

New Approaches to Recalcitrant Species Propagation — Never, Never, Never, Ever Give Up[©]

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OVERVIEW

This presentation will cover the following:

- Background to natural area business.
- Propagation in our market and our experience and approach.
- Propagation and treatment methods.
- Success to date and some future targets species.
- Nursery financial and performance implications.
- Relevance to IPPS and this audience.

BACKGROUND

This presentation is about the ways in which we have pursued propagation of recalcitrant and difficult species, mainly from seed and the benefits that have accrued to the business. For us, it's been about deciding that standing still is not an option and non-stop product development is the way to drive our market, motivate our staff, and enhance our broader environment business.

Our Nursery

Natural Area operates in contracting, consulting, and supplies for the management, maintenance, and rehabilitation of natural habitat areas in Perth metro and regions with all operations integrated to provide a comprehensive in-house service. Our staff total is 43 going to 50 in peak season.

Stock is produced for in house company projects and for outside revegetation and natural landscape markets. We produce approximately 300 species mainly Perth provenance. Current volume is 650,000 units split between contract production (40%) specific production (60%). Our focus is on difficult-to-grow species and bringing new species into production. We anticipate client needs and back ourselves to promote sales to project users.

Where our plants go:

- Coastal rehabilitation
- Woodland rehabilitation
- Riverine rehabilitation
- Wetland rehabilitation

Our Propagation Market

Western Australia (WA) has 13,500 naturally occurring plant species and less than half have ever been propagated. Perth plain species total about 2,200, 50% endemic to Southwest WA. Many exhibit high levels of seed dormancy and successful techniques for many are not well documented. Generally no more than a third of these would be available in market at any one time and many in low numbers.

Our market is full of propagation challenges and opportunities. Propagation from seed is considered highest and best for restoration and rehabilitation. Cuttings do not always perform well in dry land revegetation. Tissue is important to meet essential species return but not always cost recoverable. Vegetative propagation from cuttings is not as important to us as it is being done well by others and does not provide us with an economic point of difference but plant salvage and division figures highly for us as it connects with our on ground presence.

We started propagation 14 years ago, but after the first few years realised that there were many plants which were important to our revegetation business and the broader

market that we did not know how to grow and the market demand was not being met. It would have been easy to accept that it was all too hard and that we would stick to the sausage plants, you know the ones that many nurseries grow because they are relatively safe, this is the conventional wisdom. We took the view that our reputation and our returns would be enhanced by tackling the hard ones. This often involved unconventional approaches and a willingness to experiment and speculate.

This has been a long road, starting from a low knowledge base and we are now seeing the benefits flow from the early decision and ongoing work. Many plants, which we thought impossible from seed in the early years, are now within our capability (Table 1).

I am talking about propagation difficulties due to various forms of seed dormancy, varying viability as well as seed that either cannot be isolated from the host plant, or that most commercial seed collectors will not collect because it is uneconomic for them to do so.

SEED GERMINATION

Experience has shown us that:

- Seed from outside collectors often performs badly.
- Seed from different locations and collected at different times can show significant variance in viability.
- Propagating specialist native species requires understanding and involvement in the on ground habitats.
- Obtaining specialist vegetative material requires rigorous pursuit of collection opportunities, e.g., land clearing applications and seed collection opportunities.

Our Approach

- Study all available literature and references to target species.
- Pursue botanical gardens authorities or universities for their research and practical experience. (It's often publicly funded and therefore should be available to propagators.)
- Study the plant in its natural habitat and different locations and understand the natural processes/replicate the natural processes.
- Collect and buy in seed from a wide range of locations. In any one season we would collect seed from over 200 sites in and outside Perth.
- Pursue established methods and if not successful, go radical.
- If we can't isolate seed, we take the mature inflorescence and process it.
- Genera often the guide to what will work.
- Some species require immediate sowing after collection. Viability can be lost rapidly.
- Important to maintain detailed and accurate propagation records and techniques employed, both successes and failures.
- Staff needs to be informed on protection of company ownership of intellectual property.
- We use enzymes to remove thick fleshy coats.
- We treat damp prone species seed with fungicide pre sowing.
- We use wetting agent when preparing to imbibe seeds.
- We use granulated fungicide on potting for damp prone species.
- We use hormone on root cuts to improve survival.

Propagation Methods/Treatment Options

1. Isolated Seed.

- Weathering.
- Manual scarification (small numbers).
- Hot and or cold water treatment, often repetitive.
- Concentrated acid exposure (H_2SO_4).
- Extended conventional sowing (Patience, don't throw out those seed trays).
- Temperature stratification, hot and/or cold.
- Variable stratification.
- Extended imbibitions (deionised or rain water with wetting agent or smoked water).

- It may be unconventional but we have had high success in some cases from soaking particular seed for anything up to 14 days.
- Physical smoke: Often for extended periods up to 1 week.
- Heat: We are surprised by the resilience of some seeds to high heat (100°C and beyond) and their response.
- Light: Some seeds require light to germinate and a carefully controlled surface sow is essential.
- Extended burial.
- Inoculants and fungi are added to selected species.
- Exposure to plant hormones, e.g., gibberellic acid, jasmonic acid, and abscisic acid.

Our experience suggests that often a combination of treatments can yield results. We don't get too carried away with the science behind all this. We are not doing research; we are trying to get an outcome, a business result and one that we can learn from.

2. Unisolated Seed. Some species hold seed for extended periods and isolation of seed is either very difficult or not commercial. The solution may be to depart from the desire to isolate clean seed and harvest the entire inflorescence and sow in mass. We have had outstanding success with a number of species using this method.

Key targets for future work include: *Astroloma*, *Conostephium*, *Cyperaceae*, *Ericaceae*, *Liliaceae*, *Mesomelaena*, *Schoenus*, *Tetraria*, and *Tricoryne* sp.

NURSERY BUSINESS IMPLICATION

Being a specialist propagation nursery is generating sales prices at levels of between 50 to 250% above industry tube stock (sausage plant) average price.

They represent about 10% of our production but produce over 25% of our gross sales revenue and 40% of our pre-tax bottom line. Our net profit before taxes and dividends has ranged from 27 to 33% of sales. If we did not do this and substituted more of the straight forward lines our net profit before tax would fall to well below 20% of sales.

Importantly, being a go to firm for the difficult species leads to new customers and complimentary sales of the easier plants often without downward price pressure. We are in a position also to say that if you only want the hard to grow stock then maybe we will sell them to someone else, therefore becoming a price maker and not price taker.

The enhancement of our reputation has extended to cases where we are being paid for advanced propagation services regardless of outcome, i.e., where particular and not previously grown plants are requested, we are being paid for the attempted propagation and not a per plant price outcome. We intend to press for more such arrangements in the future.

Our nursery capability enhances our revegetation reputation and provides a competitive advantage. Being able to guarantee inclusion of specialist plants in revegetation project plans and tenders can get us over the line ahead of other revegetation contractors who are not growers.

The benefits from pursuing difficult propagation also include strong staff interest in outcomes, their willingness to trial and be proactive, development of high end staff skills in botanical development, and potential to develop plants for the broader landscape market.

Table 1. Cases of species propagated from seed considered recalcitrant or often difficult.

| Family | Genus | Species |
|--|----------------------|------------------------|
| <i>Apocynaceae</i> | <i>Alyxia</i> | <i>buxifolia</i> |
| <i>Laxmanniaceae</i> (including <i>Lomandraceae</i>) | <i>Acanthocarpus</i> | <i>preissii</i> |
| | <i>Laxmannia</i> | <i>squarrosa</i> |
| | <i>Lomandra</i> | <i>maritima</i> |
| | <i>Dichopogon</i> | <i>capillipes</i> |
| <i>Amaranthaceae</i> | <i>Atriplex</i> | <i>cineria</i> |
| | <i>Atriplex</i> | <i>isatidea</i> |
| | <i>Atriplex</i> | <i>hypoleuca</i> |
| <i>Cyperaceae</i> | <i>Machaerina</i> | <i>articulata</i> |
| | <i>Machaerina</i> | <i>juncea</i> |
| | <i>Machaerina</i> | <i>preissii</i> |
| | <i>Chorizandra</i> | <i>enodis</i> |
| | <i>Cyathochaeta</i> | <i>avenacea</i> |
| | <i>Gahnia</i> | <i>trifida</i> |
| | <i>Lepidosperma</i> | <i>calcicola</i> |
| | <i>Lepidosperma</i> | <i>gladiatum</i> |
| | <i>Lepidosperma</i> | <i>effusum</i> |
| | <i>Lepidosperma</i> | <i>longitudinale</i> |
| | <i>Lepidosperma</i> | <i>persecans</i> |
| <i>Dasygogonaceae</i> | <i>Dasygogon</i> | <i>bromeliifolius</i> |
| <i>Dilleniaceae</i> | <i>Hibbertia</i> | <i>hypericoides</i> |
| | <i>Hibbertia</i> | <i>subvaginata</i> |
| <i>Epacridaceae</i> | <i>Brachyloma</i> | <i>preissii</i> |
| <i>Ericaceae</i> | <i>Leucopogon</i> | <i>conostephioides</i> |
| | <i>Leucopogon</i> | <i>parviflorus</i> |
| | <i>Leucopogon</i> | <i>propinquus</i> |
| <i>Frankeniaceae</i> | <i>Frankenia</i> | <i>pauciflora</i> |
| <i>Haemodoraceae</i> | <i>Phlebocarya</i> | <i>ciliata</i> |
| <i>Iridaceae</i> | <i>Orthrosanthus</i> | <i>laxus</i> |
| <i>Loranthaceae</i> | <i>Nuytsia</i> | <i>floribunda</i> |
| <i>Poaceae</i> | <i>Spinifex</i> | <i>hirsutus</i> |
| | <i>Spinifex</i> | <i>longifolius</i> |
| | <i>Sporobolus</i> | <i>virginicus</i> |
| | <i>Triodia</i> | <i>epactia</i> |
| | <i>Triodia</i> | <i>wiseana</i> |
| <i>Proteaceae</i> | <i>Conospermum</i> | <i>stoechadis</i> |
| | <i>Conospermum</i> | <i>triplinervium</i> |
| <i>Ranunculaceae</i> | <i>Clematis</i> | <i>linearifolia</i> |
| <i>Restionaceae</i> | <i>Desmocladius</i> | <i>flexuosus</i> |
| | <i>Dielsia</i> | <i>stenostachya</i> |
| | <i>Hypolaena</i> | <i>exsulca</i> |
| | <i>Lepidobolus</i> | <i>preissianus</i> |
| <i>Rutaceae</i> | <i>Diplolaena</i> | <i>dampieri</i> |
| | <i>Diplolaena</i> | <i>angustifolia</i> |
| <i>Santalaceae</i> | <i>Exocarpos</i> | <i>sparteus</i> |
| | <i>Leptomeria</i> | <i>preissiana</i> |
| | <i>Santalum</i> | <i>acuminatum</i> |

RELEVANCE TO IPPS AND THIS AUDIENCE

Potential for New Members from the Native Plant and Revegetation Sector

There is potential for sharing of specific information across the jurisdictions and I am keen to continue my visits to discuss techniques with other IPPS connected growers.

My limited reading suggests that there are some propagation challenges within the suite of endemic New Zealand plants. I made a list of 13 genera where some common ground exists. I hope we can share now and into the future.

In a business sense, it seems logical to me for growers to continually seek out niches in the market by going down paths different from their competitors.

Whilst we are not retailers, there is much potential to bring new and rarely seen plants to a broader audience.

CLOSE

Everyone here understands how important plants are to the world and all other life forms. I hope that you as growers realise how important you are to the health and wellbeing of the environments in which we live. All of us should feel very good about what we do.

The sharing of knowledge and information and competition within in our respective markets is a difficult balancing act. We are here to share and at the same time, obliged to protect our personal commercial interests. Passing on knowledge within our industry is important and we need to recognise that the next generation will see the world very differently from the way we see it. Personally, I am still trying to determine if I will be able to find anyone to continue our work with passion and commitment. The challenge is with us to find a way. It may be done differently but what will never change is the need to belong and communicate.

Meantime, we have been diligent in recording all we have learned about the plants that we have grown and look forward to sharing more over the times ahead.

Thanks to IPPS and our Kiwi hosts. I hope that all of you will look hard at attending future IPPS conferences and especially the 2017 event that we will host in Perth, Western Australia. Put it on your must do list and we will make sure you are well looked after.

