PRODUCTION OF SCIONWOOD AND ITS USE IN SPECIALIZED BUDDING AND GRAFTING

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The production of scionwood for all purposes of budding and grafting on our specialist tree nursery has made specific stock tree management necessary to service not only our own nursery but to provide sales of scionwood to others. We are at present producing 250,000 trees per year and a similar number of buds for sale. Graftwood production, although not in such large numbers, also supports a wide range of grafting techniques.

The main reasons for taking on this large production approach to budwood and graftwood came about for the following reasons:

EMLA virus-free programme in fruit trees. The first introductions of virus-free fruit material were made in 1969 by East Malling and Long Ashton Research Stations. This required the establishment of isolated scion blocks under the scrutiny of the Ministry of Agriculture and the Plant Health Propagation Scheme.

Increase in demand. It was soon recognized that managed stock trees were very productive and increased the availability of quality material and gave more efficient collection at peak propagation periods.

Application to ornamental trees. The principles of high health and efficient production have been applied across the range of all fruit and ornamental trees produced by budding and grafting.

STOCK TREE SYSTEMS

Stock tree systems have developed from wide spacings with standard pruning to more intensive plantings with variable training and pruning techniques to suit individual cultivars.

Planning. Assessing numbers that will be needed in the future is a difficult exercise. If you estimate present production and demand for scionwood and double this quantity this would be a good starting point. It is also necessary to estimate the variable numbers of propagating wood from different species and particularly cultivars within a species that can vary so much in the productive wood they produce. Trees produced mainly from grafting, requiring greater numbers, should be calculated accordingly.

Density. This is linked directly to likely age of replacement and to make good use of production area. Single row and bed systems have both been used to meet this criteria. Single row plantings have come down to 4 metre by 1.3 metre spacing for intensive

management and variation in bed systems with overall herbicides and grass strip alley-ways as an alternative.

Rootstocks. All fruit mother trees are produced on vigorous rootstocks for maximum growth and anchorage. Clonal rootstocks are ideal for uniformity, but seedling rootstocks can be used where these fail to produce the necessary growth. This also applies to ornamentals where clonal rootstocks are not available. It has to be remembered that seedling rootstocks are generally virus-free, which does not threaten the virus-free status of many cultivars. *Pyrus communis* for pear, is a good example where fruiting and ornamental stock trees have superior vigour and hardiness compared with normal quince rootstocks.

Early establishment. There is often an inevitable time lapse between the instant need for propagating wood and the actual delay caused by establishment time and build up of stock, and this is particularly so in the case of new cultivars. There are two ways in which stock trees can be established quickly:

Establishing *in situ* rootstocks, planted at final spacings on an on-going basis, allows for quick response to demand because it avoids the growth check caused by planting-out of stock trees. Multiple budding or spring grafting are both used in this instance. Extra close plantings with later thinning can also help to increase production in the early years.

Alternatively, on the basis that one has twice as much stock available than is needed at any one time, there should be a number of stock trees available for topwork grafting. Simple rind or stub grafting can produce quick results with little work. There is a danger of allowing suckers to grow undetected in the tree canopy.

Pruning and tree training. Hard pruning is necessary on all stock trees to produce the vigour for good quality scionwood. This can vary, but removal of most of the previous season's growth is generally needed. In instances where vigour is too strong, tying down of some branches can help to spread this excess growth creating a larger productive surface area. Discouraging apical dominance is important in over-vigorous stock trees to produce uniform growth. Early season tipping of very feathering cultivars can help to create useable shoots when none would otherwise be possible. The height at which the cropping area is created should have some bearing on the ease of collection and pruning.

Trueness-to-type. The establishment of stock trees from which propagation material is taken year after year is a secure way of ensuring the proliferation of the right cultivars, provided correct labelling and care is taken when collecting wood. There are, however, circumstances in fruit production that require the monitoring of fruit colour to ensure trueness-to-type. Off-types can occur in unstable cultivars so fruiting branches are encouraged to allow

inspection of fruit. Reversion in some ornamentals, particularly variegated types, needs to be watched carefully.

Disease. Annual heavy pruning can cause some species to be susceptible to bacterial diseases, such as silver leaf, bacterial canker, and coral spot. This is particularly so of *Prunus, Acer, Robinia,* and *Betula*. Once a tree is infected with any of these diseases it should be removed. Some types of stock trees can only last five or six years and need to be replaced on a regular basis.

There are certain circumstances where it would be advisable to take scionwood from young production trees.

Stock trees under protection. There are many circumstances where forced or protected growth improves propagation material for budding and grafting. This has always been so of most softwood cuttings but is perhaps not so recognised with hardwood material. There are several advantages in this approach:

The first is improved vigour. Various slow growing species, such as *Acer pseudoplatanus* 'Brilliantissimum', that are naturally dwarf can be forced and elongated to provide better propagation wood.

The second is freedom from disease. Peaches are a good example of a subject that grows well under glass to providing early and ripe budwood free from leaf curl disease.

Thirdly, timing is easier. Many of the more difficult species, such as *Acer* and *Betula,* require precise budding timing to match ripe budwood with exact growth stages of rootstocks. By producing early ripening of wood under cover one is then in a position to bud at the precise time.

Coldstorage. Cold storage of budwood allows flexibility when budding. De-leafing should be immediate but storage of prepared wood at approximately 5 °C is possible up to 10 days.

Cold storage of graftwood is vital to enable late spring use. Although 0 °C is ideal it is possible to freeze graftwood provided moisture levels are maintained by either wrapping in polythene or using a jacket coldstore.

SPECIALIZED BUDDING AND GRAFTING

It is not planned to go into exact details of budding and grafting techniques as these are well catalogued. We will only deal with various ideas and possibilities in light of the previously described management of stock trees, cold storage, and recent trials in relation to timing of budding and grafting.

Budding. Although chip budding is used for nearly all subjects it is worth noting certain observations. Chip budding allows and encourages the use of larger diameter wood to enable a good cambium match. Thin budwood and large diameter rootstocks often means reverting to T-budding with some species, e.g. *Malus, Pyrus,*

Prunus. Inverted T-budding can still be advantageous for some subjects such as *Aesculus* and should be tried where chip budding is not fully satisfactory. Removal of wood from the back of the bud eye can help where the bud is too large for the rootstock. Where buds are particularly proud and delicate and liable to damage then the stick budding technique is often the best method.

Multiple budding. This can be extremely useful in many circumstances. *In situ* virus-free mother trees are double-budded to produce twin maidens for maximum early canopy development.

Interstems. These are mostly raised by double-budding or grafting over one or two years. Originally, interstems were used to alleviate incompatibility between scion and rootstock. For fruit growers interstems are now used for other reasons:

- Using a strong base root system with a dwarf interstem piece for a free standing dwarf tree.
- To induce better cropping in main crop cultivars by using a prolific cropping cultivar, such as 'Golden Delicious.'
- To induce hardiness or resistance to disease.

Spring chip budding. Although resulting growth is inferior to previous year's budding, spring chipping can be useful in certain circumstances where there is a shortage of propagation material. This can be done on established rootstocks in the field, in pots, or even on bareroot rootstocks for raising under glass. Timing is critical to coincide with early sap rise.

With all forms of budding, polythene tape tied over or around the eye, depending on proudness, is used to allow precise tie removal.

Field grafting. Field grafting (whip and tongue) as a back-up to poor bud take is used throughout the nursery provided a high percentage of first grade trees can be produced. Complete immersion in wax of the scion can improve take and eventual growth.

Bench grafting. Bench grafting is only used on difficult subjects and where other propagation methods of the same time scale are inferior. These are produced as container whips to complement the field-grown tree. The plentiful resources of rootstocks and graftwood in coldstore up until the beginning of April gives excellent opportunities to respond to demand for the following autumn. The use of large diameter rootstocks and scions is important to promote maximum growth. The ability to produce a saleable tree inside six months can be very advantageous.

Hot pipe callusing. We have only used this technique for three years but it is well described in previous IPPS articles on subjects such as filberts and walnuts. Although this is an expensive operation the main advantages are to make difficult subjects easier to graft and to produce a superior tree by extending the growing season. Pre-callusing of the graft union during the winter months sets up the tree for the difficult spring period and from a management approach it

is possible to spread the heavy spring workload over a wider period. The subjects we have concentrated on are *Acer, Betula,* and *Fagus.* The main principles are as follows:

1) A period of three weeks at approximately 30 °C appears to be the optimum treatment.

2) The heat should only be applied to the graft union.

3) Any graft method can be hot-callused.

4) Potted or bareroot rootstocks can be used depending on the difficulty of the subject.

5) Cables or hot water can be used, although hot water is preferred as it is a more even temperature.

6) It is vital to seal the heat in around the union to provide an even and economic temperature.

7) It is important to graft species that run sap easily, e.g. *Acer* and *Betula* at peak of dormancy, and make sure that the rootstocks have been dried off well.

8) Other subjects can be callused up until early spring provided graft and rootstock are kept dormant outside the heated union. Some form of cold storage to control air temperature would be helpful for late hot pipe callusing.

Materials. It is well established that overall waxing of the graft is essential for good results in any form of bench grafting. Dipping paraffin wax is used mostly, but it is brittle (although it is the cheapest and easiest of waxes to use). Like many other nurseries we have developed our own wax which is low-melting, soft, and flexible, so that subsequent handling does not cause cracking and flaking. A thermostatically-controlled wax heater has been produced to provide instant liquid wax throughout the grafting season.

Tapes of numerous types can be used and a soft wax allows for the use of more flexible tying materials that will not cut into the graft union. Rubber is still the best material and the degradable budding rubber ties, used single thickness, are very suitable.