BROADLEAVED TREES FROM CUTTINGS

JOHN JOBLING

Forestry Commission, Forest Research Station
Alice Holt Lodge, Farnham, Surrey

In 1958 and 1959, after a year of exploratory tests, 90 clones of poplar, *Populus*, and 25 clones of elm, *Ulmus*, were propagated from softwood cuttings in trials at the Forest Research Station, Alice Holt Lodge. The cuttings were rooted in a heated frame equipped with automatic overhead mist irrigation.

Until then, stocks of most of the clones had been produced by grafting, since propagation by other techniques, including hardwood cutting methods, had proved difficult or impossible. The trials provided hopeful signs that many trees which hitherto had not been easily raised by conventional means might be readily reproduced in future by the softwood cutting method using a mist system of watering. Thus, many trees could now be grown on their own roots for the first time, an advantage to foresters and arboriculturists.

Several species and cultivars included in the trials were then in short supply in the nursery trade or were not produced at all. Some of them, such as gray poplar, *Populus canescens*, and European aspen, *P. tremula*, are still uncommon although much sought after by conservationists, landscape architects and foresters. This paper attempts to review progress, if any, in softwood cutting methods by drawing attention to some of the work presently being carried out at Alice Holt Lodge. It is hoped that by discussing current trials and programmes of stock production for field experiments, horticultural interest in the practice of softwood cutting propagation might be stimulated.

Type of Cutting. Early trials in poplar clones of widely different botanical origin, and on elm clones artificially bred in the Netherlands or selected in hedgerows in this country, showed that the best results on both rooting and subsequent survival were obtained with sturdy and vigorous apical cuttings at least 12 cm long (6). Since then, large numbers of clones of many other tree genera have been successfully propagated using only apical cuttings. Other workers have confirmed the general use of apical cuttings.

Little research has been done on the rooting of sub-apical cuttings. However, recent trials at Alice Holt Lodge have demonstrated that many broadleaved clones can be readily propagated regardless of type of cutting. Studies being carried out to improve the production of stocks for field experiments of Hybrid Wingnut, *Pterocarya* × *rehderana*, a rare tree of immense vigour in

southern England (8), provide an interesting example The work has shown in successive seasons that both apical and sub-apical cuttings from young stock plants root equally well under mist, usually in 10 to 14 days.

Late flushing trees whose shoots grow slowly in the first part of the season and then quickly ripen, for example small-leaved lime, *Tilia cordata,* may be much more difficult to propagate from sub-apical cuttings. However, apical cuttings of this species as short as 8 to 10 cm can be easily rooted between mid-June and early August.

Cutting Origin. The highest rates of rooting are achieved with cuttings taken from young, vigorous stock plants cut back annually during the dormant season. Cuttings from plants grown close-to-hand usually root better than cuttings produced some distance away from the nursery.

Many broadleaved species and cultivars can be reproduced, however, from softwood cuttings taken from mature trees. As a consequence, large numbers of plants can often be quickly raised from material collected from specimen trees selected in the field. Stocks of more than 60 elm clones have been raised in this way during the past 20 years The method ensures the successful propagation of rare trees which, for one reason or another, cannot be reproduced from seed. The production of stocks of one of the last remaining remnants of a small-leaved lime population in south-east England has been achieved in this way.

The ability to root cuttings taken from mature trees also permits the early propagation of field specimens selected for outstanding characteristics. In 1979, seven trees of Sargent's cherry, *Prúnus sargentii,* were selected and propagated for field trials on account of their upright branching habit and attractive autumn leaf colour. At the same time, selections of goat willow, *Salix caprea,* were made for their tolerance of difficult man-made sites, and stocks were easily raised from softwood cuttings collected from trees which could not be propagated from hardwood cuttings.

If cuttings from epicormic shoots and root suckers can be found, they will often root better than cuttings taken from the crowns of the trees, though less well than cuttings from nursery stock plants. The relationship between cutting origin and rooting potential is well illustrated in gray poplar propagation (3).

Timing of cutting insertion. Most workers agree that the highest rates of rooting and the largest plants at the end of the summer are achieved with batches of cuttings inserted in the first half of the growing season. Care is needed to prevent wilting and death of very soft apical cuttings early in the season, however,

and insertion may have to be delayed until shoots on stock plants begin to ripen. The collection and preparation of cuttings of London plane, *Platanus* × *acerifolia,* in particular, must be carefully timed though, overall, stock production from softwood cuttings is generally better than that from hardwood cuttings rooted in open beds

While many easy-to-root trees, such as the common cultivars of willow and poplar, exhibit little falling-off in rooting rates in the latter part of the growing season, the plants may be small and comparatively poorly rooted at the end of the year and, after potting-up, overwintering losses may be substantial. Their survival during the winter may be only marginally superior to that of cuttings of difficult-to-root clones inserted towards the end of the season. This aspect of softwood cutting propagation requires further study. It is possible that some form of containerization for cuttings may be advantageous, permitting over-wintering indoors without having to handle the plants after root initiation.

There is insufficient evidence to prescribe optimum times for preparing and inserting softwood cuttings of related clones.

Type of Substrate. Trials started in 1979 to compare the rooting of softwood cuttings in different substrates have not been particularly informative. Some clones have had higher rates of rooting in a substrate of 75% vermiculite: 25% sphagnum peat than in other media, and cuttings in this mixture have sometimes developed a more fibrous root system which has suffered less damage during potting-up. However, only hybrid elms, *Ulmus* × *hollandica,* have benefitted significantly and, until a larger number and range of clones has shown consistent improvements both in rate of rooting and in survival and vigour after potting-up, a change from the widely used 50% coarse sand: 50% peat substrate to a vermiculite-peat rooting medium cannot be recommended

Compared with sand-peat and vermiculite-peat mixtures, substrates based on perlite and peat have usually depressed rates of rooting regardless of the perlite proportion. Roots in perlite-peat mixtures have been more brittle and liable to breakage than in other rooting media. The poorest rates of rooting have been in substrates based on bark, though further trials are probably needed before their unsuitability can be confirmed.

Substrate Temperatures. Softwood cutting propagation has been successfully carried out at substrate temperatures of 21°C (7), 21° to 24°C (2,5) and 24°C ± 3°C (1). Recently, hardwood and semi-ripe cuttings of a wide range of trees and shrubs have been satisfactorily rooted on a bench allowed to cool down for 12 hours each day, by switching off the current between 10 a.m. and 10 p.m. (4). During the night and early morning, substrate tem-

peratures were kept at 21° to 24°C.

Current trials in greenhouses at Alice Holt Lodge indicate that softwood cuttings can be adequately rooted in mid-summer on totally unheated benches. Though variations in behaviour have already been noted from clone to clone, root initiation and development overall have only been delayed by a few days due to the absence of bottom heat. Cuttings of English elm, *U. procera;* Commelin elm, *U.* × *hollandica* 'Commelin'; small leaved lime; London plane; an artificial poplar hybrid between *Populus trichocarpa* and *P. deltoides;* and an unidentified willow hybrid related to *Salix daphnoides,* have rooted satisfactorily in four weeks.

Rooting Hormones. Root initiation and development of softwood cuttings of easy-to-root clones are not significantly improved by hormone application. In the case of clones known to be difficult-to-root, hormone application may increase the speed of rooting but not the number of cuttings rooted. A trial started this season to compare the effect of different formulations and concentrations of rooting hormones on cutting survival and rate of rooting of difficult-to-root clones may throw light on the problem. So far, application of proprietary powders based on indole-3-butyric acid (IBA) and 2-naphthaleneacetic acid (NAA) have improved rooting rates more than application by the quick-dip method of the same growth regulators in solution. Perhaps, not surprisingly, some concentrated solutions of IBA and NAA quickly killed the cutting base.

The tests are being carried out on cuttings from seedling sources of sycamore maple, *Acer pseudoplatanus;* sweet chestnut, *Castanea sativa;* common ash, *Fraxinus excelsior;* common (Persian)' walnut, *Juglans regia;* and gean (sweet cherry) *Prunus avium.* These are trees which yield high quality timber suitable for the manufacture of superior furniture.

LITERATURE CITED

1 Good, J E G., Bellis, J A and Munro, R C 1976 Clonal variation in rooting of softwood cuttings of woody perennials occurring naturally on derelict land *Proc. Inter Plant Prop Soc* 28· 192-201

2 Jobling, J. 1970 Aspects of propagation in forestry *Proc Inter Plant Prop Soc* 20 342-351.

3 Jobling, J 1975 Alternative to the elm *Gardeners Chronicle/Horticultural Trades Journal* 177 28-31

4 Lamb, J G.D , 1977. Effect of two temperature regimes on rooting cuttings *Proc Inter Plant Prop Soc* 27 35-37.

5 Lamb, J G D , Kelly, J C and Bowrick, P 1975 *Nursery Stock Manual* London Grower Books.

6 Matthews, J D and Jobling, J 1960. Propagation of elms and poplars from summerwood cuttings *Forestry Commission Report on Forest Research* 1960,

London, Her Majesty's Stationery Office

7 McMillan Browse, P D A 1972 Propagation for the nursery trade *A Gardeners Chronicle/Horticultural Trade Journal Handbook* 34 pp

8 Mitchell, A.F. 1974. A field guide to the trees of Britain and Northern Europe. Glasgow, Collins

VOICE: What are the growth rates of *Pterocarya*?

J. JOBLING: Oddly enough, I can and I cannot say. It is a tree that has just begun to receive attention for its fast rate of growth. While there are not many specimen trees about they occur in arboreta, like Westonbirt, Borde Hill, etc. They are not in plantation conditions and we haven't really observed them. We don't know what it does to begin with; maybe on some sites it could be frost tender — perhaps a bit like eucalyptus. I cannot really answer, suffice to say if you pick out of the league table of fast-growing trees it would lie in the first half dozen. Possibly up to 10′ a year in good conditions; at the beginning of its life perhaps more than that, but maybe on average 4 to 5′ per year.

D. CLARK: 1, *Pterocarya*, could you confirm species? 2, London Plane, do you have any easy rooting clone suitable for hardwood cuttings? 3, *Populus* — Moffats Clone, is it of economic importance to forestry? 4, *Nothofagus*, after a hard winter, any comments?

J. JOBLING: *Pterocarya* — we went to 4 to 5 different *P.* × *rehderana* trees; whether they were different or not, I don't know. *Pterocarya robellans* is a hybrid wing nut. It is mentioned in the Nursery Stock Manual and other books. I've been asked over the years by landscape architects how they can get *Populus canescens* for amenity planting — mostly as a replacement for elm. It is in the Commissions elms replacements leaflets for the countryside. It is a tree that grows extremely well in woodlands but can in some circumstances give a very valuable timber for lapping I think. It is suggested as an extremely good tree for heavy clay and therefore may be useful on man-made sites which are getting so much attention at the moment. We are beginning to plant it in gravel pits and domestic refuse sites. *Nothofagus* — there is a new publication that will be soon available; you may be advised to read this.

D.N. CLARK: *N. procera* does not grow well on limestone?

J. JOBLING: No.

H. SHEPHERD: East Malling has some clones of London planes grown from hardwood cuttings and has quite a lot of information on them.