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NURSERY PRODUCTION IN ENGLAND

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INTRODUCTION

Among United Kingdom nurserymen there is an increasing awareness in the need for specialization in the containerized market for Garden Centres, which is particularly attractive to marketing groups, and the awareness of the need for purpose-grown stock particularly smaller feathered trees, potted shrubs, and herbaceous plants.

Specialist producers are now concentrating either on landscaping and its plant requirements, high quality choice or up-market plants for the plant enthusiast, heavy standards and larger specimens for local authorities and, in particular, indigenous trees and shrubs which are used in considerable quantities for conservation and the landscaping of industrial developments and roadworks. It is in this last specialist need that we have developed our production technique and it is by relating our own experiences to meet this need that I hope to convey something of our own particular part in nursery production in England. Our development is very closely linked to our participation in the International Plant Propagators Society, with considerable involvement and exchange of ideas and I hope to demonstrate this as we go along. I would, therefore, like to introduce Oakover Nurseries. We are some 80 acres in extent, primarily on greensand which is ideally suited to the production of nursery stock and forest trees. We were formerly a forest nursery and developed seedbed and transplant techniques based on forestry systems. This involved standardization of equipment and the development on the tractor bed system commonly used by the Forestry Commission and commercial forestry producers (1).

THE NEED — BRITISH GROWN NURSERY STOCK

Some ten years ago we started to collect indigenous seeds to meet the demand for this type of material; this need had been created by a greater public awareness of our diminishing tree and hedgerow population due to modern methods of agriculture and to industrial development.

During the early 1970's there was considerable activity in the need for conservation of our natural resources. This activity has further increased with the disastrous arrival of Dutch elm disease which has, in many cases, denuded the countryside, and demanded immediate remedial action in the form of increased amenity planting, particularly of such genera as *Tilia*, *Fraxinus* and *Quercus*. Our development as a nursery has, therefore, been guided at all times by the necessity to fill this need.

Such plants were formerly produced in vast quantities on the continent of Europe and imported cheaply; however, a devaluing British pound has meant that in order to remain competitive the quality of some continental stocks has deteriorated and our producing nurserymen, being fully aware of the value of quality in understocks and its effect on the final product, have, in expressing their dissatisfaction, turned to alternative suppliers. This realization of the need for high quality at all stages of production has been largely fostered by the increased communication amongst nurserymen and the ready exchange of ideas at conferences and meetings. Therefore, home production competes most satisfactorily for this supply and conditions are right for expansion and development of this specialist production.

Having mastered some of the early problems involved in increasing our range we then looked to the more specialized requirement of the nursery industry and today we are producing understocks and seedling liners for our own nursery industry. Having established the need we are now confident and are turning over the greater part of our nursery to this type of production.

The Seed. Our early experiences involved the collection of home produced seed, the establishment of contacts on the continent and at home where seed could be purchased, and visiting other nurseries to obtain details of their experiences and requirements. The subject being very poorly documented we have relied very much on the work of our own men and, in particular, that of Dennis Fordham who is now involved principally in seed collection and production from seed. He has undertaken considerable work on the storage, dormancy breaking and stratification treatments and, in particular, calculations of bed density to produce the optimum size of plant required by the Trade and has presented a paper on this work to the G.B. & I. Region (2). He has progressed his techniques since this presentation and much of the new material I have today relates to his experiences.

We have built up a large dossier on seed collection noting

proven good sources of reliable performance and detailing optimum timings for observations of crop and collection arrangements. The subsequent extraction treatment and storage of seed is now handled systematically to ensure maximum collection from our home supplies. This is the most important single factor in our production as availability of seed in Europe, and in England in particular, is by no means certain from year to year and, as many species do not store well, our own ability to collect is reflected in the continuity of supply that we can offer to our customers. There are very few reliable seed suppliers for woody species and the seed supplied is often of indifferent quality.

We have improved our handling and treatment techniques and, with experience, are getting greater control, particularly during the imbibing period when temperature and moisture levels over variable durations must be considered for each species (3). The use of warm and cold stratification to facilitate embryo development and seedcoat breaking, together with hot water treatment for waxy pericarps and imbibing periods to enhance and speed up germination are now standard practice and, whilst we have avoided the use of acids, we have used gibberellin to assist in germination of stored seeds, such as *Nothofagus*. We still employ natural dormancy breaking by using the autumn sowing method with *Viburnum*, *Cornus* and some *Prunus* species. With the larger difficult-to-store seeds such as *Aesculus*, *Castanea* and *Quercus* we are grading the seed to size to produce evenness of stand prior to autumn sowing.

In all of our sowing the aim is to produce the optimum number of plants that will give either height or stem diameter at the end of a predetermined period and these factors are considered in all calculations of bed density. Our normal cycle of production is one or two years with intermittent undercutting.

Site facilities. The nursery must be capable of accommodating these operations. As many take place during the winter period the site must be well drained and upon sandy soil; in addition a sheltered position is desirable. Facilities and equipment to provide these needs are necessary and the provision of windbreaks is essential to ensure optimum growth.

There must be a readily available supply of water, particularly at the time of sowing when treated seeds will be near the point of germination and are at a most vulnerable time. Water will also be needed to feed the crop and to replace any deficit in the natural rainfall, but particularly when undercutting operations are considered during the main growing period. One cannot overstress the need for good water on a seedling nursery. Good buildings are also essential, in particular a large

grading and packing shed where material can be handled safely during the winter months and the high quality graded plants can be kept safely prior to dispatch. Cold store facilities are also an advantage and we hire such a facility for our material. Machinery to reduce the work load and handle the crop quickly is also important and must be tailored to suit the system of growing. Our machines are, therefore, all of the standard bed width that we have adopted and include gritting or sanding machines, undercutting and lifting equipment and planters for the transplanted crop. We also have a specialist lifting machine for this crop.

Land preparation. We grow our crop on a three year rotation, with two producing years plus one fallow (4). It is during this fallow year that pernicious weeds are removed, the land is sub-soiled and added manure ploughed in and cultivation undertaken prior to sterilization; we do the latter using Basamid at a rate of 340 lbs per acre to control autumn weed seeds and some nematodes. The increased growth resulting from sterilization more than justifies the cost. Having sterilized in early autumn the beds are left to go "stale" to await the earliest spring sowings.

All sowings are made broadcast and seeds of the small-seeded species are covered with ¼" grit. Sowing densities are calculated by germination tests carried out under glass some 4 to 6 weeks before sowing. For the coarse seeds a cut test is used (these are often sown in autumn in raised beds which give good water drainage and are covered with the nursery soil). Bed densities are all calculated on the basis of these tests and it is our aim to sow the minimum number of seeds that will produce the maximum density of uniform plants to the size that we require. Sowing densities have changed over the last few years in most cases giving a reduced population and an increase in the quality of the product. This is particularly important where understocks are being grown, as opposed to the forest trees and amenity plants that we were formerly producing, wastage levels being far higher in the intensive grading operation of stocks.

Aftercare. Protection of the seedbeds with netting is necessary for most species. We use different nets for different birds, having found that the larger seeds attract larger birds and are not hazarded by the smaller birds which may pass through the larger net; however, on smaller seeds very fine netting is necessary if losses are to be avoided. These losses have greater significance than the numerical reduction of plants. The subsequent reduced density can result in over-sized or badly feathered plants where the calculated density is changed by this factor; e.g. feathers on *Betula pendula* (Syn.: *B. alba*) or *Sorbus*

aucuparia where a clean stem was required for budding or grafting.

Irrigation water is applied on a fairly dry regime in order to encourage good rooting. Frost protection may be given on tender species such as *Acer campestre*, *Fraxinus excelsior*, or *Hamamelis virginiana*, where late radiation frosts are a hazard.

Feeding the crop is done using an organic 7:7:7 fertilizer at 7 to 10 day intervals during the growing season. Undercutting commences in July, using a straight Egedal cutting blade; this is designed to produce a dense fibrous rooting system. This technique is applied to both one and two year seedlings and may result in some thickening of stem diameter due to reducing extension growth. Top trimming of some species such as *Crataegus* has also been undertaken.

Pest and disease control is carried out by overhead spraying as a matter of routine, the main problems being aphid, red spider and associated mites and also mildews; for the latter a regular 7 to 10 day programme of Benlate and Dinocap is used.

Potted liners. There has recently been a trend towards container-grown trees, either as self rooted plants or as bench-grafted specimens. We are now producing pot grown liners to meet this demand. Certain *Acer* species, *Liriodendron*, *Eucalyptus* and several conifers including *Taxodium*, *Pinus*, *Cedrus*, *Ginkgo* and *Cupressus* species are treated in this way. It is our normal practice to either direct sow or sow in trays under glass and prick off into final pots of 7 or 9 cm. These are then grown on under polythene tunnels or shading tunnels before being hardened off in frames or unclad tunnels. Marketing of such liners is undertaken at the end of the first year when they have reached a height of 12 to 36″ according to species.

Harvesting & Dispatch. This starts in late October with the undercutting, lifting and clearing of the 2 year crop and the undercutting and selected thinning of the 1 year crop. Selected one year and, in some cases, two year seedlings are used to re-line out to produce a transplanted crop, but many seedlings are graded out for direct resale. The criteria used are stem diameter and height, in the case of understocks, and height and ability to feather in the case of amenity plants. The graded plants are bundled and packed into polythene bags and may be held in a strawed condition outside in open weather or in cold store prior to dispatch.

We deliver all of our own plants using our own transport; this service is very much part of our whole production and is a major consideration with our customers. It is our hope to increase our range of plants to provide a self-sufficient service to our industry, grading to our own grower requirements upon

their own recommendations following consultations. As our industry progresses and becomes more specialized this communication and understanding becomes more and more important and we make a point of regularly meeting with our customers for this purpose. It is in this last respect in the creation of better knowledge and understanding in the spirit of true cooperation that the role of I.P.P.S. features in the progress of the nursery industry.

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SEXUAL FLEXIBILITY IN PLANTS

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Finding and producing non-fruiting trees is an important way of providing buyers with improved selections of landscape trees, but unexpected sex expression of trees can thwart such aspirations. Notwithstanding a possible mixup of budwood, an ephemeral change in the sex of a tree or any other plant can occur. Typically non-fruiting individuals occasionally may shift towards femaleness and bear fruit. In other cases, plants that normally have female sex expression, may shift in some years towards maleness and have only male flowers and, of course, *no fruit.*

From an ecological viewpoint, there seems good reason for expression of sexual flexibility in plants. Because of immobility, plant survival depends on the ability to cope in place, whatever the environmental stresses may be. Charnov and Bull (3) proposed that "labile sex determination (not fixed at conception) is favored by natural selection when an individual's fitness (as a male or female) is strongly influenced by environmental condi-