



ROBIN® TRUFFLE PLANT
Mycorrhiza with
Tuber magnatum Pico

Produced following the INRAE/ROBIN process
under license and quality control of INRAE



**Controlled Production
of White Truffle**

A world first !



Robin pépinières

Presentation



Robin Pépinières, Saint Laurent du Cros site (05500)

The ROBIN pépinières nurseries were founded by Max Robin in 1948 in Saint Laurent du Cros in the Hautes-Alpes department. Given the geographical location and local demand, Max ROBIN specialised first of all in the production of forest plants for mountain reforestation.



Very quickly he developed innovative solutions such as the first ROBIN ANTI-CHIGNON[®] pots to improve the performance of his plants.

Joined by his son Bruno in 1980, then by his two daughters Christine and Cécile, in 1988 the ROBIN family created a controlled mycorrhization laboratory in Saint Laurent du Cros, with the help of ANVAR (French national agency for the development of research).

In this state-of-the-art laboratory and thanks to qualified and competent personnel, ROBIN pépinières very quickly mastered all the stages of controlled mycorrhization. Additionally, they are equipped with production greenhouses and acclimatisation devices for the proper development of young mycorrhizal plants at Pépinières ROBIN's 2nd production site located in Valernes in the Alpes de Haute Provence department.



One of our ROBIN truffle oak production greenhouses on our Valernes farm (04200)



Bruno, Cécile and Christine Robin with part of the ROBIN pépinières team.

For more than thirty years, ROBIN pépinières have thus been producing mycorrhizal plants under controlled conditions with many fungi, and in particular:

- HIGH-PERFORMANCE CONTROLLED MYCORRHIZAL PLANTS®: the association of selected strains of fungi on the roots of young forest plants makes it possible to very significantly improve the recovery and growth performance at forest plantation sites. And particularly under difficult conditions: poor soil or drought.

- Plants for the production of edible mushrooms:
PLANT CHAMPIGNON® for the cultivation of *Lactaria* or *Boletus* within the framework of the VERGER À CHAMPIGNON® plantation.

- EXCELLENT TRUFFLE PLANTS with *Tuber melanosporum*, *Tuber aestivum* and *Tuber aestivum var uncinatum*, under multiple plant species.
These different truffle plants have been produced under license and quality control by INRAE since 1996.

Very early on, ROBIN pépinières naturally became interested in mycorrhization with *Tuber magnatum*, the most sought after and rarest.

This world first with the 1st controlled production of *Tuber magnatum* under truffle plants outside the natural geographical range of this truffle confirms the position of Pépinières ROBIN as a world leader in the field of controlled mycorrhization.



Plantation of ROBIN truffle plants which produced its first *Tuber magnatum* at the age of 4 years.

Tuber magnatum Pico

Controlled production of white truffle made by Pépinières ROBIN :

A world first !



Tuber magnatum Pico

Tuber magnatum Pico, known as Piedmont White Truffle or Italian White Truffle, is the rarest and most expensive truffle. It is harvested exclusively from the forests of a few European countries, but the supply often fails to meet the strong global demand for this fungus. From 1999, Pépinières Robin, in partnership with INRAE, began to work on mycorrhisation with *Tuber magnatum*. After 9 years of joint research between INRAE and Pépinières Robin, the first truffle plantations intended for its cultivation were created in France in 2008.

In a joint INRAE/Pépinières Robin research programme, five French plantations were studied. The first result was the discovery of the persistence in soil three to eight years after planting the white truffle for four plantations distributed in regions with different climates (Rhône-Alpes, Burgundy, Franche Comté and New Aquitaine). The main result of this work was the harvest in 2019 of three truffles and four in 2020 in the Nouvelle-Aquitaine plantation.

These truffles are thus the first to be harvested in a plantation outside the natural geographical range of this species.

The scientific results of this work were published on February 16 2021 in the scientific journal MYCORRHIZA, a paper entitled:

"First production of Italian white truffle (*Tuber magnatum* Pico) in an orchard outside its natural range **distribution in France**". The production of *T. magnatum* fruiting bodies in a plantation outside its natural distribution area is a world first, paving the way for the development of the cultivation of this truffle in France but also elsewhere in the world.



Claude Murat and Cyril Bach, INRAE Nancy, in front of a 4-year-old Robin truffle-bearing *Quercus pubescens* that produced its first *Tuber magnatum* at the age of 4.



Pierre Cammalletti, technical manager of the controlled mycorrhisation programme and Claire Cotton, laboratory technician located in Saint Laurent du Cros (05).

ROBIN® TRUFFLE PLANT

Mycorrhiza with *Tuber magnatum*

Produced according to the INRAE/ROBIN process
and under license from and control of INRAE

Control of mycorrhization by INRAE: All of the plants sold have been individually checked.



Since 2008,
ROBIN nurseries have been marketing trees in mycorrhizal association with *Tuber magnatum*
according to the INRAE/ROBIN process under license and quality control of INRAE.

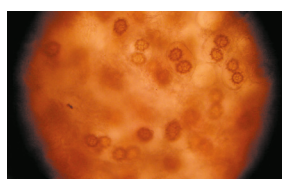
Each truffle used to inoculate our truffle plants is inspected under a microscope to check the characteristics of the spores, then by biomolecular analysis by INRAE.

All of the plants are individually checked before they are marketed.

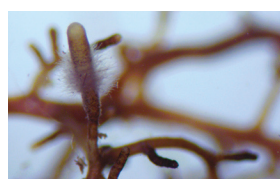
First under a binocular magnifier by the Pépinières ROBIN technicians who check for the presence of the white truffle on the root system by morphological characteristics.

Then by the INRAE experts who, after observation under a binocular magnifier, take a sample of mycorrhiza from each plant to check the DNA by biomolecular analysis. This double control provides **our customers with the guarantee** that the ROBIN® TRUFFLE PLANTS are indeed in mycorrhizal association with *Tuber magnatum*.

Identification of *Tuber magnatum* :



Tuber magnatum spores



Detail of Tuber magnatum mycorrhiza obtained using the INRAE/ROBIN process



One-year-old Robin Quercus pubescens truffle tree in mycorrhizal association with Tuber magnatum, cultivated in ROBIN ANTI-CHIGNON® R430cm3 pot



Robin Carpinus betulus truffle tree in mycorrhizal association with Tuber magnatum

Available Host Species:

Carpinus betulus
Quercus pubescens
Quercus pedunculata

Prices (valid for 2021):
Plants from 1 and 2 year old seedlings
Cultivated in ROBIN ANTI-CHIGNON® pots

Quantity	Unit price excl. VAT in € (10% VAT)
1 à 9	123.64
10 à 24	119.50
25 à 44	101.50
45 à 99	94.50
100/+	89.90



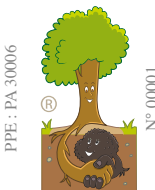
PLANT MYCORHIZÉ par *Tuber magnatum*

Sous contrôle et licence INRAE suivant le procédé INRAE-ROBIN



ROBIN
pépinières

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Label of a Robin truffle plant in mycorrhizal association with *Tuber magnatum*

Create a successful truffle orchard with *Tuber magnatum*

The choice of land is essential

Pedoclimatic conditions favourable to *Tuber magnatum* (Italian white truffle)

🌿 In its natural range, *Tuber magnatum* grows in variable climates, ranging from sub-continental to sub-Mediterranean, where the average annual rainfall is generally high (600 to 850, sometimes up to 1200 mm), with average monthly precipitation exceeding 40 mm. The most favourable micro-climates are characterised by the absence of a dry summer period.

The rains in July and August are very heavy. Daily or seasonal temperature variations are small.

T. magnatum thrives in dense vegetation where the soil is always shaded. These conditions promote constant soil moisture in all seasons, which is a determining factor. This biotope is relatively different from that where *T. melanosporum* is found.



Mr. Emidio Angellozzi in a natural *Tuber magnatum* harvesting are located in the Marche region (Italy).

Valley bottoms or slopes (low slopes, less than 50%) are the most favourable situations. The altitude must not exceed 800 metres, with an optimum below 400 m.

It is primarily the physical characteristics of soils that differentiate *T. magnatum* sites *T. melanosporum* sites.

Soils favourable to *Tuber magnatum* are poorly developed, rejuvenated by erosion. Their position at the bottom of the valley or on the slopes of the hills leads to geomorphological rejuvenation processes.

These soils are of the rendzina or calcareous brown type. They are generally deep, moderately permeable, poor in stones, rich in silt and clay (though they may be sandy).

Soil texture is variable: sandy, free sand, sand-silt, loamy, silt-clay, silt-clay free sand, free sand-clay, free silt, free silt-clay, rarely free clay, since the hydromorphy is detrimental.

Soils must be filtering, not asphyxiating, well-drained, therefore presenting a high porosity while allowing good humidity in all seasons. The soil in the area where the truffles grow must always be very porous, to ensure good air circulation in the soil and facilitate gas exchange between the soil and the atmosphere.

From a chemical point of view, the requirements of *T. magnatum* are similar to those of *T. melanosporum*.

Limestone is an essential element in the form of carbonates, though its content can vary considerably (10 to 70%). Generally speaking, total limestone is greater than 10% and active limestone 2%. The pH should ideally be between 7.5 and 8.5. Organic matter should not be overly abundant (C/N ratio of 13 to 18). Levels of macro-elements (nitrogen, phosphoric acid, potassium, magnesium) are identical to those of *T. melanosporum* soils. In short, the soil must be well-balanced, neither deficient nor too rich (possible deficiency in phosphoric acid and/or nitrogen).

In summary, the key points for choosing a suitable soil are as follows:

- no stones
- pH greater than 7 (presence of active limestone)
- good aeration (sufficient macro-porosity)
- good drainage
- constant presence of humidity (especially in summer) (e.g.: proximity to a stream)

🌿 In the truffle plantation made with ROBIN truffle plants

in mycorrhizal association with *Tuber magnatum*, which produced its first truffles after 4.5 years, the environmental conditions are a little different from those of the natural area of *Tuber magnatum*.

The plantation is located in a plain region.

The trees are spaced out, planting distance 4 m x 6 m.

Even though the soil remains cool throughout the year, there are no streams or springs that flow all year round and the plantation is equipped with a sprinkler system that helps maintain a regular supply of water.

The first productions took place on very young trees, 4.5 years after planting.

For pedoclimatic conditions: these correspond to those of the natural harvesting areas of *Tuber magnatum*.

🌿 Importance of soil analysis

When a plot is selected for a future truffle plantation with

Tuber magnatum, it is essential to perform a physicochemical soil analysis.

If you wish, we can arrange to have this analysis carried out by a partner laboratory specialising in truffle crop soil analyses.

🌿 Soil preparation

As with any truffle orchard, and in particular the truffle orchard which produced its first *Tuber magnatum* after 4.5 years, we recommend paying close attention to soil preparation before planting:

- Provide mechanical preparation if the plot is large enough, with full ploughing to 25 cm and harrowing.
- Prepare individual seed spots for smaller-scale plantings by working the soil to a depth of 30 cm and 1.50 to 2 m².

🌿 Planting distances

For *Tuber magnatum*, the recommended planting distances are identical to those for *Tuber melanosporum*: 4m x 6 or 5m x 5.

🌿 Plant protection and mulching

In order to optimise recovery and growth, we recommend protecting your ROBIN truffle plants with a 60 cm high climatic mesh sheath to protect against rodents, and the climatic sheath will also have a windbreak and shade effect for the plant.

Mulching is recommended. Its primary purpose is to maintain humidity at the base of the plants, which promotes the recovery of young plants, while allowing the development of soil micro-fauna: earthworms and insects which have an important role in the soil aeration. Mulching also prevents competing vegetation and thus avoids weeding chores during the first years. Mulching can be achieved by fitting a plastic film over the entire planting line for large-scale plantations of 100 plants or more, it must then be removed after 2 to 3 years.

For smaller plantations, individual 100% natural cork mulch tiles can be used.

Do not hesitate to contact us for any advice on providing these protections.

Our ROBIN truffle plants are guaranteed 80% recovery, and when protected by a climatic sheath and cork or plastic mulch, the guarantee is increased to 100%.



Plantation of ROBIN truffle plants which produced its first truffles after 4 years, Planting distance 4 m x 6 m, the soil is tilled every year in March.

🌿 Plantation maintenance

Tillage is necessary to obtain a quality plantation and early production. Tillage must start at the foot of the trees from the 1st year of planting, over 1 to 2 m² and to a depth of 15 to 20 cm, if mulching has not been applied, and from the 3rd or 4th year after removing the mulch. Tillage ensures:

- favourable water conditions,
- provision of organic matter favouring an intense biological activity of the soil,
- soil aeration.

Moreover, tilling the soil with a sharp-toothed tool also has a very important effect on the root system.

By tilling the soil, we also prune the roots, and this pruning serves to stimulate the growth and development of the root system and thus maintains the development of mycorrhizae which mainly develop on juvenile roots.

Ideally, you should till the soil manually with a hoe or a mattock. For a plantation over a large area, mechanical tillage will be carried out, with a subsoiler, a vibration tiller or a harrow to a depth of at least 15 to 25 cm depending on the depth of the soil.

Tillage should be performed once a year, in early spring at the end of March or beginning of April.

🌿 Irrigation

As with any *Tuber magnatum* truffle orchard, watering is essential the first two years to ensure the recovery of the plants.

We recommend a sprinkler watering system, or better by micro-sprinkling or even manual watering with a hose fitted with a sprinkler bulb.

NB: we strongly advise against drip irrigation, which has a harmful effect on the proper development of the root system of the truffle plant.

Watering should provide at least 10 litres of water per plant; it should be carried out immediately after planting and renewed every 3 weeks if there is no rain.

- Between the 2nd and the 5th year, watering is only necessary in the event of drought, and the frequency will be adapted both to the climatic conditions and to the nature of the soil (more or less filtering).

- From the 5th year, the purpose of irrigation will be to satisfy the water needs of the truffles. It must always be adapted to each type of soil and to the rainfall.

🌿 Pruning

Pruning is required primarily to stimulate the root system in addition to tillage, which allows roots to be cut to stimulate root growth, thus promoting and stimulating the growth of mycorrhizae that develop on juvenile roots.

Pruning should be gentle. It consists, from the first year following planting, in cutting off the main stem and the main ramifications, and renewing this operation each year just before tillage.

🌿 Re-inoculation

The ascospores present in truffles seem to have an important role in the cycle of sexual reproduction of truffles.

As for other truffles, addition of ascospores or reseedling of truffles with *Tuber magnatum* may also be recommended in order to promote production.

Even more than for other species however, only high-quality inocula, produced truffles that have been morphologically inspected and DNA tested, should be used.

These may be performed either directly around the tree, located in trenches or even in the form of truffle traps.

We can offer you an inoculum produced from controlled truffles to re-inoculate your truffle field.



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