

# POTENTIAL FOR THE PRODUCTION OF HIGH-PRICED EDIBLE SYMBIOTIC FUNGI IN NEW ZEALAND

IAN R. HALL

*Invermay Agricultural Centre  
Ministry of Agriculture and Fisheries  
Private Bag, Mosgiel*

**Abstract.** The very highly-prized Périgord black truffle and Piedmont white truffle only occur naturally in Europe in close association with the roots of particular host plants. The Périgord black truffle has been introduced into New Zealand and techniques have been developed for raising oak and hazelnut trees infected with it. The life cycle of this fungus, its climatic and soil requirements, and the potential for growing it commercially in New Zealand are outlined.

## INTRODUCTION

Edible fungi can be divided into four groups depending on their source of nutrients. These are the saprophytes (e.g. button mushroom), ecologically-dependent saprophytes (e.g. morel), pathogenic (e.g. honey fungus), and mycorrhizal (or symbiotic, e.g. cep, chanterelle, and the truffles). The saprophytes live on almost fresh to composted plant or animal materials with the ecologically-dependent saprophytes requiring extremely specific conditions. Pathogenic fungi live on other living plants but cause disease, whilst the mycorrhizal fungi form a very close association with the roots of a host plant and generally benefit its growth.

Because of ease of culture, 99% of all fungi consumed worldwide (approximately one million tonnes) are saprophytes. However, some of the mycorrhizal mushrooms are highly sought after and can command very high prices. Of these the Périgord black truffle and the Piedmont white truffle are valued most highly and have a place in haute cuisine alongside saffron, caviar, foie gras, and the finest of wines.

As Périgord and Piedmont truffles can only be harvested at restricted times of the year (September to February in the Northern Hemisphere) and cannot be stored fresh, only preserved—or inferior species of truffles are available for the remainder of the year. There is therefore the opportunity for New Zealand to produce fresh Périgord and Piedmont truffles for out-of-season Northern Hemisphere markets in Europe, U.S.A., and Japan.

In the mid-1980s a research programme on the Périgord black truffle commenced at Invermay. This paper presents a brief summary of this research (2), and covers the likelihood of black truffles being produced in New Zealand for the home and export markets. It also points the way to the possibility of producing other edible mycorrhizal fungi in New Zealand.

## LIFE HISTORY OF THE PÉRIGORD BLACK TRUFFLE

Like the cap of the button mushroom, a truffle is the organ of the truffle fungus that produces the fungal spores. But there the resemblance ends, as the black truffle tends to be roughly spherical, has no stalk or gills, and is formed underground.

Throughout the year the black truffle fungus can be found forming a tight sheath (mantle) around the root tips of its host plants. This combined structure of root and fungus is called a mycorrhiza. Above ground this zone of infected root is marked by a circle of dead vegetation known as the *brulé*. It is in this zone that truffles are formed and harvested in winter with the aid of specially trained dogs or pigs.

## TECHNOLOGICAL DEVELOPMENTS IN NEW ZEALAND

Research has been conducted at Invermay over the past three years to develop a routine technique for producing large numbers of seedlings infected with the Périgord truffle fungus. Although tens of thousands of black truffle-infected plants are produced annually in Italy and France, for commercial reasons the details of procedures used to produce them remain closely guarded. The New Zealand Ministry of Agriculture and Fisheries has also decided to adopt this approach. This is partly to ensure a return on its investment but also, through the careful quality control of the plants it sells; this will ensure that this potential industry has the very best chance of becoming established in New Zealand.

Research has also been conducted that has identified areas in New Zealand which should be suited to the establishment of Périgord black truffle truffières (truffle plantations).

## CLIMATIC REQUIREMENTS OF THE PÉRIGORD BLACK TRUFFLE

The périgord black truffle naturally occurs on calcareous soils in France, Italy, and Spain and, less commonly, in Bulgaria, Portugal, and Yugoslavia, between latitudes 40° and 47°N. In France they are to be found in an incomplete arc to the southwest and east of the Massif Central. In Italy they are primarily found in the north and centre of the country in Emilia, Liguria, Marche, Piemonte, Trentino, Toscana, Umbria, and Veneto, while in Spain they are found in Alava, Cuenca, Guadalajara, Huesca, Soria, Valencia, and Zaragoza provinces.

The French black truffle growing areas are characterised by warm summers (16.5°C to 22°C mean daily temperature in July), cool winters (2°C to 8°C mean daily temperature in January), 600 to 1500 mm of rain per year and 1900 to 2800 hours of sunshine per year. Areas in New Zealand that have climates within these ranges



extend from North Otago in the South Island to Poverty Bay in the North Island.

### SOIL REQUIREMENTS OF THE PÉRIGORD BLACK TRUFFLE

In Europe black truffles occur naturally and are grown artificially on rendzinas and brown earths (1). The principal characteristic of these soils is their high pH caused by the considerable quantities of limestone present in them. The ideal truffle soil should have a pH above 7.5 and with an optimum of 7.9.

In addition to the high pH, the soils in French truffières have moderately high levels of organic matter, high levels of available calcium and magnesium, and moderate levels of available phosphorus. The soils are also free-draining and have a well-aerated granular texture with neither an excess of silts, sands, nor clays. Similar soils can be found in New Zealand in, for example, North Otago and South Canterbury (e.g. Oamaru and Waikakahi soils), North Canterbury (e.g. Waikari soil), Marlborough and Nelson (e.g. Amuri soil), Poverty Bay (e.g. Waipaoa and Waihirere clay loams) and Northland (Arapohue soils).

The distribution of the ideal soils in these areas, however, tends to be very uneven and is most pronounced in North Canterbury where the soil map resembles a patch-work quilt. Great care therefore has to be taken in choosing a suitable site for a truffière.

While pH test paper and pH meters can be used to test soil pH, the other tests can be carried out only by a well-equipped laboratory. For this reason the Ministry of Agriculture and Fisheries Soil Fertility Service analyses and assesses the suitability of soils for the establishment of black truffle truffières as an adjunct to its comprehensive agricultural soil testing service.

Although a naturally high pH soil is probably the ideal, several truffières have been established in New Zealand on normally acid soils augmented with large quantities of limestone.

### COMPETITION FROM OTHER MYCORRHIZAL FUNGI

When selecting a site, care has to be taken to ensure that any competition from other ectomycorrhizal fungi is minimised. Truffières should therefore be established well away from plants which might harbour competing ectomycorrhizal fungi. This includes pine, birch, alder, oak, hazelnut, Douglas fir, and beech. Gum, poplar, willow, manuka, kanuka, and macrocarpa (Monterey cypress) can sometimes also carry competing ectomycorrhizal fungi on their roots so establishing a truffière where these occur should also be avoided.

## FUTURE DEVELOPMENTS

The first black truffle truffières were established in spring, 1987, and by spring, 1989, approximately 7 ha of truffière were established. Given the right conditions, black truffle truffières begin producing at four to seven and, occasionally, 10 years after planting. Consequently, it is reasonable to expect that if all continues to go well, production in New Zealand would begin sometime between the winters of 1991 and 1994. It is anticipated that there will then be a dramatic increase in the number and size of truffières established. While it is expected that the bulk of the crop would be sold overseas, it is likely that high quality New Zealand restaurants would also be interested in extending their haute cuisine.

## LITERATURE CITED

1. Delmas, J. 1978. Tuber spp. In. *The Biology and Cultivation of Edible Mushrooms*. Chang, S. T and W. A. Hayes, eds. New York, Academic Press. 645-681.
2. Hall, I. R. and G. Brown 1989. *The Black Truffle* Wellington, New Zealand, Ministry of Agriculture and Fisheries. 73 p.