

the information is not amenable to statistical analysis. Had we replicated, the already large number of operations would have become utterly unmanageable. Nevertheless, we have provided a practical basis on which it should be possible to achieve high germination regularly; and we have highlighted several areas, which will be of great interest to academic researchers, where further work could be done.

## PROPAGATION AT BRIDGEMERE NURSERIES

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I have worked at Bridgemere Nurseries in Cheshire for the last 14 years. I achieved the position of head of propagation some 9 years ago, due to a knowledge based purely on practical experience and advice from fellow propagators.

I have a minimal involvement in field propagation and this is limited to fruit trees and the easy evergreens, such as laurel and *Vinca* spp. The latter are propagated under low polythene tunnels on a sheltered, well-drained section of the field.

The breakdown of the 800,000 cuttings which are rooted by my department each year, is as follows: 30% shrubs, 25% heathers, and 25% conifers, the balance being split among everything from Exbury azaleas, *Pieris* spp., *Mahonia* spp., with about 5% of this balance being climbers.

The second type of propagation under my control is the division of bareroot herbaceous plants, a crop which is increasingly being home nursery produced. The reason for this is customer demand which is creating a demand for almost limitless cultivars of plants of all kinds. This means that I am constantly having to add new plants to my propagation lists, the present range covering some 750 different ones. Sadly, once the newer cultivars become popular, we have to axe some of the more traditional lines in order to keep a careful balance.

One of the few types of hardy plants which we do not propagate as yet are the alpines, but we may one day add them to our range.

**Propagation Techniques.** In the main, our cuttings are rooted in Macpenny mist units, which provide mist between March and October.

Having on several occasions experienced temperatures as high as 120°F without any problems, my propagation technique is to use total humidity and maximum temperature. The vital safeguard is to keep the humidity as high as possible. Until now I have never seen any ill effect on cutting material as a result of this method. On the contrary, the speed with which the cuttings will root lessens the chance of disease which can be caused by high humidity.

Throughout the winter the mist unit is turned off and the beds are covered by a tent of 150 gauge polythene which creates a microclimate around the cuttings, thus creating both higher humidity and temperature than in the rest of the house.

Certain crops are rooted in closed cases. For example, Exbury azaleas and Clematis. Here the cases are covered with poly-carbonate sheeting. In the case of hybrid rhododendrons however, the polythene is laid directly on the foliage of the cuttings.

**The Propagation Team.** There are five regular staff members in the propagation department, although this always includes one middle-year student who works about four months in each department. Another of the five is engaged for most of the year to work on climbers, as this crop remains the responsibility of my department, even to the extent of filling the relevant retail section in the garden centre.

In July and August the number of staff is usually doubled. This is due in the main to summer students being called in to help out on the climber section.

**Shrub Propagation.** My propagation year starts either late April or early May. The exact timing depends upon availability. The first cuttings are made from any soft material available. This is taken from liners which have been overwintered under polythene. This operation also effectively trims the liners.

This is the only forced material available as we do not have the space to force plants. The lack of space has caused us to abandon the forcing of Exbury azaleas and the propagation material now comes from liners overwintered under glass. These are kept frost-free from early March until the end of May as at this time Exburys are very sensitive and can quite easily be killed even under glass.

The Exbury azaleas are one of the few crops for which I do have a set deadline for finishing, and this is the end of May. The reason is that we need to have cuttings rooted early enough to allow extension growth to be made in the same

season. This gives a far greater chance of survival during the winter.

This growth is helped by supplementary lighting. This equipment consists of a string of ordinary light bulbs spaced four feet apart and suspended three feet above the cuttings. The cuttings are lit for a period of four hours in the middle of the night right through until the end of October.

The one vital thing needed to ensure success is that the cuttings must be vernalized (chilled) after Christmas and, as with the liners, frost protection in early spring is essential.

Once the supply of material from shrub liners is exhausted, we make use of our stock field material. This field is about four acres in size. Although it is situated about three miles from the propagation unit, it is on good light soil and has a supply of water from a bore-hole should it be needed.

We have recently planted out another stock area. I will explain about this in more detail later on.

We normally gather cuttings from the stock plants early in the morning and they are placed into cold water, drained, and then stored in white polythene bags. The cuttings are kept in the shade until they can be transferred to the propagation shed. Once there they are stored in deep crates within pallets and wrapped in white polythene to keep them cool.

The material is then kept moist until it is needed. It can be kept in the summer for up to two and a half days and up to five days in winter. This is very useful as the taking of cuttings in winter is controlled very much by the weather. Therefore, a store of ready material enables the staff to always have a supply available. This system proved itself in the recent bad winter as it enabled us to work right through.

I usually like to have the general deciduous shrub propagation finished by the end of July, although there are always certain species to be struck in August. Deciduous *Berberis* spp. for example, root best when taken in mid-August. Immediately after the deciduous propagation has been completed, we go on to deal with the evergreens in the autumn. The main groups of plants are *Pieris* spp., heathers, evergreen azaleas, and dwarf rhododendrons. The later two tend to take priority over the others as I have found the timing to be more crucial for success with both of these crops.

**Azaleas and Rhododendrons.** With azaleas, growth has to be ripened and I invariably find that the best material has a terminal flower bud. However, this in no way hinders rooting. This crop must be propagated before the nights get cold, otherwise leaf drop occurs in certain cultivars.

With azaleas I rely upon cuttings which have been taken with great care from saleable stock. The reason is that we have found stock plants in this case to be impractical, except when they are used for assessment and drawing comparisons between new cultivars.

Dwarf rhododendrons are rooted over a much longer period and are started before the end of August. The first to be handled are the smallest kinds, such as *Rhododendron impeditum*, gradually working through to the larger-leaved dwarfs, such as *Rhododendron* 'Scarlet Wonder'. With these cultivars timing is less rigid as they can be struck successfully through February if need be.

**Heathers and Pieris.** Heathers are usually started early in August and are gradually worked through by Christmas. There, again, *Calluna* spp can be taken quite successfully as late as February. On one occasion I had good success as late as April.

*Pieris*, I find tends to be a useful stop gap as it is a very adaptable crop which will tolerate a variety of propagation systems. *Pieris* is very important to us and we grow approximately 30,000 per year. Although two-thirds of this is *Pieris* 'Forrest Flame', we also grow a further 16 cultivars, but only in limited quantities.

**Rhododendrons, Mahonias, and Elaeagnus.** By late October the crops propagated tend to be the larger-leaved species and cultivars of *Rhododendron*, *Mahonia*, and *Elaeagnus*.

Rhododendrons are inserted directly into Irish moss peat, usually without any additional moisture. On some of the larger-leaved cultivars, such as *Rhododendron* 'Cynthia', it is necessary to trim the foliage before insertion.

The rooting hormone used for rhododendrons is various strengths of IBA in talc. This is usually mixed with captan so that equal volumes of 4% IBA plus captan will give an effective rate of 2% IBA.

However, I have found with several species, for example *R. caucasicum*, *R. 'Pictum'* and *R. 'Sappho'*, that a solution of only half this strength is needed, but this is very much a case of trial and error.

Too weak a hormone causes slow rooting or none at all, whereas too strong a hormone will kill the cuttings outright. When the cuttings have been prepared they are covered with 150 gauge polythene which is in direct contact with the foliage. It is then removed every seventh night to give the foliage a chance to dry out and for any dead foliage to be removed.

Mahonia is one of the few crops to be directly inserted into a pot, in this case 7 cm square. As material for this crop is always scarce, we use single leaf-bud cuttings and once these have been inserted they can either be covered by polythene directly on the foliage in a low, heated case or they can go onto the mist beds, which by this time have a polythene tent over them.

*Elaeagnus* × *ebbingei* cuttings have polythene directly on the foliage and the cuttings are treated in the same way as the rhododendrons, apart from being inserted into boxes. The success rate of this method is 80 to 85% rooting, which must make this a far more efficient way of producing a crop than the tens of thousands which are grafted every year, particularly in Holland.

**Conifers.** the only conifer I have time for before Christmas, is × *Cupressocyparis leylandii* 'Castlewellan.'

These cuttings are generally held in cold cases until February and, if necessary, can be left until April, by which time they would normally be about 75% rooted.

The rest of the conifer cuttings, some 175,000 in all, are taken after Christmas, and for this reason, I try to ensure that all other crops are finished by December.

With the exception of the junipers, which do best during the cold winters, there is no definite order in which the conifers have to be done. Although having said this, during the last bad winter I found that certain juniper cultivars seemed almost impossible to root, one in particular being *Juniperus chinensis* 'Pfitzerana Aurea'.

My only priority, therefore, is to make sure that the more difficult and rare cultivars are given the best position on the heated beds.

**Propagation by division of bareroot herbaceous plants.** This material is either bought in or lifted directly from our own fields. It is then split into pieces which are just large enough to make a saleable plant within three months of being potted.

With the herbaceous material we are responsible not only for the division of the plants, but also for the potting of certain species. This is either because they need careful handling, examples being species of *Pulmonaria* and *Delphinium* or, as in the case of *Paeonia* and *Gypsophila* species, the root systems make machine potting totally impractical.

To conclude, I return to a subject which I touched upon earlier, that of the new stock area which has recently been planted.

In size it measures roughly one acre and is almost square in shape. The section allocated to me is one of four adjacent walled-in plots of land which have recently been acquired by the nursery. Already we are making good use of this extra space and have planted out various shrubs numbering from 50 of certain cultivars down to as few as three of others.

This area should prove itself to be useful for testing plants of species which are unable to survive in the sheltered conditions provided by the walled in area and are not worth the risk of growing. Two of the main genera in question here at the moment are *Cistus* and *Ceanothus*, both eminently saleable plants but of questionable hardiness.

The other plus factor of this new area, is that we are now able to compare new species and cultivars side by side and to judge their worthiness for our use.

## CHANGE ON THE NURSERY

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If our I.P.P S. Conference has been of value at all, there will be some changes on the nursery as a result of our attendance. These changes need careful study to be effective, and so we will look at possible changes under five headings.

**(1) In what area of business should there be changes?** Changes in the wrong area could precede disaster. One guideline is, "the area where we do worst." Here, change can only improve things — or so it may seem. Another guide is, "where we are doing very well" — change in this area could shift us from the mediocre nursery to the elite nursery.

Suggestions are.

*Outlets.* Selling wholesale, to garden centres, instead of retail to the visiting public, — or vice-versa.

*Subjects involved, or type of plant produced.* Perhaps growing standards of choice ornamental trees instead of maiden fruit trees. A bigger change could be in going from bare-root to container sales. .

*Sources of Stock.* Beginning a stock-plant area, so that all the cutting material is completely under your own control, instead of depending on local nurseries or gardens. An addi-