The Propagation of Australian Native Plants from Cuttings at the Australian National Botanic Gardens (ANBG)

Paul Carmen
Australian National Botanic Gardens, GPO Box 1777, Canberra ACT 2601

INTRODUCTION

The Australian National Botanic Gardens (ANBG) is a major scientific and educational resource, and has the world's most comprehensive display of living Australian native plants.

The ANBG occupies 90 ha on the lower slopes of Black Mountain in Canberra, together with 80 ha at Jervis Bay (Jervis Bay Botanic Gardens). There are approximately 91,000 plants, representing more than 5,900 taxa, growing at the ANBG. These plants are held in open-ground plantings, permanent pot collections and in glasshouses.

The objectives of the ANBG are to grow, study, and promote Australia's indigenous flora and vegetative propagation plays a major role in the achievement of these objectives.

VEGETATIVE PROPAGATION

A significant function of the ANBG's study and display of the Australian flora is the correct identification of plants. The maintenance of this attribute is guaranteed by vegetative or clonal propagation.

The preferred method of propagation is by the use of cuttings because they are easy to prepare, and are successful with a wide range of species. Grafts have been used when plants have either shown a susceptibility to root fungi or are difficult; however, for long-term clonal continuity, vegetative propagation is essential.

The nursery at the ANBG propagates approximately 500 plant species from cuttings each year and produces more than 12,000 plants.

COLLECTION OF CUTTING MATERIAL

Field Collection. Most of the plant material entering the gardens is collected on field trips, by staff or other authorised collectors.

After collection, cutting material is wrapped in wet newspaper and then placed in plastic bags and kept cool either in an esky or a portable refrigerator. Plant material prepared in this way will keep fresh for several days; this allows time for collection from remote locations.

Collection within the Gardens. Repropagation of existing collections is carried out throughout the year. Lists of the plants required are prepared and staff use reference maps to locate particular stock plants. Clear plastic bags are used to store cutting material, which is collected in the morning to minimise stress. Bags are kept out of direct sunlight whenever possible and a small amount of water is sprayed over cutting material. When the plant material reaches the nursery the bags are placed in a refrigerator and kept at approximately 4C.

PREPARATION OF CUTTING MATERIAL

The cutting material selected is usually semi-firm new growth and cuttings are taken initially at a length of about 150 mm when possible. Preparation involves the retention of two to three sets of leaves at the apical end of the cutting. The other leaves are stripped away, taking care to make sure that the stem is not damaged. The cuttings are then held between the thumb and index finger which are lined up with either the first or second node below the bottom set of leaves. The basal ends of the cuttings are then cut just below the fingers and immediately dipped in the hormone solution for a maximum of 5 sec depending on the softness of the plant material. The purpose of this procedure is:

1) To limit the length of the cutting—especially the distance between where the roots will form and the bottom leaves. This will mean that the cutting will not become top heavy later and be difficult to prune.

2) To make a fresh cut on the cuttings—the removal of at least 3 cm of the stem opens the transpiration stream and allows the cutting to take up the liquid hormone.

3) To make all cuttings the same length so they can be dipped to give uniform uptake of the hormone.

After dipping, the cuttings are put to one side for a minute or two to allow excess liquid to evaporate. They are then placed in punnets of cutting mix so that the bottom leaves of each cutting are just above the surface. The cuttings are then gently firmed down and watered before placing in the propagation house. All cuttings are drenched with an eradicant, systemic fungicide and this is repeated on a weekly basis.

MEDIUM

The cutting propagation medium used at the ANBG is 5 perlite : 1 peat (v/v), which is mixed before being steam sterilised for 15 min. With an air-filled porosity of about 35%, this mix has excellent drainage and supports healthy root growth. It has a number of advantages:

1) Roots form uniformly throughout the mix because the air space is uniformly distributed throughout the mix.

2) It is easy to check whether cuttings are rooted by giving a gentle tug. (Mixes which contain sand tend to be come compacted and tight around the cuttings, *making it difficult to tell whether they are rooted or not.)*

3) Rooted cuttings are easy to extract without damage—this is especially relevant for cuttings with brittle roots, for example some *Grevillea* spp., *Hakea* spp., and *Acacia* spp.

PROPAGATION STRUCTURE

The ANBG propagation glasshouse uses a fogging system with the fog produced by the compressed air method. This method gives a droplet size of between 10 and 20 microns. Controls are set for 90% relative humidity throughout the year.

The glasshouse is covered with shade cloth which provides a 50% reduction of light. Propagation benches have electric cables for heating and the temperature is maintained at 24C for most of the year but is reduced to 15C during the hotter months.

SELECTION OF TREATMENT

Selection of treatment or hormone is made by the analysis of information provided by the ANBG computer data base (IBIS - Integrated Botanical Information System). This system allows data input and processing for all aspects of the ANBG's operations including the living collections, herbarium, and research.

It is an easily accessible source of information about all plants that have been collected and propagated in the gardens. Propagation history includes the range of hormones used, date of application, number of cuttings made, strike rates, and present location of cuttings or plants.

When propagation has been difficult, unsuccessful, or a new species is being tried, it is treated as a mini trial with 2 or more hormone treatments used. This procedure is continued until all feasible variations are tried or plants are successfully propagated. Analysis of the information stored by IBIS allows accurate assessment of propagation history and the elimination of repetitious treatments.

HORMONES AND OTHER TREATMENTS

Auxins. Indole-3-butyric acid (IBA) has been found to be the most effective rooting hormone for a wide range of Australian native plants at the ANBG. However, combinations of IBA and NAA (naphthaleneacetic acid) are also effective for many taxa. All rooting hormones used at the ANBG are liquid (Ellyard, 1981a) and are made by dissolving pure hormone in a 50% ethanol/water solution. The hormones are stored in light-excluding bottles in a refrigerator and when used, a small quantity is poured into a petrie dish. The petrie dish is kept covered when not in use to minimise evaporation and possible contamination. At the end of each day all used hormone is poured into a jar and kept for safe disposal.

The response to rooting hormone treatments may vary from species to species and at different times of the year. In many cases, cuttings will strike without the use of hormones; however, hormones frequently speed up the process, improve root systems, and provide more uniform results. The list below indicates some treatments which have been found to be consistently successful for the families and genera indicated.

1) 500 ppm IBA / 500 ppm NAA
   Asteraceae: *Brachyscome*, *Cassinia*, *Helichrysum*, *Senecio*
   Chenopodiaceae: *Maireana*, *Rhagodia*, *Atriplex*
   Cunoniaceae: *Bauera*, *Ceratopetalum*
   Epacridaceae: *Epacris*
   Goodeniaceae: *Dampiera*, *Goodenia*, *Lechenaultia*, *Scaevola*
   Fabaceae: *Dillwynia*, *Hardenbergia*, *Pultenaea*
   Myrtaceae: *Calytrix*, *Darwinia*, *Kunzea*, *Leptospermum*
   Rutaceae: *Boronia*, *Crowea*, *Zieria*

2) 1,000 ppm IBA / 250 ppm NAA
   Rutaceae: *Boronia*, *Zieria*

3) 2,000 ppm IBA
   Cunoniaceae: *Bauera*, *Ceratopetalum*
   Dilleniaceae: *Hibbertia*

Fabaceae: *Pultenaea*
Goodeniaceae: *Scaevola*
Lamiaceae: *Prostanthera*, *Westringia*, *Hemigenia*
Myrtaceae: *Melaleuca*, *Baeckea*, *Darwinia*, *Kunzea*
Rutaceae: *Eriostemon*
Sapindaceae: *Dodonaea*
Thymelaeaceae: *Pimelea*

4) 4,000 ppm IBA
Araliaceae: *Astrotricha*
Fabaceae: *Bossiaea*
Myrtaceae: *Callistemon*, *Calothamnus*, *Eremaea*
Proteaceae: *Telopea*, *Lambertia*, *Grevillea*, *Adenanthos*, *Isopogon*, *Petrophile*
Rhamnaceae: *Pomaderris*

5) 4,000 ppm IBA / 2,000 ppm NAA
Rutaceae: *Eriostemon*

6) 6,000 ppm IBA
Mimosaceae: *Acacia*
Proteaceae: *Hakea*, *Banksia*, *Persoonia*

7) 1,000 ppm IBA / 200 ppm NAA / 200 ppm 2,4-D (Ellyard, 1981b)
Proteaceae: *Persoonia*

Cytokinins. Some trials have been carried out on those *Acacia* species which have compound leaves and other taxa that have a tendency to drop leaves quickly after cutting. Soaking the basal ends of cuttings in a solution containing kinetin before dipping in an IBA solution has given some encouraging results. (Richmond and Lang, 1957; Mothes and Englebrecht, 1961).

CONCLUSIONS

The propagation system used at the ANBG has produced good results given the wide range of taxa being attempted. Using the methods and the computerised recording techniques outlined above, we are succeeding in propagating difficult and hitherto untried taxa.

LITERATURE CITED

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