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248. Vegetative propagation of *Quercus robur*. Carter, N. International Plant Propagators' Society, combined proceedings 2011, 61:89-94. 2012.

Vegetative Propagation of *Quercus robur*©[1]

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BACKGROUND

In Australia since the mid 1990s there has been a rapidly developing French black truffle growing industry. Truffles are the fruiting body of a mycorrhizal fungus that lives in a symbiotic relationship with the roots of oak trees (*Quercus*).

About the Propagator. Nathan Carter is the director of Trufficulture Pty Ltd. Trufficulture is a family business operating in Gembrook, Victoria. The primary business for the company is propagating oak seedlings and inoculating these with the French black truffle. Infection usually takes 12 to 18 months and after this the trees are ready for planting out.

Truffle Industry Issues. Many truffieres (truffle farms) are experiencing low and variable yields of truffles. According to a Rural Industries Research and Development Corporation (RIRDC) report titled "Taking Stock of the Australian Truffle Industry" (2008) only a small percentage of trees in truffières have yielded truffles to date. There is much conjecture and theories surrounding the reasons for this. One school of thought is that all *Quercus* trees are propagated by seed and therefore quite a lot of seed variability is seen in tree shapes and sizes. If *Quercus* could be vegetatively propagated this removes the factor of genetic variability. The industry may benefit from *Quercus* being vegetatively cloned from truffle-producing trees. However, *Quercus* are particularly difficult to propagate by conventional cuttings. Also micropropagation techniques have not been successfully developed. See the following link to "Taking Stock of the Australian Truffle Industry" <https://rirdc.infoservices.com.au/items/08-124>.

Aim of This Study and Trial Work. To develop and evaluate a method for vegetatively propagating *Q. robur*.

RESEARCH

In *Quercus* the production of naturally occurring plant hormones (auxins) may be suppressed. This may result in the plants inability to produce roots on cuttings.

Previous methods of propagating *Quercus* have been described using a method known as "etiolation." The following link was used as background information for this research <www.hort.cornell.edu/uhi/research/articles/IntPlantProp(57).pdf>.

This process involves growing plants under reduced light. The shoots grow with little/no production of chlorophyll and are therefore blanched and elongated. Light is then gradually increased and chlorophyll develops and the cutting becomes green. In theory rooted cuttings are produced.

TRIAL

The trial was conducted at Blue Frog Truffle Farm in Sutton, New South Wales, in September 2010 through to January 2011. The proprietor of Blue Frog, Wayne Haslam, is the immediate Past President of the Australian Truffle Growers Association. Wayne provided a 7-year-old *Q. robur* (English oak) for the trial work. The

[1]Editor's Note: This paper was selected by the Australian Region as the Rod Tallis Memorial Youth Award.

tree has produced truffles but was damaged and consequently was growing at an obtuse angle and was in need of major tree surgery.

The trial needed to be conducted in the field where the tree was growing. Therefore without the support of greenhouse facilities (no controlled environment conditions), a field process and equipment needed to be devised.

METHOD

1) The *Q. robur* was coppiced (cut down to ground level) in June 2010. Several new buds developed at the base of the stump.
2) In August 2010 the stump was covered with a 250-L drum. The drum was prepared by cutting off the lid on one end and cutting a 25 × 25-cm square flap in the other end. The flap was closed off allowing only a 3-mm diameter gap for light to enter (Figs. 1 and 2).
3) A shade cover was fitted over the drum to provide protection from sun. Also the drum was secured with three stakes and wire mesh to prevent blowing over in the wind. The developing shoots became blanched and elongated in the presence of 99% darkness (Figs. 3 and 4).
4) Preparation of the cuttings:
   - When the shoots reached an average height of 200 mm the drum was removed to allow the fitting of a pot and propagating medium. (Fig. 5)
   - Next the base of the shoots was painted with IBA root promoting hormone (3,000 ppm gel).
   - A 200-mm plastic pot with the base cut off was placed over the shoots.
   - Propagation medium consisting of perlite, sharp sand, and peat moss (2 : 5 : 3, by vol.) was moistened and placed in the pot around the base of the shoots. The medium was watered in.
   - Then the 250-L drum was reinstated with shade cover and secured with wire mesh and stakes. (Figs. 6 and 7)

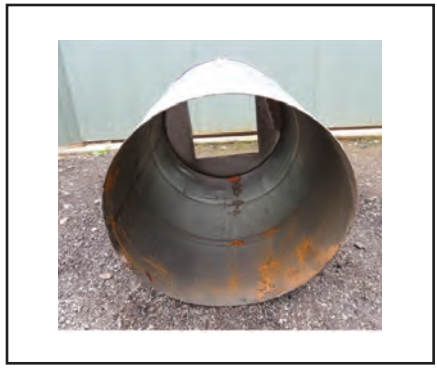
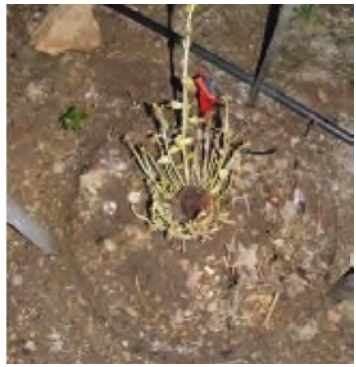
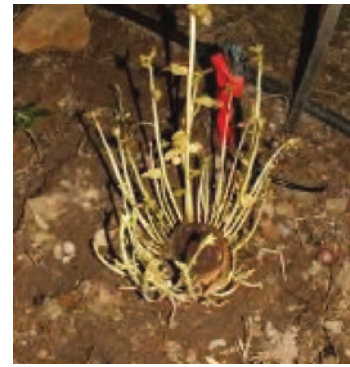


Figure 1. The 250-L drum with the base cut out.

Figure 2. The flap cut from the top of the drum to adjust the amount of light entered.

Figures 3 and 4. Etiolated shoots (blanched) after 4 weeks of darkness under the drum. The photos were taken at night so as to not allow sunlight to reverse the process.

Figure 5. The pot (base removed) with propagation media around the shoots.

- The hole on top of the drum was adjusted to 3-mm diameter. Each day the opening was increased slightly to allow more light to enter over the next two weeks, until fully opened.
- Once a week the drum was removed to allow the propagating media to be rewatered.

5) In January 2011 the pot and media were removed to allow the cuttings to be inspected for root development. There was good evidence of root tip development and some cuttings were removed from the mother plant with secateurs and placed in water to remain hydrated (Figs. 8, 9, 10, 11, 12, 13, and 14). These cutting were potted into 75-mm tree tubes and moved to a greenhouse for root development and further growing on.


Figures 6 and 7. With the drum removed the shoots have returned to healthy photosynthesis and are protected by wire mesh against animals. Also a shade cover was used for sun protection on the soft shoots.

RESULTS AND CONCLUSION

The trial resulted in the successful propagation of *Quercus* cuttings (Figs. 15 and 16). These will later be inoculated with the French black truffle. It is possible that from one mother tree about 20 cuttings could be produced per annum.

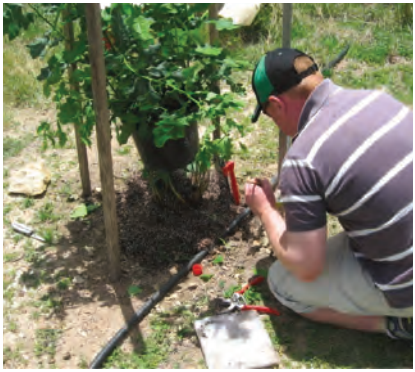
Whilst the numbers are small and would be commercially unviable, this will allow genetically identical material to be developed for further trial work.

An improvement on this method to be included in future trials is the use of banding the base of the shoots. As the diameter of the stem increases the cambium layer (phloem) is restricted and hormone is accumulated and prevented from entering the mother plant. This will result in an independent cutting with a stronger root system.

Also in future these cuttings can be pot grown and propagated more conveniently in a greenhouse using the etiolation method.

LITERATURE CITED

Haslam, W. Australian Truffle Growers Association. <http://www.trufflegrowers.com.au/>.

Figures 8 and 9. The pot raised and the developing roots exposed.


Figures 10 and 11. Nathan reapplying the IBA gel hormone by painting the base of the shoots.


Figures 12 and 13. The developing roots on the shoots.

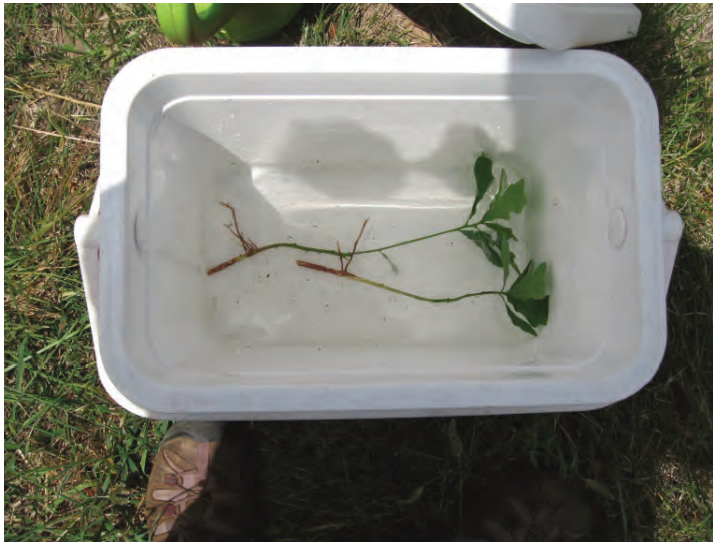


Figure 14. Two rooted cuttings removed from the parent plant.

Figure 15. One of the cuttings with healthy roots after growing on for 8 weeks.

Figure 16. Nathan Carter in the greenhouse at Trufficulture, with one of his prized clones.