

from this limited area of bench for periods of 27 days and 57 days respectively, in a glasshouse with a minimum air temperature of 15.6°C. These results indicate the possibility of quite substantial savings in costs, with as good or better percentage rooting, for many woody plants propagated from cuttings. The warm bench and plastic method employed would have the advantage over mist of greater insulation and of the absence of cooling effect due to the evaporation of water which takes place in a mist unit.

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STOCK PLANT MANAGEMENT

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The first stage in any production cycle is obtaining the propagation material of the right quality in the quantity required. As techniques become more exacting it is becoming increasingly important to have full control over propagation material from the earliest possible stages. This thinking has brought about an increasing awareness of the use of ornamental stock beds for vegetative propagation material and seed orchards for seed.

Sources of Vegetative Material. Cuttings can come from one of three sources:

1. *Saleable plants in the nursery.* It is only feasible to take cuttings if this fits in with normal trimming, otherwise you may be cutting away saleable material.

2. *Plants outside your control.* Many nurserymen still collect cuttings from local gardens, the wild and parkland areas. This material inevitably has an unknown history and often involves excessive labour and transport costs to obtain.

3. *Stock Beds/Hedges.* The advantage of a stock area is that the history of the plant is known and can be controlled. The plant is grown purely for the purpose of producing the right type of cutting at the right time. Large batches of cuttings are within easy reach, which reduces time and money when collecting. The plants can be easily managed and even manipulated to produce the cutting material required. The disadvantages of a stock area are that it takes up valuable land and that costs are involved in managing this area. Many people often imagine a small arboretum mushrooming in their nursery, but by planting hedgerows in lines 3m apart and 450 mm apart in

the row, it is possible to plant 6,500 stock plants per ha and still manage the crop using a tractor.

Siting of Stock Grounds. Cutting hedges or beds are a long term crop and therefore initial preplanting preparations must be thorough. A site should be selected that is fairly sheltered (from wind and frost pockets), yet has plenty of light, (plants in shade often produce undesirable material for cuttings). The soil should be of the correct structure and of a suitable pH for the plants being selected. The site should be suitably drained and free of perennial weeds, pests and soilborne diseases.

Planting. Plants should be true to type, uniform and correctly labelled as far as name and source are concerned. At Merist Wood, newly purchased or received plants that go into the Stock Ground are given an entry number. The first two digits signify the donor and the last two the year in which they were received, e.g. *Hamamelis mollis* 1577 indicates Schumacher, U.S.A., obtained in 1977.

There are many plants in the trade that are grown under different names or have clonal variations. It is essential that we, as propagators, know the source of our stock and continually check and compare the identities of those stock plants being propagated. Where possible the best clone or form for the particular species required should be used. In Denmark at the Hortum Research Station, research work is being carried out with this in mind. A trial ground has been established where different clones of particular species have been gathered. The Research Station propagates 100 plants of the best clone and sends these to the F.S.H. (similar to N.S.A.).* The F.S.H. bulks up these plants and distributes them to the trade. The plants will be sold as O.P.G. (Optimum Pathogen and Genetic Plants). To date, *Forsythia*, *Pyracantha*, *Hypericum*, *Ribes* and *Rosa* have been completed in the trials. At present *Cotoneaster horizontalis* and *Berberis* are being tried.

Similar interest is now being shown at Long Ashton Research Station, Bristol.

Plants should also be pathogen-free when planted. In the British Isles this often means free of *Phytophthora*, especially in conifers and ericaceous plants.

When I toured the United States I was able to visit Forest Keeling Nurseries in Illinois. They have an interesting project of selecting *Quercus robur* 'Fastigiata' which is resistant to Oak Mildew whilst in the nursery. They felt this would be an excellent landscape tree if this problem could be overcome. Once 'clean' material was obtained this plant would be incorporated into their stock areas.

* Nuclear Stock Association.

The same time of work could be carried out in this country to "clean up" such plants as *Vinca* to reduce losses at propagation, but to select for genetic variation for disease resistance is harder in genera that are not conveniently propagated from seed.

Stockbed Management. At the end of this paper is the routine maintenance programme for the Stock Ground at Merrist Wood. It must be pointed out that this is a rather extensive programme, but we have the advantage of large student participation.

A number of important points are worth considering when managing these plants:

1. *Nutritional Status of Stock Plants.* It is important to maintain a vigorous mother plant, but also remembering that the rooting of cuttings depends on the nitrogen:carbohydrate ratio in that plant. An excess nitrogen feed can result in the wrong type of cutting and a reduction in rooting potential.

In the U.S.A. they feed stock plants at higher rates than in this country.

Example: Chase Nursery, Alabama:

Every spring	45% N (Urea).	Rate equivalent to 450 kg/ha.
Every other year also	0-20-20 Feed.	Rate equivalent to 340 kg/ha.

In this country very little work has been carried out on stock bed feeding. Foliar feeding is preferred by many as the nitrogen and potassium can move freely within the plant. Information, at present, is lacking on the number of applications to get maximum response from the plant or the number which causes harm. A suitable foliar feed for stock plants is a 20-20-20 (N, P₂O₅, K₂O), fertilizer applied at the rate of 225 g of the compound fertilizer per 450 litres of foliar feed to be applied.

2. *Age of Stock Plants.* Generally juvenile material roots better than adult material. This cannot be taken as a golden rule, as some subjects, e.g. *Thuja occidentalis*, seem to root just as well from old as young material.

The effects of juvenility on stock plants has been mentioned before at IPPS Conferences, but the importance of it cannot be overstressed. This seems to necessitate a planned removal and replacement programmed for stock plants. At Merrist Wood *Calluna* and *Erica* cultivars are replaced every three years enabling us to keep a healthy and young stock bed.

3. *Pruning Treatments.* Pruning methods can help maintain or induce juvenility. At planting many subjects should be pruned back to induce them to bush out near the base and produce vigorous cuttings.

4. *Weed Control.* Residual herbicides can be root pruners if used consistently on the same piece of ground around the same plants. Because of this, a selection of herbicides should be used, both residual and contact.

5. *Irrigation.* The rooting of cuttings is in relation to their water content, although the water content of cuttings varies with species and age. It is therefore important that the cutting is removed from the stock plant in a turgid state and remains so until it is in the rooting environment. With this in mind it is important that the stock plant be healthy and turgid when cuttings are removed which, in dry spells, may mean irrigating the plants the day before cuttings are taken.

The cuttings must not be allowed to wilt in transit to the cutting preparation area. In the United States, where they have very large numbers of cuttings to handle, they often have elaborate storage chambers with mist units in the ceiling where cuttings are stored in a turgid state until time is allocated for their preparation.

The Future. I feel a few major developments may occur in stock plant production.

Firstly, if the trend continues in nursery production, as it has in other areas of horticulture, we may see our stock plants grown hydroponically under cover. Although initially this would prove expensive, it may be an ideal method for certain subjects, either producing more crops per year or inducing the right type of cutting for propagation.

The second advancement may be by our scientists inducing stock plants to start rooting whilst on the mother plant. We can already see this with the dwarf cherry rootstock, 'Colt', and other plants may be induced to react similarly.

In many American nurseries they are using gibberellic acid to manipulate plant growth and it seems a logical progression to use this type of chemical in the Stock Ground.

It may now be time to question our traditional technique of stooling certain plants, e.g. apple rootstocks; either an alternative technique should be sought, such as hardwood cuttings as a propagation method or, if the plant does not respond, then an alternative method to "earthing up" should be considered. Synthetic foams would give the darkness and moisture required and would be a far easier method to handle during the stooling programme.

ROUTINE MAINTENANCE OF MERRIST WOOD STOCK GROUND

Area: 2.5 ha. Plant Entries: 1,000.

	STOOL BEDS	LAYERING	PRUNING	SPRAYING	COLLECTING	LIFTING	MISCELLANEOUS	PLANTING
JAN	Unearthing, lifting, grading.		Fruit and ornamentals for budwood production.	Propyzamide for couch control.	Hardwood cuttings (ornamentals and fruit) and hard prune s/plants. Buddleia cuttings. Conifer cuttings.	Perennials for division and plants for root cuttings.	Drainage. Ditch maintenance.	
FEB		SIMPLE LAYERING. Lift tip layers of blackberries and loganberries. Lift ornamental layers.			Hardwood cuttings (ornamentals and fruit) for E.M. cutting bin. (Hard prune S/plants). Conifer cuttings.	Perennials for division.	Check labels and tree ties and stakes.	
MAR		TRENCH LAYERING. Peg down Prunus F12/1 FRENCH LAYERING. Pegging down.	Stock for soft and semi-nature cuttings. Stock for hardwood cuttings.	Simazine to weed-free beds.	Scion wood for grafting and hard prune s/plants. Conifer cuttings and pruning.			Final planting and moving of deciduous stock.
APR	1st earthing up of Malus rootstocks, quince A & Aronia prunifolia.	SIMPLE LAYERING. Ornamentals, pegging down.	Broadleaved evergreens for cutting production.	Lenacil - perennials, heathers, etc. Fruit and ornamentals for aphids. Junipers for webber moth.	Softwood cuttings. e.g. Hypericum Spiraea.		Set up irrigation for these.	Perennials, Conifers, Evergreens.
MAY	2nd earthing up of stool beds.	TRENCH/FRENCH LAYERING. 1st earthing up. SIMPLE LAYERING. Ornamentals - pegging down.		Kalthane against conifer-spinning mites (esp. junipers). Benomy soil drench to cherry layer beds to prevent Thielaviopsis basicola. Rate: 150 gm to 90 m row.	Softwood cuttings.		MULCHING rhodos, heathers.	Perennials (then spray Lenacil) (irrigation)
JUN	3rd earthing up of stool beds.	TRENCH/FRENCH LAYERING. 2nd earthing up.	Summer pruning of conifers.	Paraquat if necessary. Spray Applicide.	Scion wood for budding. Cuttings of heathers & other ornamentals.			

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STOOL BEDS	LAYERING	PRUNING	SPRAYING	COLLECTING	LIFTING	MISCELLANEOUS	PLANTING
JUL	Final earthing up of stool beds.	LAYERING. Strawberry runners. TRENCH/FRENCH LAYERING. Final earthing up.	WEED CONTROL. Hand weeding of layer beds. Repeat residual herbicide applications if necessary.	Cuttings of ornamentals. Scion wood.			
AUG	LAYERING. Tip layering blackberries and loganberries.	Early Aug. spray against juniper webber moth (Malathion). Spray weeds as necessary.	Cuttings of ornamentals. Scion wood.				
SEP		Apply Basamid granules for new heather & conifer beds.	Cutting material of conifers and broadleaved evergreens.			Check labels and tree ties and stakes.	Conifers and broadleaved evergreens.
OCT		Raspberries, blackberries and loganberries.	Cutting material of conifers, evergreen shrubs. Berberis, etc. Seed of trees/shrubs.			Deep ploughing of fallow land inc. FYM prior to planting.	Conifers and broadleaved evergreens.
NOV	Unearthing, lifting, grading.	SIMPLE LAYERING. Lift layers of ornamentals then prune mother plants.	Hardwood cuttings (fruit/ornamentals) and hard prune s/plants. Cuttings of coffee and broadleaved evergreens.		Raspberry spawm for lining out.		Deciduous stock, through to March.
DEC	Unearthing, lifting, grading.	TRENCH/FRENCH LAYERING. Lifting and grading.	Fruit with tar-oil or DNOG/ petroleum oil to control over-wintering pests.	Hardwood cuttings of ornamentals and fruit and hard prune s/plants. Conifer cuttings.	Plants for root cuttings.		Replant for future root cutting material.