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TRUFFLES

Southern Woods Nursery in conjunction with Southern Cross Truffle Nursery Ltd supplies Perigord black truffle, and Burgundy or “Summer truffle” inoculated trees. The Perigord black truffle fruits in winter and is inoculated onto Holm Oak, Common or English Oak, or Hazelnut seedlings. The Burgundy truffle is only available on Common or English oaks in 2008.

Information presented below is given in good faith by Southern Woods based on information gathered from a number of sources. Refer to the contacts and references listed at the bottom of this information sheet.

On a cautionary note, black truffle production, and its support industry, is in its infancy in New Zealand. As such, our knowledge of how to grow and market truffles is incomplete. There is a significant risk associated with any horticultural crop. Most importantly with variation in the expected volume of crop, the quality of the crop, the price received at your gate, and the time taken to produce a crop – if the trees produce at all.

Nonetheless, black truffles are being produced in NZ, some good experience has been gained, and there is the potential for an exciting new industry. This information sheet is designed as a guide, and hopefully an inspiration, to the novice truffle grower.

WHAT IS A TRUFFLE?

Truffles are fungi that grow in and on the roots of specific trees, and have fruiting bodies that grow beneath the ground. Truffles of various kinds are found throughout Europe, Asia, America, Australia and Africa, but only a few species have any real commercial value.

The Perigord Black Truffle (*Tuber melanosporum*) occurs naturally under oak trees in winter in the limestone soils of central and southern France. They are considered the finest of edible fungi and have a place in gastronomy alongside saffron, caviar, and foie gras.

The Burgundy truffle (*Tuber aestivum*) occurs in France and Italy during summer and autumn, and is widely consumed in those countries. It is easily distinguished from the Perigord black truffle by its coffee coloured interior and the network of ridges that cover the surface of its spores. It is a heavy producer but the flavor and smell are not as strong as the Perigord black truffle and it sells for a reduced price. It is useful in a truffiere to spread the season but should be kept well separated from Perigord black truffle inoculated trees.

Since the times of Greeks and the Romans, truffles have been eaten as delicacies, aphrodisiacs, and medicines.

Truffles are harvested in winter, using specially trained dogs. Handlers carefully dig out the truffle, which can be as much as 30cm below the surface.

Mature black truffles vary in size from pea-size to a tennis ball or bigger, and can weigh up to 1kg. They actually look like a dogs nose!! They have a shelf life of about 2 weeks.

Female pigs were originally used to indicate where individual truffles were by smelling them out. Today dogs are used for this task, as they are easier to control.

At the beginning of the 20th century the total volume of black truffles harvested in France was estimated at more than 1000 tonnes a year. This compares with just 80 tonnes for 2004/05. Much of the French crop harvested is still found in the wild and yields vary considerably depending on the growing conditions.

The steady decline in production over the last 100 years, and the consequent threat of the extinction of one of its traditional and most prestigious agricultural industries, has led to France's Ministry of Agriculture to invest in a huge amount of research and development.

Plantation farming has been developed, involving the careful preparation of soils, infection of the roots and tree seedlings with truffle spores, ongoing tree husbandry, and the use of irrigation.

These developments are being achieved against a background of strong consumer demand for black truffles throughout the world.

TRUFFLE PRICES

Prices for first grade fresh black truffles in the French market are currently about 1,400 Euros per kilogram. Elsewhere in the world prices paid by those very few top-class restaurants, which are able to source the product, are in excess of \$3,600 NZ per kilogram.

European truffle production is limited by the lack of large-scale farms, relatively low levels of technical skill and business expertise within the farming community, and enormous competition from other forms of land use. Total truffle production is expected to vary from 50 to 70 tonnes annually.

Burgundy truffles sell for between NZ\$400 to \$800 per kilo.

TRUFFLE GROWING IN NEW ZEALAND AND AUSTRALIA

Partly following on from the developments in France but also as a consequence of successes with other new crops, there has been growing interest from New Zealand and Australia in establishing a black truffle industry. Both countries have been growing black truffles for a number of years.

The soil and climate conditions required by truffles and their host trees exist in both countries, and both have the high technical and management skills required to make black truffle growing a success.

Because of the seasonality of black truffle production, supply from New Zealand and Australia will complement that from the Northern Hemisphere, with the overall effect of a better spread of product throughout the year.

In New Zealand, the industry gained impetus from the efforts of Crop & Food Research that developed a system of infecting the roots of young trees with black truffle spores.

At present there are about 40,000 trees on more than 100 sites, most of which have fewer than 600 trees. Truffles were first produced in a Gisborne truffiere in 1993, and there are now nine productive plantations from the Bay of Plenty to Canterbury. This includes 3 producing truffieres in North Canterbury. Because of the relatively small size of the existing truffieres it is difficult to extrapolate precise production data but yields equivalent to well over 100kg/hectare have already been achieved. These yields are reputed to be the highest in the world for cultivated truffles.

THE HOST TREE

Southern Woods Nursery supplies Holm Oak (*Quercus ilex*), Common or English Oak (*Quercus robur*), and Hazelnut (*Corylus avellana*) seedlings complete with a guarantee of successful inoculation with the Perigord black Truffle fungi. Burgundy or Summer truffles come inoculated on to Common or English Oaks only.

The Holm oak is a tough evergreen oak suited to a wide range of sites including dry and exposed conditions. There are many old examples of Holm Oak throughout the temperate areas of NZ. These areas are also the most suitable for black truffle truffieries. The Holm Oak is one of the main host trees used in European and Tasmanian truffieries.

Common Oaks and Hazelnuts naturally suit deeper and moister soils, and cooler climates. In an orchard situation you can add water and fertilizer to improve the soil if necessary so you can grow these species on drier sites and successfully produce truffles. On a cold site that is too cold for the Holm Oak then these are the preferred tree species. They have mostly been planted mixed together in truffieries in NZ with more hazelnuts than Common oak trees as the hazelnuts will ultimately form much smaller trees. The Hazelnuts will generally fruit (form truffles) earlier than the Common oak but won't fruit for as long. In time the Common oaks will over-shadow the Hazelnuts and become dominant.

THE NURSERY

The nursery where the trees are inoculated and grown is operated under strict quarantine and hygiene conditions to ensure a high standard of quality control.

The inoculation process is based on a French system, modified to meet local hygiene and quarantine requirements.

Trees are grown from seed for 12 months up to approx 20 cm in height in carefully managed conditions to ensure a high level of mycorrhization (establishment of the fungi on the root). They are sold with every chance of producing truffles, given correct, and on-going, management.

Larger seedlings are supplied as demand allows, or by arrangement.

CHOOSING AND PREPARING THE SITE

A number of key conditions must be satisfied in order to successfully grow the Perigord black truffle in a plantation setting.

These are

- Correct soil pH [add natural lime and/or dolomite to achieve optimum 7.9]
- Friable, well aerated, and well drained soil [drain if required, and cultivate prior to planting]
- Sufficient moisture at key times [install a mini-sprinkler irrigation system]
- An absence of competing fungi [see table below]
- Absence of competing weeds [maintain a weed-free spot around the tree]
- A relatively dry climate [more so for Holm oaks]
- Warm summer temperatures [mean daily 16.5 to 22 °C]
- Cool winter temperatures [mean daily 1 to 8 °C]
- Easy contour [for ease of machinery operation]

PLANTING

- Plant in spring after the worst of the frosts into weed free and well cultivated soil. Use a non-residual herbicide like 'Buster' but don't use 'Glyphosate' e.g. RoundUp as it is detrimental to soil fungi. Autumn and winter planting can also be successful with larger seedlings and/or more cold-hardy species (eg Common oak and Hazelnuts).

- Plant at 5m x 4m spacing i.e. 500 trees per hectare
- DO NOT over fertilize the soil at planting as you risk killing off the truffle fungi. Avoid salt based fertilizers such as DAP, Nitrophoska etc. Blood and bone would be a good choice.
- Disturb the roots as little as possible
- Ensure that the potting mix is well covered with soil
- Water in well
- Put a 75cm tall KBC shelter with stake on each tree. This will help to protect against frost, pests, wind and sprays
- Put a 40cm diameter mulch mat (or similar) around each tree.

LISTS OF SUITABLE AND UNSUITABLE WINDBREAK AND COMPANION TREES

Truffle fungi are ectomycorrhizal fungi and for them to establish well it is important that your truffiere is not positioned within 20 m of other trees that could harbor competing ectomycorrhizal fungi.

Most trees form arbuscular mycorrhizas – the other main form of mycorrhizal fungi. These are all suitable for use as windbreak or companion trees close to your truffiere.

SUITABLE companion/windbreak trees (these form arbuscular mycorrhizas)

NZ Natives (most are suitable so just the key species have been listed below)

Totara (<i>Podocarpus totara</i>)	Ribbonwood (<i>Plagianthus regius</i>)
Lacebark (<i>Hoheria</i> species)	Flax (<i>Phormium tenax</i> , <i>P. cookianum</i>)
Corokia species	Coprosma species (<i>C. lucida</i> , <i>C. robusta</i> , <i>C. propinqua</i>)
Broadleaf (<i>Griselinia littoralis</i>)	Akeake (<i>Dodonaea</i> and <i>Olearia</i> species)
Kowhai (<i>Sophora</i> species)	Pittosporum species (<i>P. tenuifolium</i> , <i>P. eugenioides</i> , <i>P. ralphi</i>)

See the native shelter designs in the Southern Woods catalogue.

Exotics

Leyland cypress	Other cypress i.e. <i>Cupressus lusitanica</i> , <i>C. torulosa</i> , <i>C. macrocarpa</i>
Japanese cedar (<i>Cryptomeria japonica</i>)	Lawson cypress (<i>Chamaecyparis lawsoniana</i>)
Ash (<i>Fraxinus</i> species)	Maples (i.e. <i>Acer negundo</i> , <i>A. pseudoplatanus</i>)
Rowan (<i>Sorbus aucuparia</i>)	Olives (<i>Olea</i> cultivars e.g. Frantoio, Leccino, Pendolino)
Viburnum (e.g. <i>V. tinus</i> ‘Lucidum’)	Redwoods (<i>Sequoia sempervirens</i> , <i>Sequoiadendron giganteum</i>)
Deciduous fruit trees (<i>Prunus</i> and <i>Malus</i>)	

See the mixed shelter designs in the Southern Woods catalogue.

UNSUITABLE windbreak and companion trees (within 20m of the truffiere)

Alders (<i>Alnus</i> species)	Pines (<i>Pinus</i> species including <i>P. radiata</i>)
Poplars (<i>Populus</i> – all cultivars)	Eucalyptus (all species)
Willows (all cultivars and species)	Cedar (<i>Cedrus</i> species)
Douglas Fir (<i>Pseudotsuga menziesii</i>)	Manuka (<i>Leptospermum scoparium</i>)
Kanuka (<i>Kunzea ericoides</i>)	Firs (<i>Abies</i> species)
Spruces (<i>Picea</i> species)	She-oaks (<i>Allocasuarina</i> species)
Chestnuts (<i>Castanea</i>)	Oaks (<i>Quercus</i> species)
Hazelnuts (<i>Corylus</i> species)	Walnuts (<i>Juglans</i> species)
Beech (<i>Fagus</i> and <i>Nothofagus</i> species)	Larch (<i>Larix</i> species)
Hornbeam (<i>Carpinus</i>)	Birch (<i>Betula</i> species)
Lime (<i>Tilia</i> species)	

SET UP COSTS

Set up costs varies depending upon factors including topography, soil type, climate and infrastructure. Estimated establishment costs are

	\$/Ha excl GST
Reticulated spray irrigation system	8,000
Liming and soil rectification	1,500
Soil Preparation	500
Planting, tree guards, stake, mulch mat	3,000
400 trees @ \$50	20,000
TOTAL	\$33,000

RUNNING COSTS

On-going costs include weed spraying, tree maintenance, watering and soil maintenance. On average these will be around \$1,200/hectare/annum.

Harvesting silage or hay from between these rows may offset some of these costs.

NURSERY TREE PRICES

Note that Perigord Black truffles are available on Holm Oak, Common Oak and Hazelnut. Burgundy truffle is only available on Common Oak.

2008 prices for all species are

For 1 year old trees (Perigord black and Burgundy truffles)

1 to 50 trees	\$60 each + GST
51 to 100 trees	\$55 each + GST
101 or more trees	\$50 each + GST

For 2 year old trees (Perigord black truffles only)

1 to 50 trees \$70 each + GST
51 to 100 trees \$65 each + GST
101 or more trees \$60 each + GST

RETURNS FOR PERIGORD BLACK TRUFFLES

It is almost impossible to get verifiable income data from a fully developed, mature truffiere anywhere in the world.

This is partly due to the very high prices received for the product, and the fact that the European producers are very secretive about methodologies and systems and the consequent returns.

Experience from Tasmania has shown that, given the right conditions, truffles around Holm Oak trees can be found four years after inoculation, though it would be wise to use 7 or more years in your financial projections. Naturally a small tree in the early years is not going to have a large root system on which to harbor many black truffles.

In New Zealand there have been instances of yields in excess of 90kg/ha. One plantation in the Bay of Plenty has achieved a yield of more than 400g/tree.

Once a tree starts producing it seems to then continue to produce on a regular basis. Several mature plantations in France have reported individual trees consistently producing 150-200g grams of truffles per year. Assuming correct inoculation, appropriate on-going management and that each tree is producing, estimates can be made regarding yield.

Production can be projected from an initial 2 to 4kg/ha at year 6, up to a potential of 40kg/ha over a subsequent 5-year period. After 11 years, on-going production is estimated at 20 to 40kg/ha/year.

Returns per Hectare (\$)

Average Price per Kilo

Total Yield Kg/ha		\$1,000	\$1,500	\$2,000	\$2,500	\$3,000
	5	5,000	7,500	10,000	12,500	15,000
	15	15,000	22,500	30,000	37,500	45,000
	25	25,000	37,000	50,000	62,500	75,000
	40	40,000	60,000	80,000	100,000	120,000
	55	55,000	82,500	110,000	137,500	165,000

Notwithstanding the potentially high financial returns suggested, we consider it prudent to allow for a range of risks and uncertainties. The matrix above outlines the relationship between price and yield and it shows an enormous variation in possible returns.

For those considering growing Perigord black truffles as an investment, we suggest projections of long-term production at between 20kg and 40 kg/ha/year, and average prices between \$1,500 and \$2,000/kg.

RETURNS FOR BURGUNDY TRUFFLE

Typically ranging from NZ\$400 to \$800 per kilo.

MARKETING

During June, July and August, when “down under” black truffles can be supplied fresh, France’s population of 55 million almost doubles to about 100 million thanks to an influx of tourists. Europe is on summer holiday, and restaurants throughout France do a roaring trade. Local people in the European market believe that if they can access fresh black truffles in their summer it will increase the overall awareness and result in increased demand.

Currently the small volume of NZ produced truffles are mostly sold locally to top-end restaurants. As volumes increase more truffles will be air freighted to overseas markets. Contact should be made with the NZ Truffle Association and Southern Cross Truffles Ltd for an update of current industry marketing initiatives.

IMPORTANT CONTACTS

Southern Cross Truffles Ltd, Contact: Bill Lee, Web www.southerncrosstruffles.co.nz, Email enquires@southerncrosstruffles.co.nz

NZ Truffle Association Inc, PO Box 10629, Wellington. Web www.southern-truffles.co.nz

NZ Crop & Food Research Ltd, Invermay Agricultural Centre, Private Bag 50534, Mosgiel, NZ

Soil Testing Laboratories

- e-lab Ltd, Ph 0800 655 126, Email labinfo@e-lab.net.nz
- Hills Laboratories, Ph 03 377 7176, Web www.hill.laboratories.com

Soil Amendments - Contact you local farm supply merchant, or fertilizer representative. Note that natural lime or dolomite is better than palletized products

IMPORTANT REFERENCES

Taming the Truffle – The history, lore, and science of the ultimate mushroom. Ian Hall, Gordon Brown & Alessandra Zambonelli, 2007. www.timberpress.com

The Black Truffle – Its History, Uses and Cultivation. Ian Hall, Gordon Brown & James Byars. NZ Crop & Food Research, 2001. www.crop.cri.nz/books

Edible Mycorrhizal Mushrooms and their Cultivation. Proceedings of the 2nd International Conference on Edible Mycorrhizal Mushrooms, Christchurch, July 2001. Editors: Ian Hall, Wang Yun, Eric Danell, & Alessandra Zambonelli. www.crop.cri.nz/conferences/em-mushroom

Edible and Poisonous Mushrooms: an introduction. Ian Hall, P. Buchanan, Yun Wang, & A. Cole. NZ Crop & Food Research, 1998.

The Truffle Book. Garath Renowden. Email info@limestonehills.co.nz, Web www.limestonehills.co.nz, Ph 021 790 070

Factors affecting the fruiting of the Perigord black truffle: a comparison of productive and non-productive *Tuber melanosporum truffieries* in NZ. NZ Crop & Food Research, 2002

TRUFFLE ORDER FORM



Thank you for your interest in the truffle inoculated trees. Below is a form for you to fill out as to how many trees you require, as well as planting accessories required in order to successfully grow the trees. Supply is limited so ensure you get this form back to us as soon as you have decided. The trees will be ready in Spring, so we will contact you regarding delivery closer to this date.

Please send back to us by fax, post or email (as above)

Name: _____

Postal Address: _____

Telephone: _____

Email Address: _____

Delivery Address (if different from above): _____

Signed _____

You may receive an invoice for a 25% deposit once we have received your order

Perigord Black Truffle (1yr old)	Qty	<u>All 1yr old truffle prices:</u>
On Quercus ilex	_____	@ \$67.50ea for 1-50
On Quercus robur	_____	@ \$61.87ea for 51 - 100
On Hazelnut	_____	@ \$56.25ea for 101+
Bergundy Truffle (1 yr old)		<u>All 2yr old truffle prices:</u>
On Quercus robur	_____	@ \$78.75ea for 1-50
Perigord Black Truffle (2 yr old)		@ \$73.12ea for 51-100
On Quercus robur	_____	@ \$67.50ea for 100+
On Hazelnut	_____	
KBC Shelter (750 x100cm)	_____	@ \$4.50ea or \$4.20 for 10+
Mulch Mat (400mm diameter)	_____	@ \$150ea or \$1.10 for 10+
Stakes (1.2m)	_____	@ \$1.75ea