time of planting, particularly with *Fagus* and *Quercus*, which are very long-lived trees.

PESTS AND DISEASES

Aphids are the major pest which can attack and damage young growth, and these should be controlled as soon as they are seen. Routine fungicidal sprays can be given, especially one which prevents mildew on *Quercus*.

SOME COMPATIBLE ROOTSTOCK/SCION COMBINATIONS

Stock	Scion
Alnus glutinosa	*Alnus glutinosa* 'Imperialis'
A. incana	*A. incana* 'Aurea'
Betula pendula	*Betula pendula* 'Dalecarlica'
	B. jacquemontii
	B. ermanii
Fagus sylvatica	*Fagus sylvatica* 'Riversii'
	F. sylvatica 'Rohanii'
Quercus cerris	*Quercus castaneifolia* 'Green Spire'
Q. robur	*Q. frainetto*
Q. rubra	*Q. rubra* 'Aurea'

All birches are compatible on *Betula pendula*. With oaks one must graft within one section, e.g. *Q. cerris* section type onto *Q. cerris*. All the *Alnus* appear to be compatible, but as stocks are readily available it is best to work on the same species.

S. FRASER: Why is it necessary to graft *Betula nigra* — in America they are grown from cuttings?

C. LANE: No nurserymen in the U.K. are successful in rooting cuttings or, if some do root, the root systems are poor. It is essential to have a good root system on trees.

B. HUMPHREY: They, perhaps, have better rooting clones in the U.S.A. I have seen clones there which root from two-year-old wood.

BENCH GRAFTING ORNAMENTALS AND FRUITS

PAUL BRADLEY

Swallownest Nurseries, Sheffield

The aim of our bench grafting is the production of pot-grown whips for growing on into small sized, container-grown trees suitable for Garden Centre sales. We only grow the more

popular kinds of ornamentals and a range of fruit species.

Established potted stocks are used for *Acer*, *Fagus*, and *Betula* cultivars.

Bare-root stocks are used for all the fruits, i.e. apples, pears, plums, damsons, cherries, and peach. Of the ornamentals, *Syringa*, cherries, *Malus*, *Prunus cerasifera* 'Atropurpurea' (Syn.: 'Pissardii'), *Crataegus*, *Laburnum*, *Pyrus salicifolia*, *Sorbus*, and *Robinia* are also grafted bare-root.

We do not find it convenient to grow our own stocks, so these are bought from a reliable source during the autumn. The potted stocks are put straight into a tunnel or glasshouse.

It is vital that the bare-root stocks are the best quality, freshly lifted, transplants available — preferably 7 to 12 mm. Undercut seedlings and one-year layers are not good enough.

When the bare-root stocks are delivered they are immediately trimmed, both stem and roots, to facilitate easier potting later on. The stems are shortened to about 12 in. The trimmed stocks are then plunged into crates of moist to dry peat. We use the Continental type plastic crate which is approximately 9 in. deep and 15 in. × 2 ft., into which we get approximately 250 stock plants. The crates are then put into a frost-proof building, not necessarily a glasshouse. This is to make sure that they will not be frozen when needed for working in the first week of January. All preparation is completed before Christmas.

Grafting commences the first week in January. The early growing species, such as double lilacs on *Syringa tomentella*, or *Prunus cerasifera* 'Atropurpurea' on Myrobolan B, are grafted first, ending with *Robinia pseudoacacia* 'Frisia'. I aim to complete all bare-root grafting before the end of January. I find that stocks worked in January produce a larger tree by the end of the growing season and take better than stocks worked in February. It is also a useful job to do during the bad weather of January. This year the temperature was approximately −15°F and all other nursery operations were at a standstill.

The splice graft is used for all the bare-root stocks, this being the quickest and most simple type. The ornamentals are worked as low down the stock as possible, or even the root itself.

The scionwood is usually the prunings taken from the previous year's growth, which is cut and used immediately. The scion has three buds. Virus-free material is used wherever possible.

The grafts are tied-in with Rapidex rubber strips without any sealing. I find that polythene tape also gives excellent

results, but needs removing by unwinding rather than slitting up the back with a knife. This job usually must be done in early June when we are very busy with other work and is very time consuming. However I still use polythene tape for *Robinia* 'Frisia'.

The completed grafts are re-plunged into crates of moist dry peat. This time they are placed almost horizontally with the union and scion completely buried. This keeps the union and the scion moist and seems to aid callusing.

The next important step is slow callusing. The crates of completed grafts are placed in a cool, shaded building. It does not have to be a glasshouse; a temperature of about 34 to 40°F is ideal, although no heat is used to control the temperature.

The timing of potting is very important. The stocks worked in early January are usually ready for potting in early February. I find the ideal time to start potting is when the leaf bud scales begin to show signs of swelling and expanding. If potting is delayed and long white roots develop on the stocks then losses will be heavy. It is better to pot early when the buds are dormant rather than wait too long. Our potting of grafts is a continuous process at this time, the early grafts being potted first. But even grafts that were worked perhaps a week earlier are also potted at this time as growth is much more active.

The ornamentals are potted into 8 in. (6 litre) poly bags, potted deep to disguise the graft on the final finished tree. Fruit trees on dwarf stocks are potted into 4 litre poly bags. These are worked higher to preserve the influence of the stock. *Robinia* 'Frisia' is potted into rigid 4 litre pots. They have a naturally poor root system, but we find it is improved in a rigid pot, which also improves the presentation of the tree and usually makes quite an acceptable saleable one-year plant.

The potting compost is the conventional peat/sand mix with full strength Osmocote added.

The potted grafts are then placed in an unheated polythene tunnel which is shaded with 10 ft. wide strips of black polythene on the outside, zebra fashion. This is another critical stage in the process. It is most important to keep the air temperature low until plants are well established to assist the slow callusing and to prevent premature bud development which will lead to failures.

The next phase, which is the growing-on, will determine the profitability of the crop. It is one thing counting the take at the 6 in high stage, and another counting the number of first class trees at the end of the growing season.

During spring the grafts are watered as required taking care not to over water until growth is well established. Suckers are removed promptly. When growth is 10 to 12 in high an application of Temik 10G at the recommended rate, is applied with a hand applicator. We find this gives us complete freedom from aphids and red spider for the whole of the growing season and no further insecticidal spraying is necessary.

In early June the trees are caned with 5 or 6 ft canes and spaced as required. When growth reaches the top of the cane it is stopped to encourage branching. I find that by letting the leader run on 6 to 9 in extra, then pruning back rather than pinching, this removes the apical dominance and produces better branching. This is most noticeable with plums and damsons.

The pot-grown stocks are grafted after all the bare-rooted stocks are finished. We put them onto an unheated glasshouse bench and wait for the natural activity of the sap. A veneer graft is used on these. Scionwood is collected and cool-stored until required.

If all the cultural procedures have been carried out as soon as necessary and the trees have not been under stress for any reason, then a large number can be selected for Garden Centre sale at competitive prices.

In conclusion, we are satisfied that our method of grafting bare-root stocks is a viable proposition and gives an economical one-year tree.

If we did not use this method it would mean our buying-in field-grown stock.

COSTINGS

Average cost of bare-root stocks		20p	
Preparation of stocks		3p	
Cost of grafting, 400 per day at £5. pr. hr.		10p	
Cost of compost, 3p per litre in 6 litre bag		18p	
Cost of potting and putting down		3p	
Cost of plant pot		6p	
	total	60p	(assuming 100% take; If 80% take this becomes 72p)
Growing on		12p	
Cost of 6 ft. cane tying and spacing		12p	
Insecticide, watering, and weeding		9p	
	total	93p	

Allowing for unforeseen costs, the total cost is about 1 pound

Having looked in a few English and Dutch catalogues, the current cost to buy in 6 to 8 ft whips is about £2.00, plus carriage. In other words, one can grow their own for approximately half that of buying in.

N. CLAYTON: Do you use wax when you bind with rubber ties?

P. BRADLEY: No, we just bury grafts in peat.

BENCH GRAFTING METHODS AT CROWDER'S NURSERIES

RONALD THURLOW

W. Crowder and Sons Ltd.
Thimbleby Nurseries, Horncastle

GRAFTING FACILITIES

We have four grafting benches, each 45 ft long and 6 ft wide and having 9 in high wooden sides. These benches are supported by small 2 ft 9 in high walls, made of concrete blocks. The floor of the benches consists of corrugated zinc sheets covered by a layer of polystyrene for insulation. On top of the polystyrene there is a layer of sand in which we have soil warming cables embedded. Only three benches have bottom heat.

Each bench is covered by a 3 ft high polythene tent with lift up sides. These benches are housed in a double span greenhouse, two benches each side.

Across the roof and partly down the sides of the greenhouse we have a movable Netlon type shading. This shading was stitched by a sheet maker and is made to measure fit. It is held in place by wire and can be easily slid to the sides when not in use.

Also three tunnel houses are available, measuring 50 ft by 14 ft. These are used by the propagators in summer and have soil warming cables in them if we need them.

ROOTSTOCKS

We use mostly pot-grown rootstocks and have two methods of obtaining them.

First method: One year seedlings are graded in February or March from our own seed beds, or they are bought-in transplants for machine planting. These are cold-stored then potted when time allows. They are ready for grafting the following spring. Examples of genera whose rootstocks are handled this way are *Fagus*, *Prunus*, *Robinia*, *Picea*, and *Chamaecyparis*. For *Picea* and *Chamaecyparis* we would probably use two-year-old seedlings, or 1+1.

Second method: These rootstocks are bought in ready for grafting. They have been grown from seedlings propagated in seed trays and then pricked out into pots. Examples are *Betula*