VEGETATIVE PROPAGATION OF RIMU
(DACRYDIUM CUPRESSINUM)
WITH CUTTINGS FROM NURSERY PLANTS

A. J. Dakin*

SYNOPSIS

Nursery propagation of rimu (Dacrydium cupressinum) in New Zealand is often complicated by poor availability and quality of seed. This is due mainly to marked periodicity in fruiting and to variation in the amount of viable seed produced in any one year. This paper describes two trials in which cuttings from three-year-old nursery plants were given various treatments, including wounding and root hormone preparations, in an attempt to assist production of adventitious roots. Trial results show that rimu can be propagated successfully from terminal cuttings, set in a scoria/sand/peat medium, and rooted under mist. Speed of rooting and number of roots formed were improved by hormone powder treatments and, of the various strength powders used, Seradix 3 gave the best results. Cuttings set in November showed superiority in rooting over cuttings set in January. Wounding of the cutting base did not increase root production in cuttings set in November, but appeared to be beneficial for January set cuttings.

INTRODUCTION

Nursery production and artificial establishment of rimu (Dacrydium cupressinum) on a forestry scale in New Zealand has been of limited extent (Hinds and Reid, 1957). The species has, however, enjoyed a measure of popularity amongst horticulturists and foresters for amenity and garden plantings, and also for forestry planting on a small scale. The principal limiting factors in nursery propagation are usually the poor availability and high cost of seed brought about by marked periodicity in the fruiting of the species (Beveridge, 1964, 1973). Quantity and quality of seed vary considerably from year to year. Beveridge (1973) found at Pureora that there are periods of two to four years when little sound seed is produced. Travers (1961) also found, in south Westland, that there is a large variation in the amount of viable seed produced in any one year. Hinds and Reid (1957) stated that seed years occur infrequently and irregularly, and though a modest amount of seed is produced in intervening years, much of it is sterile. Seed collection is reported to be difficult and costly, and percentage germination in the nursery can be low. In addition, Beveridge (1964) indicated the strong possibility that birds, chiefly chaffinches, eat much seed in tree crowns.

* Forest Technical Assistant, Auckland Regional Authority, Hunua.
This variation in the availability and quality of rimu seed has led to the alternative practice of collecting young seedlings from the forest and growing these on in the nursery. However, wildling collection has limitations, due to variation in the numbers of seedlings available each year. It can also be a costly exercise in years of poor availability when several localities have to be visited to collect sufficient numbers. It also brings into question the desirability of removing quantities of seedlings from the forest, thereby depleting potential stocking in some areas. Collecting wildlings has been the chief method of obtaining rimu at Hunua over the past eight years, but collection in recent years has become more difficult. This has led to the search for alternative methods of propagation and to the cuttings trials reported in this paper.

**PREVIOUS WORK WITH *DACRYDIUM* SPECIES**

Very little specific information is available in New Zealand about asexual reproduction of *Dacrydium cupressinum*, nor indeed in the genus *Dacrydium* as a whole. Wardle (1963) described natural stem layering in *D. biforme* and *D. intermedium*, which produced adventitious roots from prostrate outer branches. This layering was most prevalent in high rainfall areas at higher altitudes. However, Cameron (1963), in studies on tree and seedling root systems, indicated that rimu was never observed to exhibit stem layering under forest conditions. A. Farnell is reported (Quinn and Rattenbury, 1972) to have successfully rooted cuttings of *D. intermedium* and *D. laxifolium*. Metcalf (1972) stated that *D. laxifolium* is readily propagated from layered pieces and cuttings. He also indicated that *D. kirkii* can be propagated from cuttings. Fisher et al. (1970) reported that propagation of *D. bidwillii* was successfully undertaken using tip cuttings 5 cm long, set in April: these had rooted by September.

Information on attempts to propagate rimu asexually appears to be absent from the literature studied. Franklin (1968) does not record any vegetative propagation of rimu. However, it has been reported (R. C. Lloyd, pers. comm.) that J. Bayer, a nurseryman at Warkworth, has successfully rooted rimu cuttings from terminal shoots. Bayer stressed that it was necessary to take the growing tip, not laterals, as these tend to run along the ground and do not assume an erect form.

Initial work at Hunua by E. B. Mearns confirmed that terminal shoot cuttings could be successfully rooted. Cuttings 15 to 20 cm long were taken from 2½-year-old plants growing under shade, treated with a commercial hormone powder (Seradix 3°—0.8% indolebutyric acid), and set in a scoria medium in June. The first roots were noted in August, and by

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*The use of trade names does not imply endorsement by the Auckland Regional Authority, nor does this imply that other materials cannot be used for the same purpose.*
November 54% of the cuttings had satisfactory root systems and were potted up. The final take was 83% by January. This initial success led to the trials reported upon in this paper, in which a comparison is made between various treatments with cuttings set in November (Trial 1) and in January (Trial 2).

**METHOD AND MATERIALS**

**Trial Treatments**

The trial involved the treatment of three cuttings batches with hormone powders of varying strengths: Seradix No. 1 (0.1% indolebutyric acid); No. 2 (0.3%); and No. 3 (0.8%). These were compared with an untreated control. In addition to this, a parallel trial was established to determine whether wounding of the basal part of the cuttings would improve root production. Wounding has been found to be beneficial in promoting root production in some *Juniperus* species (Hartmann and Kester, 1968). They found that “following wounding, callus production and root development is much heavier along the margins of the wounds, thus spreading out the regions where roots originate”. Wounding in these trials involved the removal of a small strip of bark (0.5 to 1.0 mm wide) on the base of the cuttings for a length of 2 to 2.5 cm. It was felt later that this type of wounding may have been somewhat severe on cuttings which had only a small basal diameter.

**Cutting Medium and Containers**

The medium into which the cuttings were inserted was the same as that used in the initial trial, and is a combination of materials which have proved satisfactory for a range of species grown from cuttings in the nursery. For this reason there seemed little purpose in attempting to evaluate alternative materials at this stage. Component parts of the cutting medium are 3 parts scoria (0.5 to 6.0 mm particle size), 1 part sand (0.25 to 3.0 mm), and ½ part peat shredded through a 6 mm sieve—all by volume. This medium was steam pasteurized before use.

Hartmann and Kester (1968) state that the essentials in a good cutting medium are that the medium provide sufficient porosity to allow good aeration, have a high water-holding capacity, and yet be well drained. The medium described meets these requirements very well, but this does not imply that other media will not achieve the purpose as adequately. Hartmann and Kester indicated that cutting media which contain a peat fraction tend to produce a better balanced and less brittle root system than one in which sand alone is used. Cath (1972) found in trials with *Nothofagus solandri* that a sand/peat medium gave better results than sand alone.

Containers were plastic trays 6.5 cm deep; these have an excellent drainage base, which is particularly important under mist. The medium was placed to within 0.5 cm of the top of the container.
Cutting Preparation

Stock plants were three years of age, raised from seed and grown in a sand/peat potting mixture under about 60% shade. Plants were 30 to 50 cm in height. Material for cuttings was gathered by removing a 15 to 20 cm portion of the terminal shoot, the point of severance being just above a lateral. Cuttings were made 10 to 15 cm long with basal cuts made by razor blade at about a 30° angle. Basal leaves were removed to give a clean stem section of 2.0 to 2.5 cm. The ends were dipped into the appropriate hormone powder, each cutting was tapped lightly to remove excess powder, and then was inserted into the medium to a depth of 3 cm. A dibble was used to prevent powder removal at insertion.

Environmental Conditions

Cuttings were placed, under intermittent mist controlled by an electronic leaf, on a well-drained bench, with polythene top and sides to give good light distribution. Temperature and humidity readings were taken daily, the instruments being mounted above the mist line in a shaded screen. Air temperatures during the trial period are shown in Fig. 1.

Relative humidity was recorded at 9 a.m. and 12 noon daily, and averaged 70 to 90% during the period.

The containers were rotated every month to reduce any possible position effects on the bench.

RESULTS

Initially a sample of cuttings was examined fortnightly. Later this was changed to a 20-day period and finally to a monthly examination. With Trial 1 (November) all cuttings treatments (except one) had formed first roots on some cuttings 45 days from setting. The control non-wounded treatment

Fig. 1: Monthly air temperatures in cutting bench during trial period.
### TABLE 1: PERCENTAGE OF CUTTINGS POTTED AT EACH EXAMINATION

<table>
<thead>
<tr>
<th>Treatments</th>
<th>60 n.w.</th>
<th>60 w.</th>
<th>80 n.w.</th>
<th>80 w.</th>
<th>100 n.w.</th>
<th>100 w.</th>
<th>120 n.w.</th>
<th>120 w.</th>
<th>140 n.w.</th>
<th>140 w.</th>
<th>200 Days n.w.</th>
<th>200 Days w.</th>
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n.w. = non-wounded    w. = wounded

**Trial 1.** Cuttings set 12 November

**Trial 2.** Cuttings set 10 January

Final observation on both trials made on 31 May, at 200 and 140 days from setting, respectively.
Fig. 2: Mean number of roots and mean length of longest root for cuttings in Trial 1 — 80 days after setting.

did not form first roots until 59 days from setting. In Trial 2 (January) first roots were noted in all treatments 50 days after setting. It was apparent even at this stage that treatment with Seradix 3, and to a lesser extent Seradix 2, had improved root production. After 80 days all cuttings in Trial 1 were examined, the roots were counted, and the length of the longest root was measured. These figures were averaged and the results are presented in Fig. 2.

In the absence of hormone powder treatment, or when a low-strength powder is used, wounding appears to be of some benefit.

At each examination, those cuttings which had a well-balanced root system were potted into a sand/peat potting compost. The number potted gave a measure of progress for each treatment and this information is presented in Table 1.
The term "balanced root system" was not defined quantitatively. Cuttings were selected for potting by an experienced propagator. A measure of the success of this selection is that all cuttings have survived and grown well.

The best treatment was Seradix 3/non-wounded, set in November; 75% of these cuttings were potted after 80 days. In the January trial, Seradix 3/wounded was the best treatment, with 70% of the cuttings potted after 100 days. Wounding was more beneficial with cuttings set in January; this can probably be attributed to the cutting wood being firmer than in the November setting. Figures for Trial 2 also indicate that lower-strength hormone powders (Seradix 1 and 2) have little or no advantage over the control treatments with January set cuttings.

All cuttings in Trial 1 were again examined at 200 days from setting and the numbers of adventitious roots were counted. This revealed that all cutting treatments had increased numbers of emergent roots by 17% to 66% when compared with the number at 80 days. The smallest increase was with Seradix 2 and 3 treatments, and the largest in controls and Seradix 1. Figure 3 illustrates a sample of cuttings from Trial 1 at 200 days from setting. It can be seen that control/wounded and Seradix 1/wounded have retained the early advantage, which was evident at 80 days, over the same treatments in non-wounded.

Height growth of cuttings after potting was generally good, and in Seradix 2 and 3 treatments of Trial 1 those cuttings potted up at 60 days from setting had increased height by 25 to 28% at 200 days. An examination of the stock plants from which the cuttings were taken revealed that in most cases the lateral below the point of severance had assumed the role of a terminal shoot with only slight stem deformity. This was more noticeable in the November stock plants, but not quite so marked in the January plants.

**DISCUSSION AND CONCLUSIONS**

The trial results show that rimu can be propagated successfully with cuttings taken from young nursery stock plants. Speed of rooting and number of roots formed were improved by treating cuttings with synthetic chemical compounds having auxin activity. In this particular trial Seradix 3 (0.8% indolebutyric acid) was the most successful compound used. Cuttings set in November showed superiority in rooting over cuttings set in January.

Wounding of the cutting base did not increase root production in cuttings set in November, but appeared to be beneficial with January cuttings. It is suggested that this was due to the condition of cutting wood at this time of year—i.e., greater firmness of wood owing to maturity of tissues (thickening and lignification of cell walls). Wounding in the January trial would have cut through these harder tissues and provided a better outlet for developing roots. It was suggested that the type of wounding practised may have been rather severe on some cuttings. It was noted in several wounded cuttings that root pro-
duction was more prevalent on the non-wounded side of the cutting, and this created an unbalanced root system (see Fig. 3, control/wounded). It seems that if wounding is contemplated, then only a light scoring of the stem should be done, particularly in cuttings with small basal diameters.

The best time to take and set rimu cuttings cannot be exactly determined by these trials. However, the fact that June set cuttings in earlier trials did not form roots until August, and that the November setting was successful, indicates that the optimum time may lie between August and November. Cath (1972) found that October gave best results in rooting *Nothofagus solandri* cuttings. Logically, the best time to set cuttings will be during a period when the cutting can be expected to


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**Fig. 3:** Sample of cuttings from Trial 1 — 200 days from setting.
initiate a good root system in the shortest possible time, followed by a relatively long growth period. It would seem that the spring/early summer period, when temperature and day length are increasing, and when stock plants commence active growth, may be the best time to set cuttings. However, the optimum time can be determined only by further experiments.

Temperatures in these trials were uncontrolled, and during December to February daily maximum temperatures in the cutting bench were at times high (see Fig. 1). Despite these high temperatures, no mortality was observed in cuttings. This indicates that rimu cuttings are tolerant of high temperatures and will still root successfully under these conditions. Hartmann and Kester (1968) note that excessively high air temperatures should be avoided, because this tends to promote shoot development in advance of root development. They suggest that daytime air temperatures in the cutting bed should be 21 to 27°C, with a night temperature of about 15°C; and also that a uniform temperature of near 21°C at the cutting base gives much better rooting than is obtained with widely fluctuating temperatures. It appears that the high air temperatures encountered in the November trial (in particular) may have increased the proportion of shoot to root (Fig. 3). Also, night minimum temperatures were relatively low, and this could suggest that some form of basal heat may be beneficial in maintaining warmth during cooler periods. However, bottom heat may be of little advantage during the warmer months (December to February), and probably some method of reducing air temperatures would be more advantageous at that time of year. Bottom heat may also be useful in initiating root development earlier in the season, but the cost of such extra equipment would have to be balanced against the expected improvement in root production. Again further experiments are necessary to decide some of the above points.

Hartmann and Kester (1968) note: “In rooting cuttings taken from individual plants of a species which ordinarily is propagated from seed, experience has shown that wide differences may exist among individuals in the ease with which cuttings taken from them form roots”. This occurs with rimu as revealed in Table 1, in which rooting took place over a long period. For example, 75% of cuttings in the Seradix 3/non-wounded treatment (Trial 1) had rooted and were potted up at 80 days. However, the remaining 25% showed marked variation in rooting ability and a further 120 days elapsed before the last cuttings were potted. Besides the time factor involved, the cuttings in this final 25% had progressively poorer root systems and this, plus the cooler temperatures during this period, inhibited shoot growth after potting. There would seem to be little advantage in retaining late-rooting cuttings after the initial 70 to 80% of a batch have rooted.

The cuttings used in these trials were from terminal shoots on stock plants. Clearly some advantage would be gained if laterals could be used. Stock plants would produce more cuttings and no stem deformity would result. This point may be of importance in horticultural production where plants are offered for sale. However, if the findings of Bayer mentioned
earlier (that lateral cuttings do not achieve an upright form) is correct, then taking lateral cuttings could pose some problems. Rimu often exhibits a marked weeping habit in lateral branches, even in young plants, and some diverse results could be expected if such material is used. Hartmann and Kester remark on the variation in rooting that can take place with cuttings from different positions on the same plant. This being the case, it is possible that upright lateral cuttings, selected from near the apex of the stock plant, may grow into erect plants. Further trials have been initiated to test this possibility.

In conclusion, it can be said that the propagation of rimu from cuttings, as described in this paper, offers an attractive alternative to current methods of nursery production of the species.

ACKNOWLEDGEMENTS

I am particularly grateful to E. B. Mearns who conducted the initial rimu trial, and also assisted with cutting measurements. The assistance of B. R. McClure, who was involved in all stages of cutting preparation and measurement is also gratefully acknowledged.

I am also indebted to I. L. Barton for his helpful criticism of the original draft of this paper.

REFERENCES