Grafting of *Chamelaucium* Cultivars©

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WHY GRAFT?

The genus *Chamelaucium* consists of a group of medium- to tall-growing shrubs native to the southern and central areas of Western Australia. It is widely cultivated over much of Australia for cut flower production. There is extensive production in southern Queensland and most of the early waxflower exports from Australia emanate from the Toowoomba, Darling Downs, and Lockyer Valley districts of Queensland.

Most *Chamelaucium* forms are highly susceptible to the soil-borne fungus *Phytophthora cinnamomi*, or root rot fungus. The poorly drained heavy soils of south Queensland and the intense summer rainfall make the spread of the fungal spores in waxflower plantations very rapid and many waxflower growers experience significant plant losses during each summer growing period. It is not uncommon for south Queensland waxflower growers to suffer losses of 10% of plants per year with cutting-propagated plants. This level of loss makes waxflower plantations uneconomic and profitability within the industry is poor as a result.

There is a commercial waxflower plantation in the Lockyer Valley that has experienced severe plant loss through *P. cinnamomi* infection over the past 10 years. However, a small number of waxflower selections and other related Myrtaceae selections growing in this plantation have never shown any significant losses to this fungus. The plantation manager, Mr. Ken Young, discussed this observation with me in the mid 1990s and we decided to explore the possibility of developing a suitable system of grafting of waxflower selections onto these apparently *Phytophthora* resistant or tolerant selections.

GRAFTING TRIALS

There was no literature available on grafting of *Chamelaucium* so I set up small-scale trials to determine if any conventional grafting techniques would be successful. With commercial grafting of ornamental and fruiting plants in the nursery trade, there are two main systems of grafting used.

1) Top Grafting. With this system the top of the rootstock is removed at an appropriate height above soil level and the scion of the cultivated cultivar grafted in its place. There are many forms of top grafting, including whip grafting, whip and tongue grafting, and cleft grafting.

I was trained in the belief that the simplest and quickest graft to perform is the one to use so I decided to try the whip graft.

2) Side Grafting. There are a number of plants including many ornamental conifers that do not graft successfully if the top is cut off the rootstock. Conifers are normally grafted using a side-grafting technique and the top of the rootstock is not removed until after the graft union has formed.

In my initial trials I decided to compare the whip graft with the side veneer graft to gain some initial understanding of the most appropriate grafting technique.

In my trials, the side-grafting technique proved to be significantly better than the whip graft. The side veneer graft gave a success rate of 93%, while the whip graft only managed 52%. On the basis of these results I have continued using the side-grafting technique in preference to top grafting.

THE GENETIC IDENTITY OF THE ROOTSTOCKS

The waxflower and related Myrtaceae selections that we are using as rootstocks cannot be protected under Plant Breeders Rights (PBR) or Plant Patents as they are all public domain material. Therefore, to maintain a commercial advantage in the development of this process to a commercial conclusion it has been necessary to maintain commercial confidentiality over the genetic identity of the rootstock selections. These selections are only identified using a series of code letters and numbers, e.g., A2, B4C4, and D2E2.

Inoculation studies using cultures of *P. cinnamomi* have been carried out at the University of Queensland and the Department of Agriculture in Western Australia and both studies have shown the rootstock selections to have a high level of resistance to *P. cinnamomi*.

Up to this time, our studies using these rootstocks have been confined to a number of sites in south Queensland. We are not able to draw any conclusions on their performance in other areas of Australia, however, a number of grafted plants will be supplied to growers in other areas later this year for wider evaluation of their performance.

When grafted plants are planted out in a field plantation, it is essential that the graft union remains above soil level. The principal objective of this form of grafting is to produce a plant that will grow in root-rot-infected soil. If the root-rot-susceptible scion stem comes in contact with soil, splash of spores into the graft union may transmit the disease into the susceptible part of the grafted plant. Deep planting also creates the possibility of scion root development. This must be avoided as it provides the pathogen with free entry into the susceptible scion cultivar.

ROOTSTOCK PROPAGATION

Propagation of the rootstocks is by softwood tip cuttings. Best results have been obtained when propagating through spring and summer. Lower strike rates can be expected if propagating after flower bud initiation has taken place.

The terminal softwood cuttings are trimmed, graded to a uniform 10-cm size and the basal 3 cm of leaves are removed. The cuttings are dipped in 4000 mg litre^{-1} IBA liquid preparation (Rootex L®) prior to planting. The propagation container used is the Jiffy Strip 515 compressed fibre container. The Jiffy Strips are filled with a propagation medium consisting of equal parts sphagnum peat, perlite, and vermiculite. Mini Osmocote® is incorporated in the medium at the rate of 1 kg m^{-1}.

It is essential that the Jiffy Strips are thoroughly wetted before sticking of the cuttings.

The trays of cuttings are then placed in a fibreglass propagation greenhouse. The greenhouse is equipped with open-topped weldmesh benches with 12-mm black poly heating pipes spaced at 10 cm spacing. Warm water is circulated through the bench heating system to maintain a minimum temperature of 25°C.

The greenhouse is equipped with a high-pressure fogging system, which is set to maintain 90% relative humidity. Humidity control is via a humidity sensor. There is an internal shadecloth screen in position to provide shade throughout the year. During the summer months an additional layer of external shadecloth is used to provide further light reduction.

The open-topped benches and the warm-water heating system combine to produce a strong air-pruning effect on the roots as they emerge through the walls of the Jiffy Strips. This has provided a dramatic improvement to root system quality.

Root development is well advanced after 4 weeks and the trays are removed from the heated benches for hardening off. Two weeks of hardening is adequate and then the rooted cuttings are sorted for potting. The success rate varies with the different selections but is regularly within the 80% to 90% range.

The rooted cuttings are then potted up into deep square native tubes with the Jiffy Strips left intact and when the plants are well established in the native tubes the grafting process can commence. The potting mix used at University of Queensland Gatton is composted pine bark, aged hardwood sawdust, and coarse sand (2 : 2 : 1, by volume). Rootstocks can be grafted around 10 to 12 weeks after propagation commenced. However, the stems of the rootstocks are still very thin at this time and grafting onto thin pliable stems is a considerable challenge.

METHOD OF GRAFTING

As discussed previously, my preferred method of grafting is the side veneer graft. Scion material for grafting is collected from stock plants (either container or field grown). Young non-flowering shoot tips are preferred. My preferred time of grafting of waxflowers is from November to May. During the warmer months the plants (both rootstocks and scions) are in active growth and this appears to give better results. We can get quite good results with grafting in winter but *Botrytis cinerea* (grey mould) causes serious problems in the high humidity propagation house.

At the time of grafting the stem of the rootstock is typically 1 to 2 mm thick. The leaves are manually removed from the bottom 5 cm of the stem of the rootstock. My preferred position for the graft union is approx 3 cm above the level of the potting mix in the container.

Grafting should be carried out using a sharp knife or a sharp scalpel. A very thin slice of bark is removed from the side of the rootstock, 1.5 to 2 cm long. Care must be taken to avoid cutting too deep as the rootstocks are very thin and are easily broken. The soft terminal portion of the scion is removed. A scion, 3 to 6 cm long, is satisfactory and the scion wood should be developing a woody appearance. A corresponding cut is made at the base of the scion and the two cut surfaces are fitted together.

Tying is accomplished using thin strips (1 cm wide) of laboratory film such as Parafilm®. This is a transparent stretchable film that is wrapped tightly around the area of the graft. The film must be stretched during application to ensure that the graft union is watertight. The very thin stems of rootstock and scion make tying of the graft quite a challenge. Care during tying is essential to prevent misalignment of the cut surfaces.

THE GRAFT ENVIRONMENT

Newly grafted plants must not be allowed to dry out otherwise desiccation of the

scions will occur. On the other hand, it is essential to avoid overly wet conditions otherwise *Botrytis* and other foliar diseases will be troublesome. The challenge for the plant propagator is always to provide a happy medium.

At University of Queensland (UQ) Gatton, newly grafted plants are placed in the same high humidity propagation house in which the rootstock cuttings were propagated. Spun-bonded polyester sheets of white Marix® cloth are draped over the benches for the first 7 to 10 days. This helps to maintain localised high humidity under the cloth and prevents over wetting from occurring.

After 7 to 10 days the Marix cloth is removed. By this time the graft union is starting to develop. Improved air circulation around the tops of the grafted plants helps in the management of foliar diseases.

It has become standard practice at UQ Gatton to cut back the rootstock tops 14 days after grafting. This is done using sharp secateurs or trimmers. The top is cut off flush with the top of the graft union. Within 6 months the graft union will swell to the point where the top of the rootstock is enveloped into the graft and will no longer be visible.

The grafted plants spend a total of 3 weeks in the high humidity propagation house and are then transferred to a growing-on greenhouse that has higher light conditions. During this period considerable rootstock sideshoot development will occur and for the first few months after grafting regular rootstock sideshoot removal must be carried out. It is essential that ALL sideshoots are removed otherwise they can outgrow the scion selection.

As soon as new growth from the scion commences, the grafted plants can be moved out into full sun outdoor beds for growing on. Some light trimming of the new growth from the scions is necessary to develop a bushy framework of shoots.

During summer and autumn at UQ Gatton, top growth on the newly grafted plants is rapid and they are ready for planting or potting up approximately 8 to 10 weeks after grafting. During winter, growth rates will be much slower.

THE BENEFITS OF GRAFTED PLANTS TO THE WAXFLOWER INDUSTRY

As previously discussed, *P. cinnamomi* causes severe problems in the waxflower industry in south Queensland. During 1998, a large trial of grafted plants of the selections Purple Pride, Winter White, and Iceberg was planted in a waxflower plantation close to UQ Gatton. There are approx 2500 grafted plants on four different rootstock selections in this block. As far as we can ascertain, this block of grafted plants is the largest block of grafted Australian native plants established anywhere in Australia.

The benefits of using grafted plants can be summarised as follows:

- Built in resistance to *Phytophthora* root rot.
- Ensures long term survival of plants in the field.
- Grafted plants are more vigorous and uniform in growth.
- Grafted plants require less fungicide use, this represents a reduced cost to the grower and there are additional environmental benefits.

In south Queensland there is also a strong retail demand for waxflower plants sold in flower in spring. All of the plants supplied to this market are cutting grown and there is a very high mortality rate for plants sold in pots in spring. A large proportion of plants sold in September will not be alive by Christmas.

At UQ Gatton we believe that a strong retail demand for grafted waxflower plants can be established and we are undertaking a trial marketing of three cultivars of grafted plants in association with a Brisbane nursery during Spring 2000. Three cultivars, Purple Pride, Wanneroo, and Lady Stephanie, will be available this year. Small-scale trials of a selection of newer waxflower types is also under way and it is likely that some of these will be introduced to the retail trade in 2001.

Tasmanian Plants for Cut Flower, Foliage, and Food Plants©

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This is a very broad topic to cover in 20 minutes! I am, therefore, going to confine myself to the actual products that are at present being cultivated or bush harvested in Tasmania. The propagation of most species has been on a small scale with some species, such as *Pimelea nivea* (bushmans bootlace), for the cut flower export market proving to be difficult. The quality of the stock plant material is critical with plants of not more than 5 years old providing the greatest strike rate. The plants grown under optimum conditions present us with material that has a much greater chance of success.

Telopea truncata (Tasmanian waratah) has been harvested under license but some small plantations are under cultivation on the west coast of Tasmania, at a place called Waratah. Some years ago a lot of research was conducted into this magnificent flower. The colour forms from locations around the state have been collected. These are being grown along with mainland species that may be more attractive to overseas markets.

This brings me to the bush harvest in conjunction with the cultivation of *Drimys lanceolata* (syn. *Tasmannia lanceolata*) (mountain or native pepper). The industry is well underway with quality products being freely available in our local supermarkets and speciality stores. Like *T. truncata*, the cultivation of these plants is proving to be a challenge to growers and propagators. *Tasmannia lanceolata* seems to be susceptible to fungal problems and bushes that have grown well for 5 years or more can succumb. Some forms are proving to be hardier, such as, the small-leafed alpine form. This is a most attractive plant, having all the same culinary properties as the larger leafed form, but providing an ideal container plant. Softwood cuttings are taken in May – July from selected sexed plants. The rootstock of the alpine form may be able to be grafted onto the large leaf form but I have not tried this as yet.

Seedlings of *T. lanceolata* result in much stronger plants. Bush harvesting will continue however as the time factor of 4 years to germinate, and longer before berry production and therefore the determination of female plants, is a major drawback.

Richea dracophylla (dragon's heath) is a cut-foliage plant being trialed and proving reliable, given a protected cool root system with good drainage and ample water. All material to my knowledge is bush harvested. Seed is collected from the flowering spikes in late spring, the seed is extremely fine. Seed is sown fresh or cool stored. Germination rate is high.