

Mediterranean Truffle Orchard Best Management Practices

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This document describes the best management practices for cultivation of Mediterranean truffles in British Columbia as determined by the Truffle Association of British Columbia.

When thinking about cultivating Mediterranean truffles in British Columbia, the future grower should consider the following questions:

1. Is the climate appropriate for growing the applicable tree and fungus species?
2. Is the land appropriate for growing applicable tree species, i.e. soils, aspect, slope, drainage?
3. Are the trees confirmed host species for the Mediterranean truffle species being grown?
4. Is there evidence that the correct truffle fungi are present as ectomycorrhizas on the trees (e.g. independent confirmation of colonization at time or planting, independent confirmation that orchard tree roots are colonized)?
5. Are there adequate trees per hectare?
6. Is there evidence of stand maintenance (e.g., soil pH at or near 7.9, absence of eastern filbert blight on hazelnuts, weeds controlled near trees, irrigation)
7. Does the grower possess the necessary training and skills for Mediterranean truffle production [e.g. certificate of participation in Mediterranean truffle cultivation training workshop put on by the Truffle Association of British Columbia (TABC)]?
8. Are adequate records being kept?

Best Management Practices (BMPs)

1. Climate region

TABC has assessed the regional climates in BC and compared them with known climate attributes for other Mediterranean truffle growing areas of the world (Hall et al. 2008). Based on this assessment, TABC concludes that climate conditions may be appropriate on south-eastern Vancouver Island, the lower Fraser Valley, and the Okanagan Valley.

Hall, I.R.; Frith, A.; Haslam, W. 2008. A rough climatic comparison of various centres adjacent to or with similar climates to Périgord black, Italian white, Burgundy and bianchetto truffle producing areas. Dunedin, Truffles & Mushrooms Ltd. (121 KB pdf file) (updated 19 October 2013)

2. Site

- I. Best prior use conditions for truffle orchard sites include pasture or other agricultural use (non-ectomycorrhizal trees) for 2 or more years prior to orchard establishment.

- II. Soils should be coarse-textured and well-drained. On sites with poorer drainage, sub-soiling and/or tile installation should be carried out before planting.
- III. Potential ectomycorrhizal host trees must be at least 50m away from the truffle orchard or removed 2 or more years before truffière establishment.

3. Host tree species

Hazelnut (*Corylus avellana*) and European oaks that are tolerant of alkaline soil (e.g. *Quercus robur*, *Quercus ilex*) and demonstrated to be appropriate hosts for truffle production should be used. Other tree species have not received the experimental attention of these two species and cannot currently be considered as proven hosts. Although *Quercus ilex* has not been found to be uniformly hardy in potential truffle growing areas of BC, it has successfully produced Périgord black truffles in one orchard.

4. Truffle species and colonization

Three Mediterranean truffle species are considered appropriate for cultivation in BC: *Tuber melanosporum* (Périgord black truffle), *Tuber aestivum* (summer or Burgundy truffle), and *Tuber borchii* (bianchetto truffle).

Because there is no assurance of quality of seedlings purchased from nurseries, it is important that ectomycorrhizal colonization of seedlings is independently assessed prior to planting; this includes both morphological assessment of morphotypes and DNA sequencing.

If this was not done, independent assessment of ectomycorrhizal colonization orchard trees is required after orchard establishment.

Determination of the correct ectomycorrhizas on host plant roots must be done under the dissecting and compound microscope by an expert with demonstrated expertise with truffle mycorrhizas. Molecular confirmation of the correct truffle species ectomycorrhiza involves sequencing of the DNA and must be done by a molecular lab with demonstrated expertise. Details of the protocols can be found in Berch and Bonito (2014).

Berch, SM, Bonito, G. 2014. Cultivation of Mediterranean species of Tuber (Tuberaceae) in British Columbia, Canada. Mycorrhiza February 2014.

5. Orchard tree size and density

Because the Mediterranean truffle industry is young, productivity data is not available. However, we can estimate minimum truffle orchard size based on data available from other truffle producing areas of the world. This was the approach used by Pilz et al. (2009) for their truffière enterprise budget. From this paper, we learn: "... if a carefully managed European black truffle plantation [with 194 trees/acre] yields 35/lbs/acre/yr, and the truffles can be sold to brokers for \$1000/lb, gross sales receipts would equal \$35,000/acre/year" (Pilz et al. 2009).

Pilz, D, Lefevre, C, Scott, L, Julian, J. 2009. *Oregon Culinary Truffles. An emergent industry for forestry, agriculture and culinary tourism.*

http://www.oregontruffles.org/truffles_feasibility_final.pdf

When converted to metric, this is \$86,450/ha/year with 480 trees/ha, or \$180/tree/year.

In British Columbia, minimum farm income for one hectare is \$2,500, so based on this calculation one hectare of producing truffle trees would easily pass this bar. For properties less than 0.8 ha, minimum income is \$10,000, and to achieve this at \$180/tree/year, a minimum of 56 producing trees would be needed.

<http://www.bcassessment.ca/public/Fact%20Sheets/Classifying%20Farm%20Land.aspx>

Because the cultivated Mediterranean truffle industry is relatively new in North America, it is difficult to provide definitive recommendations for tree density and spacing. Based on extensive study of truffle orchards around the world, Hall et al (2007) provide the best available guidance. For *Tuber melanosporum*, planting densities of 400-800 trees per hectare are recommended; with relatively cool summers, planting density and design should maximize sun hitting and therefore heating the soil. The same authors suggest that this planting density may also be suitable for *Tuber borchii*. *Tuber aestivum* grows well under nearly closed canopies so densities of up to 1250 trees per hectare may be appropriate.

Hall IR, Brown GT, Zambonelli A. 2007. *Taming the truffle: the history, lore, and science of the ultimate mushroom.* Timber Press, Portland, OR.

6. Stand maintenance

- I. Optimum soil pH is alkaline (at or near 7.9) and lime must be added to maintain this level. Most soil in BC is neutral or acidic so lime must be added to increase the pH. It is not possible to be explicit about how much lime must be added because soil type and climate affect soil pH dynamics, however many tons per hectare will be required. Each grower will need to monitor soil pH regularly and add lime to achieve the optimum of at or near 7.9.
- II. Absence of eastern filbert blight on hazelnuts (regular inspection of hazelnuts and remediation are carried out). This fungus will kill hazelnut trees and must be kept under control. Oaks are not affected by this fungus. New resistant varieties of hazelnuts exist but are not yet available with truffle ectomycorrhizas for truffle production.
- III. Weeds controlled near trees (within at least 1m radius from stem; alleyways mowed). The absence of weeds around truffle trees improves growth of fine roots and ectomycorrhizas and makes it easier to sample roots to assess their status.
- IV. Irrigation system in place and functional. When the trees are young, they need watering through the summer. Once established, late summer and fall watering are essential for truffle production.

7. Truffle harvesting

Based on information from other Mediterranean truffle producing areas of the world, the earliest production of Mediterranean truffles in a truffle orchard may occur at 7 years after installation but could take longer. Full production may not occur until 20 years after installation but reasonable production might be expected by 12 years. Once production begins, truffles should be produced annually although quantity, quality, and which trees produce can vary from year to year.

Truffles have value only when they are mature. Trained truffle dogs must be used to find mature truffles. Once found, truffles are carefully and individually dug from the soil by hand.

By year 7, trained truffle dogs should search the truffle orchard every week or two throughout the peak truffle season. Truffle season is likely to peak in January-February but may start in December and last into March.

8. Training and skills

- I. Certificate of participation in Mediterranean truffle cultivation training workshop put on by TABC
- II. Certificate of participation in Mediterranean truffle cultivation training workshop put on by other recognized organizations

9. Record keeping

It is the responsibility of the grower to maintain records documenting that the area is actively managed for truffle production. These records should include the following

- I. Maintenance of appropriate soil, tree, and weed conditions (see section 6)
- II. Starting by year 7 after planting, regular search of orchard by trained truffle dog(s) during truffle season
- III. Number, mass, and quality of truffles harvested
- IV. Price by number, mass, and quality of truffles sold