SUMMING UP

Successful grafting of *Abies*, *Pinus*, and *Picea* then, along with most other species, depends upon:

1. Ample supply of healthy scions.

2. Pot-grown understocks of the correct stem thickness with some root activity at the time of grafting.

3. Use of a good sharp knife and correct carpentry.

4. Dedicated aftercare. By this I mean, amongst other things, before the propagator disappears for the week-end at the end of March, he should pause to think whether the grafts require shading in case the weather changes. Careful attention must also be paid to the pest control programme.

BENCH GRAFTING UNDER HEATED GLASS

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This paper covers the bench grafting of deciduous trees which have proved, in the past, to be very difficult to propagate by conventional field propagation techniques. This mainly covers the production of ornamental cultivars or species of *Alnus*, *Betula*, *Fagus* and *Quercus*.

SOURCE OF SCION MATERIAL

Scion material is procured from specially established stock "mother" trees. These are planted at a spacing of 12 ft between the rows, and 6 ft apart in the row. This allows tractor access for grass mowing, strip herbicide application and spraying for pest and disease control. A branch framework is established at a height of 3 ft like a bush apple tree. The trees are pruned hard back to the framework each year once the required scion material has been removed. Cuts are then painted over with a fungicidal paint.

SOURCE OF ROOTSTOCKS

Basically there are two methods of producing good well-established pot grown stocks.

1) For *Alnus* and *Betula*, 1-year old field-grown seedlings are selected during the winter months. Ideally they should have straight stems of 3 mm diameter and good fibrous root systems. For *Fagus* and *Quercus*, 1 + 1 field-grown seedlings of 5/6 mm diameter are selected because they are slower growing. The stocks are root pruned and then cut down to 35 to 40 cm with any side shoots removed. They are then potted into 10 × 12.5 cm containers during the winter, using a fairly high (35%) loam-based compost. These are grown on for one season to produce well-established stocks to graft the following winter.

2) For the fairly rapid growing *Alnus* and *Betula*, a method of raising stocks of sufficient size for grafting from seed in one growing season has been used. Seed is sown in trays in March under heated glass, having had 3 weeks stratification at 2° to 3°C. During March and April the seedlings are pricked off into plastic units made up of 40 compartments which fit into a standard seed tray. Each seedling has an individual container which allows easier potting on. Repotting into the same compost and container is carried out, as in the first method, when the seedlings are 8 to 10 cm high; they are then stood down under polythene protection. They will grow away without any check to make good 5 to 6 mm diameter stocks for grafting the following winter. During the course of the growing season the growth is stopped to encourage thicker stem development.

PREPARATION OF THE ROOTSTOCK

At the end of December the pot-grown stocks are brought into the glasshouse 3 weeks prior to grafting. The glasshouse temperature is maintained at 8 to 10°C. Water application is restricted so that the rootball can be dried off from excessive moisture. This stimulates the stocks into activity and also prevents flooding of the union which is important, particularly with *Alnus* and *Betula*.

GRAFTING PROCESS

Two types of grafting technique are employed, side veneer for *Alnus* and *Betula*, and splice for *Fagus* and *Quercus*.

Side veneer graft. The stocks are cut down to 15 to 20 cm and the base of the stem cleaned up to make tying easier. Only strong, well-grown material should be used for the scions which are prepared 12.5 to 15 cm long, cutting flush above a bud at the top. A 3-4 cm sloping cut is made at the base of the scion with a small nick on the opposite side. A corresponding cut is made on the stock, as low down as possible. The stock and scion are placed together ensuring close matching of the

cambiums; they are then tied together using 4 × 150 mm rubber strips ensuring that the correct tension is maintained. The strip should lie flat and the basal nick is left exposed as bruising could occur here with subsequent loss. Next the union and tip of scion are waxed over using molten paraffin wax.

Splice graft. The stock is cut down to 5 to 6 cm with a slightly sloping cut. The scion is prepared 10 to 12.5 cm long, cutting flush above a bud at the top and making a 4 cm long sloping cut right through the scion at the base. A corresponding cut is made on the side of the stock from the top of the sloping cut. The stock and scion are then tied in as before but ensuring some of the cut surface of the scion is visible above the stock. This ensures a stronger cambial union.

AFTERCARE

The grafts are placed pot thick on an open bench in the glasshouse. No basal heat is given, relying on the ambient temperature being maintained at 8 to 10 C. In my experience grafts which callus more slowly form better unions than those which are forced too much. An open bench makes observation of the grafts more easy, especially for spotting those which are getting too dry. In sunny weather the grafts are shaded and sprayed with water to maintain humidity and prevent the compost getting too dry. *Botrytis* is not a problem on the open bench, compared with a closed case or polythene tent where it is a major problem.

Sucker growth is removed as it appears, and once scion growth is 5 to 6 cm long the grafts can be watered quite liberally. Heading back starts once the shoots are 10 cm long. Secateurs are used and it is necessary to leave a small section (3 to 4 mm) of the cut surface on the scion exposed. The cut is waxed over. The union will then heal over the top of the cut, thus giving a much stronger union. At this point, a 70 cm split cane is put to the plant on the opposite side to the graft, and the growth is tied in. With the splice grafts it is important to rub out sucker growth when it is small, otherwise it will take over and the scion will fail. These grafts are also caned and tied in when growth is 10 cm high.

GROWING ON

Providing field irrigation is available, grafts can be planted out in early June to become well established and make some growth before winter. Alternatively, grafts are kept in a frame until autumn and then planted out. If there is evidence of root curl at the base of the container this should be cut away at the

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

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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