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Supporting and Advancing Australian Plant Breeding

Australian plant breeders have developed many improved native trees and shrubs that are widely sold in Australia and planted in gardens. A small number of companies are exporting the intellectual property of innovative native plants suitable for seasonal potted colour and bedding to overseas markets and reversing the traditional flow of royalties. A few have had international success with exotics such as proteas, petunias and Madeira daisies. Other organisations are hoping for international sales. While there are some great success stories, the breeders and marketers we surveyed signposted numerous difficulties in breeding and marketing new plants. In this Nursery Paper, the second of a two-part series on plant breeding, horticultural writer Helen Moody examines a number of issues that could be addressed to give greater support to Australian plant breeding.



Melaleuca 'Allyn Serenity', bred at Riverdene Nurseries is a profusely flowering 3m tall shrub, selected for its nicely coloured broad foliage.

Supporting and Advancing Australian Plant Breeding

At a time when Australian manufacturing businesses are shedding staff and moving production offshore, it is gratifying to be able to report that some businesses in the Australian nursery industry are reversing the trend. After so many years of watching overseas breeders develop Australian flora, Australian breeders are now commercialising our native plants and exporting them (or the intellectual property associated with them).

New release plants are popular with consumers. Promotion and media publicity stimulates interest and creates considerable demand for new plants. On the world market our competitive edge lies in our unique and diverse native flora. But plants cannot just be plucked from the wild and marketed, and breeding isn't an end in itself. Transforming novel plants into viable commercial products that satisfy the demands of both producers and consumers is no easy task, and the difficulties are multiplied if the breeder aims to market new plants beyond our shores.

Our survey of 30 Australian plant breeders revealed many with plenty of passion, a talent for choosing plants that are different or superior, and an ability to undertake basic cross pollinations and common propagation techniques. This may result in one, or an occasional innovative new plant. But passion doesn't equal profit. The ability to consistently plan, breed, multiply and market a pipeline of products requires professionalism and a broad spectrum of skills.

Predicting the market

Given the five to six year lead time required for breeding a new plant, an important skill is an ability to predict market trends. Mal Morgan is Director of NuFlora, one of our largest and longest established breeding companies, which focuses around 80% of its efforts on the overseas market with sales of around 25 crops in 20 years. Mal says it is critical for breeders to be "picking the circumstances five – seven – ten years out". He adds, "Whatever you breed needs an application in the marketplace and must represent value for money, whatever the price point. You need to excel, create a point of difference and be the first cab of the rank".

Mal has more advice for young players. When he first started breeding plants he identified a need for plants that had adequate basal branching without the use of growth retardants. More recently the company has focused on rust resistant snapdragons and powdery mildew resistant landscape verbenas. For the last eight years they have been breeding succulents, anticipating a niche market for production friendly "species or simple crosses that have wow factor when in small pots." Mal says

"You have to breed with a consumer rather than a collector focus, taking account of production issues, packaging and transport issues, shelf life, basal branching and the ability for them to flower at certain times of the year."

NuFlora also breeds natives for the domestic market, with high hopes for good sales of two new *Westringia*, a ground cover form and a hedging form with narrow upright growth, developed to minimise pruning in order to overcome the browning at the base that occurs when wider spreading varieties are trimmed.



NuFlora bred *Agyranthemum* in production in Europe. Plants such as these are bringing royalties back to Australia.

Scientific approach

Plant breeding is highly interdisciplinary, requiring knowledge from a many fields including genetics, ecology, plant pathology, flowering physiology, agronomy, molecular biology, applied statistics, economics, project management, and intellectual property rights. Worldwide seed and breeding companies are concerned that the science of plant breeding is a dying art. Little wonder then that several of the breeders we surveyed, many of whom are experienced nurserymen but untrained in breeding, stated that while they had an excellent knowledge of Australian flora and great intentions of producing new native plant varieties that perform better in gardens, they lacked scientific knowledge and had very little information on breeding systems.

Dr Kerry Bunker of Floreta P/L has bred *Bracteantha* and *Chrysocephalem* hybrids that are marketed worldwide through the Proven Winners network. She says her scientific approach to breeding and attention to the planning stages "is driven by my Ph D background, is one of our strengths plus it avoids too many blind alleys." Her breeding time line included an entire first year devoted to "thinking about what you are going to do".



Bracteantha bred by Dr Kerry Bunker, are sold internationally through the Proven Winners network.



Innovative breeding technology – Outback Plants has had success using insect frames for breeding *Brachyscome*. Wooden frames covered with a taut, very fine mesh screen, prevent incursion of any insects. European bees are placed in the frames in small temporary hives made from cardboard cylinders (as seen in top LHS of frame) to visit flowers and undertake cross-pollination.

Esther and Graham Cook have bred a range of *Ozothamnus diosmifolius* (native riceflower), initially for cut flowers and then as garden plants. As the Cooks were the first people to grow riceflowers successfully as a commercial crop, there was a lot to learn about propagating them, their growing conditions and how to manage pest and diseases. Preliminary work included developing a gene pool by sourcing seeds or cuttings from as many different inland areas as possible and developing a database of individual plant characteristics. Esther explains "as plants from localities showed different traits this allowed us to select parents and grow seedlings which combined the particular traits we wanted."

Most of our breeders use open fields and poly tunnels for their breeding efforts. The university based programs and a small number of nurseries have more sophisticated facilities that may include their own tissue-culture laboratories to assist in the germination and propagation of hybrid material. At the cutting edge of the spectrum the Centre for Native Floriculture (CNF) at the University of Queensland, Gatton, has a state of the art research greenhouse, custom built for studying flowering. Dr Margaret Johnston says the greenhouse "has allowed research to understand flowering physiology which can greatly reduce the time to flower and increase the numbers of flowers and can

provide efficiencies for plant breeding programs by controlling and manipulating flowering."

Margaret explains that "most plants show a period of juvenile growth before they become competent to flower. During this period they are unable to perceive environmental signals [that can trigger flowering]. In herbaceous species this period can be short (30 days) however many woody species have a long juvenile period which delays breeding programs. One method used to trigger earlier flowering is by grafting a juvenile scion onto a mature rootstock. This allows flowering to occur much earlier, an initial round of selection to be completed and unsuitable clones discarded prior to a further round of evaluation."

At the Botanic Gardens and Park Authority (Kings Park) in Western Australia, advanced genetic testing techniques are used to assist in the early detection of hybrids. Director, Horticulture and Conservation, Digby Grows says "Early confirmation of hybrids through DNA analysis can save significant time, sometimes years, in evaluating plants that may or may not be hybrids." It allows you to target your resources on true hybrids, or indicates a need to adjust your breeding techniques to better ensure true hybrids, "fast tracking efficiency gains in the breeding system."

Time and money

Technology developed by these programs, or any other way of shortening the breeding process and making it less costly, could have a major impact on Australian breeding efforts. Almost all our breeders state that the long growing cycle required to develop, trial and prove each new variety, especially for woody native plants, is a major concern.

Even the most positive breeders have concerns about time and budget restraints and think they receive an inadequate return for the time invested in developing each product. Noel Jupp of Riverdene Nurseries specialises in revegetation work and focuses on selecting and breeding plants that will tolerate local clay soil and climatic conditions. A particular target is a scented *Dianella*. Noel says the limited budget he can allocate to breeding is a concern for although “the costs are high the rewards are good if you get the equation right”. Jeff Cooke, Managing Director of Ramm Botanicals, one of our largest breeding companies, says “plant breeding is expensive, requiring long lead times and high labour inputs”.

Plant Breeders Rights (PBR) and other forms of plant protection are a significant cost for plant breeders. Although the majority acknowledge that PBR protects their products and enables them to generate a royalty stream, many say the cost is too high and royalties too low. Thomas Cunneen of Pacific Plant Development has post graduate plant breeding qualifications. He reflects the comments of many when he says plant protection “is not cost effective for overseas marketing, as the time taken to recover costs exceeds the life of plant popularity.”

Small production nurseries and one man operations find it hardest to capitalise on their breeding efforts, however talented they might be at developing new plants. Their new plants sometimes receive national publicity, but typically the small operator has neither the space nor staff resources to produce enough stock to meet the resulting demand. Small operations often don't have the market at the outset to justify bulking up plants in tissue culture. Independent breeder F David Hockings, says he has been “severely disadvantaged by being a loner with no production nursery backing to cover PBR costs.”

Marketing new plants

Breeding skills are only half the equation. Market intelligence and the ability to breed to fill a niche are equally as important. Once again successful marketing is hardest for small operations, although several use larger breeding and marketing businesses to commercialise their products.

Some breeders of native trees and shrubs expressed disappointment with their lack of overseas sales. Just as many European bred plants do not suit Australian conditions, so too landscape plants bred here for our garden environments may not have applications in the global market. In Europe and the USA there is a strong emphasis on seasonal potted colour and plants that flower prolifically during the relatively short spring sales window. Most Australian woody shrubs lack the cold hardiness necessary for northern hemisphere landscape markets. Graham Brown of the Plant Breeding Institute and NuFlora says “breeding adaptable plants for overseas markets needs a dedicated program. It isn't just going to happen by selection.”



Ozbreed has had success breeding and marketing drought tolerant, strappy leaved landscape plants such as this *Lomandra longifolia* 'Katrinus Deluxe'. Imitation may be flattering but breeders need to avoid duplication.

Duplication

Another issue would seem to be duplication. A few well-established Australian breeding companies have strong international sales and ongoing breeding programs of *Brachyscome*, *Scaevola*, *Bracteantha* and *Agyranthemum*. Yet a considerable number of additional survey respondents indicated that they were hoping to sell these genera internationally. In an era of highly competitive genetics second cabs off the rank would need to offer something very special in the way of superior appearance and performance.

Todd Layt of Ozbreed P/L is a successful breeder and a clever marketer. He has carved strong domestic sales for his tough, native grass-like landscape plants, including *Lomandra* and *Dianella*, and has sold over 600,000 of them in USA, Europe, Japan and New Zealand. Perhaps it is the Ozbreed success story that has encouraged other breeders to try and follow suit, for a number also indicated they hope to sell *Lomandra* and *Dianella* overseas. But is there really room for more of these on the world market? Layt himself says “often our products are not known overseas, so it takes a long time”.

Marketing Models

A strategy for accessing and competing in the world market is critical for those aiming for international sales. No single marketing model suits all Australian breeders. NuFlora accepts financial help from overseas companies for their breeding work. Graham Brown says their "input allows better alignment with overseas markets." Others eschew financial input, preferring "independence" and freedom to market their plants widely. But they agree on the need for networking contacts and partnership arrangements in order to understand demands and trends, and all acknowledge the critical role of overseas partners in promoting their plants via pack trials, trade shows, advertising and catalogues.

Proteaflora has a different model. Their plants are grown and marketed overseas with the local companies own branding backed by technical and marketing input from Proteaflora. The Ozbreed model is different again. Todd says "overseas it is hard to make money through others, that is why we have our own staff there."

The way forward

Mal Morgan says "long term breeding is necessary for the survival of horticulture." But without a long history of plant breeding or large breeding businesses the Australian nursery industry has relied on efforts of small operators and the R & D of a handful of dedicated programs. The industry is losing some of its talented breeders to retirement and others because of the costs involved in breeding work and insufficient returns, and although there are a few university based breeding programs there is insufficient incentive to encourage a younger generation of horticulturists to take their place. We need to provide greater support and encouragement for existing and potential breeders at all levels.

An industry public relations (PR) campaign focusing on plant breeding is one method of educating the public about the time, effort and cost of producing new plants for both the domestic and international market and raising the perception of the value of new and innovative plants. Business media as well as horticulture media could be targeted, with a focus on small businesses that are exporting new and innovative products and reversing the traditional outflow of royalties.

Strengthening our efforts

This paper has signposted some issues that could be addressed to assist our plant breeders, which would in turn benefit the entire industry. Improved technical and scientific knowledge of breeding methods, especially dissemination of information on ways to shorten the breeding process to make it less costly, would benefit all breeders. Preventing duplication, access to market intelligence and business information, improved communications, networking assistance and linkages between breeders and marketers could help develop commercial partnerships.

While breeders can benefit from R&D tax concessions and export market development grants, Jeff Cooke says "AusIndustry does not consider plant breeding 'innovative' and hence we don't qualify for any direct assistance." Ramm Botanicals has tried and failed as an individual company to change this, but perhaps an all-industry approach could be considered.

To begin the process of sharing knowledge and discussing ways of solving these issues Nursery & Garden Industry Australia (NGIA) will consider funding a workshop that brings together breeders and marketers, teachers and students, and anyone else interested or involved in plant breeding. However, for this to occur there needs to be sufficient interest. Please email the author of this paper on hmoody@aapt.net.au to register interest.

Note

This is the second of two Nursery Papers on Australian plant breeding, and should be read in conjunction with the first, which is available at www.ngia.com.au



Australian bred Hardenbergias on display at the 2009 IPM Essen, one of the largest horticultural trade shows in the world.

Photo credit: Photo courtesy of FloraCulture International

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