

SOME EUROPEAN TECHNIQUES FOR LAYERING WOODY PLANTS

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The practice of layering ornamental woody plants is a standard technique for vegetative propagation. It was a primary method on nurseries during the early development years of the European nursery industry in the 19th and 20th centuries. Despite recent innovations in equipment and facilities for today's modern nursery, layering still serves as an important method of propagation for some specific situations. The objective of this short paper is to outline some aspects of the different techniques used.

Layering can be defined as a method to clonally regenerate plants by allowing the development of adventitious roots while the stems are still attached to the parent plant. The shoots are then severed from the parent plant when sufficient roots have formed for successful establishment following containerization or planting in the open ground. There are two physiological principles to encourage root initiation and development on the stem. The first principle is the restriction of carbohydrates and natural auxins within a constricted area of the stem, the constriction being induced by bending, twisting, or cutting. The second principle is the increasing of the number of parenchyma cells and reduction of the amount of cell wall deposits in an area of the stem that has been blanched by excluding light. This assists in the initiation and development of roots.

Traditionally, layering was used for many woody ornamentals, e.g., *Magnolia*, *Hamamelis*, *Acer*, and *Rhododendron*, while today it is used primarily for rootstocks, e.g., M.M. 111 and *Prunus* F12/1. Layering is a long term investment in land, labor, and plant material, and therefore there are a number of important criteria that any nursery should consider before contemplating a layering enterprise. In the end, it comes down to economics based on whether it is more efficient to use layering for individual species compared to alternative methods. In the majority of cases, alternative methods are now selected.

Stooling (mound layering) is the technique most widely used today—in particular for tree rootstocks. In the past, it was an effective method for *Chaenomeles japonica* cvs., *Daphne cneorum*, *Prunus glandulosa* cvs. and *Pterocarya fraxinifolia*. It is by this technique that innovations by creative nurseries and researchers have dramatically increased yields and productivity. Soil fumigation and the availability of virus-tested material are two reasons

why yields have increased, while improved mechanization practices have dramatically increased efficiency. For example, instead of the traditional shovel for mounding soil, custom-made machines have been constructed which combine the effect of a land-driven rolling-tined cultivator with that of compressed air from an air blast spray. The soil is moved into and around the bases of the shoots by having the cultivator at different settings while the compressed air keeps the shoots vertical. Similarly, the productivity in harvesting layers has been significantly improved by severing the rooted stems below soil level with a tractor-mounted power-driven saw blade controlled by a hydraulic depth control.

A more recent modification to the usual stooling method follows a North American practice by adapting a standard procedure used successfully in the formative years of an etiolation layer bed. The mother rootstock is planted at a 30 to 45° angle and a custom-made hand tool is used to lace twine, held in position with hop clips, over the main stem during the summer of planting or the next spring. This method is used instead of the customary pegs and wire to retain the stem in the shallow trench. The normal procedures for mounding up the soil are implemented in subsequent years. Experience has demonstrated that heavier yields are produced during the early years of the stool bed—for example, one specialist nursery in England achieved an 80% improvement in yield of rooted stems in the third year compared to the traditional planting and establishment procedure.

Etiolation and trench layering have been used on *Morus* and *Juglans*, but were the standard technique for producing *Prunus avium* Mazzard F12/1 rootstocks. One major problem that has led to the lowering of quality and yield of some *Prunus avium* Mazzard F12/1 layer beds is the build-up of soil-borne diseases—particularly specific cherry replant disease (*Thielaviopsis basicola*) and crown gall (*Agrobacterium tumefaciens*). These disease problems, plus the introduction from East Malling Research Station of the popular *Prunus* 'Colt,' normally propagated by hardwood cuttings, has significantly reduced the acreage of etiolation layer beds in Britain.

The standard procedures for simple layering and continuous (French) layering have changed very little over the years. However, they still serve as a very important method for some European nurseries and recently I saw layer beds being established on some *Acer* and *Tilia* species in England. Even with today's modern propagation facilities there are situations whereby simple layering of *Acer*, *Corylus*, *Magnolia*, *Platanus*, *Rhododendron*, and *Syringa* can still be economical for some nurseries. The major problem is the inability to mechanize the production, resulting in a considerable amount of hand labor. The techniques of serpentine, drop, and air layering are now rarely used commercially. (A series of slides was shown to demonstrate the traditional procedures used in Britain,

Holland, Belgium, and France).

Looking to the future, layering of ornamental woody plants is likely to decrease further as technology develops. The major limiting factor is the area and cost of land required. However, stooling for rootstocks will remain a standard propagation method. Further innovations in machines, fumigation, pesticides, and overall plant health will produce even greater improvement in quality and yields. Layering procedures are part of a wonderful history in the European nursery industry, but there are specific circumstances, even with today's changing technology, where layering will still have its virtues for many decades to come.

REFERENCES AND SUGGESTED SOURCES FOR FURTHER READING

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AVOCADO CLONAL ROOTSTOCK PROPAGATION

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BACKGROUND

Until 10 years ago, nearly all orchard-bound avocado trees raised in California were on seedling rootstocks. Clones were used only for fruiting scions such as Hass, Fuerte, and Bacon. Since 1977, however, some half million trees have been planted on clonal rootstocks. It's my guess that avocado tree production today is split about fifty-fifty between seedling and clonal rootstocks. How has this come about?

The stimulus for the newer commercial technologies came from Dr. George Zentmyer who was working toward the solution of a serious disease, avocado root rot, which first came to avocado growers' attention during the late 1940's. During the 1950's it occurred to industry leaders that this disease, caused by *Phytophthora cinnamomi* (Pc), was a serious threat to the entire avocado industry. Zentmyer, in a search for tolerant rootstocks,