climate, and the consistent triggering and formation of the fruiting body (truffle) of the fungi.

THE AUSTRALIAN STORY SO FAR

There are literally hundreds of varieties of truffle that exist in almost all continents except for Antarctica, yet only a handful of these many and varied types have any real significance in the culinary world. Notably, two varieties of truffle stand head and shoulders above all others in value and interest — these are *Tuber magnatum* (the Italian white) and *Tuber melanosporum* (Perigord black) of France. Despite several plantings worldwide, to this date the Italian White has not been successfully grown in cultivation. It is still only harvested from natural forests predominantly in Italy, but may also be found in south east France and Croatia.

It is therefore mainly the French black truffle that is widely planted in Australia. This tuber has proven to be far easier to produce in a range of locations around the globe. The first trees planted in Australia were in 1993 and the first truffle produced in 1999.

Currently we have around 120 growers in all states of Australia except Northern Territories, with in excess of 90,000 host trees planted. The sizes of the truffieres vary, with most being around 1–2 ha with only a few larger projects of up to 40–70 ha.

Annual production in the winter of 2007 was collectively 800 kilos, with 300 kg exported to France and the remainder consumed in Australian restaurants. It is expected that production will increase each year exponentially as the host trees, and in turn, the mycorrhiza mature.

Host Trees. To this point in time the preferred species for use as host trees has been hazelnut and oak, with both often alternately planted in the truffiere; in more recent plantations however it is generally two or even three species of oak only. The host trees roots are inoculated with the specific fungi not too long after seed germination and then tubed and kept in the nursery for 12 to 18 months depending on the species and the mycorrhizal take.

The trees roots are then checked for a healthy mycorrhizal infection and then distributed to growers.

Cultivation. The ideal soil conditions for prolific mycorrhizal development are well drained loams with similar percentages of sand, silt, and clay. The pH needs to be in the range of 7.9–8.1 with high levels of calcium maintained, and so in many parts of Australia large amounts of lime (often 50–70 tonne per ha) are added months prior to planting in preparation to achieve this. The trees are generally planted out in rows 6–8 m apart and at 3-m spacings along each row. A weed mat and tree guard is important for protection at this early stage.

The minimum/maximum temperature averages should be in the range of 4 to 28 °C with an annual rainfall upwards of 650 mm, and with a complete irrigation system installed for the summer months. The irrigation system usually consists of a ring main, sub mains, and lines running down each row with a full circle sprinkler head positioned centrally between the trees. Grass is planted between the rows with a 1-m strip of relatively clean surface running either side of the tree line.

Early maintenance mainly revolves around weed control, trimming young trees to a central leader, irrigation, and the monitoring and adjusting of pH, calcium, and trace element levels.

Harvest. In the appropriate Australian conditions we are often experiencing production commencing, albeit in a very moderate way, in years 4 to 6 after planting the host trees. This first harvest may only yield as little as 1 kilo of truffle per

hectare of planting. Yield should increase slowly but exponentially each year depending of course on the nuances in climatic conditions. It is accepted that a target of 40–60 kg·ha⁻¹ after 10–12 years is achievable, yet there are truffières in other countries that have never produced and others that have yielded up to 100 kg·ha⁻¹. Time will be the main indicator of where the best sites for production really are.

The French black truffle is harvested through the months of June, July, and August. A grower will generally walk over the truffière once or twice a week with a dog specially trained to detect the powerful aroma of the truffle that will sit, from just below the soil surface to as deep as 50 cm. When detected, the grower must then ascertain whether the truffle is ready to be dug by the intensity of the aroma. If a truffle is dug too soon it will not mature properly dramatically reducing its value, so care must be taken when assessing its readiness for harvest. If deemed ready the truffle is slowly and carefully uncovered by hand and trowel, as any damage incurred will lower the grading and hence the value of the truffle.

Truffles are then cleaned, stored in refrigerated conditions, and sent to a distributor at the earliest opportunity as the shelf life for fresh truffle is a maximum of 3 weeks. The distributor will weigh, grade, and record the truffles, before on selling them to restaurants.

THE FUTURE

The future looks very positive for a sustainable and viable industry to develop in Australia. When production from an increasing amount of growers reaches a critical level the industry will be in a strong position to export to the lucrative Asian and European markets on a seasonal basis. The fact that we are in the southern hemisphere means that our harvest occurs in the off season for the northern hemisphere. It is also the peak tourism time in Europe when the demand for truffle is at its highest level.

Other opportunities that exist for this exciting new industry include:

- The development of truffle growing “regions,” leading to agriculture tourism with obvious benefits for local accommodation, hospitality, retail and real estate sectors.
- “Value added” truffle products, including truffle-infused oils, preserves, cheeses, and pasta.

The development of the Australian Truffle Growers Association in 2006 has helped to galvanize growers from all regions.