

Oak Seedling Propagation in Plug Containers

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I have had a long-term interest in the development of techniques for propagating plantation tree species in containers. A factor commonly mentioned as a reason why shallow containers are unsuitable for tree seedling propagation is that tree seedlings produce a long tap root shortly after germination. Pruning this tap root is commonly considered to be detrimental to the plant.

As is obvious from the many millions of containerised plantation tree species propagated in shallow containers every year, pruning the tap root of these species has no obvious detrimental effect on either the root system or the overall health of the plants. However, oaks and other species with similar nut-type seeds are commonly considered difficult to propagate or totally unsuited to container propagation.

Fresh acorns of English and Turkey oaks (*Quercus robur* and *Q. cerris*) were collected and sown immediately into a peat substrate in Lannen Plantek 64F cell containers with side slots for air root-pruning. The cells of these containers are 46 mm × 46 mm × 73 mm. The acorns were placed flat, diagonally across the top of the cells. Seeds were deliberately not pregerminated because of potential root defects caused by this practice (Whitcomb, 1988). Normal air root-pruning at the base of the cells was achieved by suspending the trays on a metal bench to allow free air movement below the cells. Water was applied as required.

Six months from sowing, the seedlings were healthy and thriving. Inspection of the base of the cells showed some of the roots had curled slightly around the cross piece at the bottom of the cell. All pruned roots had a thickened callus at the pruned end. The seedlings were not easily extracted without disrupting the root plug as the roots had not yet fully colonised the plug volume. Exposing the roots showed that lateral roots had begun branching from the primary root and no root defects were noted. The very thick radicle emerging from the acorn had been successfully air-pruned.

Nine months after sowing, the seedlings were easily extracted from the cells without disrupting the root plugs (Fig. 1). Exposing the roots showed a nicely consolidated root plug made up of many lateral roots, both primary and higher order, with no apparent distortion of the root system. The callus at the pruned tip of the radicle had disappeared, or was easily rubbed off.



Figure 1. Oak plug seedling showing excellent root plug consolidation for ease of planting and handling.

Some seedlings were plugged out into larger containers where they continued to grow the following spring, showing no adverse effects of their early germination treatment. Investigation of these roots after a further summer's growth showed no root distortion and good lateral root extension from the root plug at all levels.

This experience demonstrated to me that oaks could be easily propagated in a plug tray. There are a number of distinct benefits to germinating oaks under controlled nursery conditions in plug containers (Krautman, 1995). The plug method is more likely to be used as an early stage of propagation rather than for producing field-ready plants. Research conducted elsewhere tends to emphasise the need for large-sized transplants of oak species for survival and early field growth (Zaczek et al., 1995; Burgess et al., 1996).

Why does this form of root-pruning work? Possibly it is because of a physiological change induced in the root tip before the air-pruning occurs. Physical pruning would not allow any physiological conditioning of the root system prior to pruning. The development of a carrot-shaped tap root with essentially no laterals appears to be linked to physical removal of the tap-root apex close to the cotyledons. I have seen this occurring in many species, including various *Pinus* and *Eucalyptus* species after pricking out.

The key to successful oak plug propagation appears to be to sow only fresh seed, ensure early pruning of the tap root by gentle means, and continue this root pruning for a few months after germination to ensure formation of a fibrous root plug consisting of a tap root and many laterals. Gentle pruning of roots means a gradual process, not the sudden removal of large parts of the root system. Fertilisation during this plug phase of growth is not necessary as the seed reserves are adequate for normal shoot growth.

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