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Ornamental Plant Breeding in Australia

Many of the plants on the market are new, improved varieties. But does the industry, let alone consumers recognise the time, effort, expertise and cost involved in developing these plants? We pay a premium for a superior vintage wine or to eat at a first class restaurant, but are we prepared to pay more for better quality plants? The industry and gardeners should support our plant breeders and celebrate the fact that Australians are now developing and exporting our own flora rather than letting other countries reap the benefits. Australia has a greater gene pool of flowering plants than any country in the world, but in the past we have been slow to recognise the value and commercial potential of our native plants. In this Nursery Paper, freelance horticultural writer Helen Moody discusses and applauds ornamental plant breeding in Australia.

Ornamental Plant Breeding in Australia

Many of the exotic plants we grow are the outcome of decades, even centuries, of European and American breeding efforts that have improved the natural forms of desirable species. With around 25,000 native plant species Australia has a greater gene pool of flowering plants than any country in the world. But in the past we have been slow to recognise the value and commercial potential of our native plants. Other countries, notably Israel, Germany, New Zealand and USA have developed many Australian plants for the international cut flower and gardening markets more systematically than our producers.

It wasn't until the late 1980s that our nurserymen begin to systematically "develop" native plants, encouraged by new interest in using native flora in Australian gardens and their cultivation for the cut flower export market. They were aided by the introduction of Plant Breeders Rights that enabled breeders to protect their investment in new plants. Many plants were introduced by self-taught breeders - nurserymen with a passion for Australian natives and enthusiastic amateurs with a great knowledge of Australian flora.

The Australian nursery industry and gardeners benefited immensely from this first wave of Australian plant breeding. It resulted in the wonderful array of larger flowered, more robust, pest and disease resistant grevilleas, lillypillys and other native trees and shrubs that are now widely planted in our gardens. Many of these breeders continue to bring us new plants with superior attributes and enhanced performance.

Our relatively small domestic market has encouraged some breeders to focus on distributing plant genetics and products protected by intellectual property agreements to overseas amenity markets, especially in Europe and the USA. Global demand for novel products and the desire for drought tolerant plants have given impetus to this newer wave of breeding.

Turning breeding into commercial reality in global markets requires a combination of scientific methods, operational size, market intelligence and marketing skills that are not readily available to small nurserymen and part-time breeders. Most of our native woody landscape plants are not sufficiently cold tolerant for northern hemisphere gardens. The big sellers in northern hemisphere markets are plants that can be produced quickly and used for short, seasonal flowering colour as bedding, potted and patio plants. It's a competitive market dominated by the big global horticultural companies such as Ball, Proven Winners and Suntory that require a steady stream of new and improved cultivars and hybrids, each boasting some major point of difference.

Professor Daryl Joyce, Director of the Centre for Native Floriculture at the University of Queensland, has pointed out that access to international markets requires a "pipeline of products" rather than "a one-hit wonder". Only a small number of Australian companies have achieved major international sales of either native or exotic plants, while a few university based programs, individual breeders, nursery and marketing consultants are currently "hopeful" about future sales.

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New natives for Australian gardens

Pioneers of Australian plant breeding include George Lullfitz of Lullfitz Nursery and Australian Wholesalers, which has specialised in the propagation, growing and promotion of West Australian native plants for the domestic market since 1975. *Grevillea obtusifolia* 'Gingin Gem' and *Chamelaucium uncinatum* 'Purple Pride' are well-known plants they introduced into cultivation, and they have commercialised a number of *Lechenaultia* for the potted colour market. In 1992 Terry Hennessey of Bush Garden Nursery P/L, developed and promoted Australia's first PBR *Syzygium* 'Lillyput'. Later PBR lines including *S.* 'Little Lil', *S.* 'Aussie Boomer' and *Grevillea* 'Dot Brown'.

Jo Barker of Bullock Creek Nursery typifies many nursery people that dabble in breeding when she says "it's a passion, it doesn't make money and it's occasionally rewarding. A lot is just persistence because I love Australian plants." Her desire "to replace exotic species commonly used in hedges, parterre, Japanese and Tuscan style gardens" has resulted in the production of plants such as *Syzygium smithii* 'Hot Flush' and *S. luehmannii* 'Lulu'.

Phillip Dowling of Native Plant Wholesalers has bred winners such as *Acacia* 'Limelight' and *A.* 'Bower Beauty'. He sums up some of the issues these breeders have in common - an "eye" for a "good" plant, but insufficient time and money to devote to it and the need for a more scientific approach. Peter Ollerenshaw of Bwyong Nursery who has produced a distinctive *Leptospermum* range and several grevilleas, similarly signposts his lack of information on breeding systems.

Austraflora P/L and Limpinwood Gardens Nursery are two more nurseries that market new Australian plants from their own and the breeding programs of other developers. Austraflora's *Banksia* 'Birthday Candles' and *Hardenbergia* 'Free 'n Easy' have had great market penetration in Australia. Ozbreed P/L made its name as a breeder of turf, native grasses, and tough, drought tolerant strappy leaf selections of plants including *Lomandra* and *Dianella* that have had a major impact on the landscape market in Australia. Many of these owners signpost their difficulty in marketing their plants outside Australia.

Plant breeding has given us many beautiful, improved forms of Grevillea such as this *G.* 'Fireworks' bred at Bywong Nursery.

International success stories

NuFlora International is one of our most successful ornamental plant breeding and R&D bodies. A fusion of scientific and academic endeavours by the University of Sydney Plant Breeding Institute mixed with commercial input from Mal Morgan of Protected Plant Promotions P/L, the company has applied advanced hybridisation techniques developed for crop plants to ornamental breeding, and sells over 20 million plants per annum both native and exotic, overseas. *Argyranthemum, Petunia, Verbena, Sutera, Diasca, Gazania* and *Arctotis* are the company's top selling exotics, and *Scaevola* a big selling native.

Specialising in Australian natives, Outback Plants, led by Rodger Elliott, markets "very large numbers" of plants from their own breeding program as well as selections from native plant enthusiasts and specialist breeders, through a worldwide network of propagators in nearly 20 countries built up over 20 years of existence.

Ramm Botanicals undertakes an extensive breeding program with three staff members working on it full time and four part time. Ramm also propagates and markets plants for other breeders. Managing Director, Jeff Cooke, says "We have the broadest, most sophisticated Australian native plant breeding program in the world." Best known for its Bush Gem series of *Anigozanthos*, Ramm has an extensive collection of other genera in the domestic market, and the company has sold over 3 million plants overseas since 2003.

Dr Kerry Bunker's of Floreta P/L has sold millions of plants of her *Bracteantha* Sundaze series and three hybrid *Chrysocephalum* through the Proven Winners network throughout the world. Kerry has post-graduate qualifications in plant breeding and singles out her "highly scientific approach with a lot of attention given to the planning stages" as a particular strength.

NuFlora have sold millions of the plant from their breeding program such as these *Argyranthemum*

The top sellers

Brachyscome and *Scaevola* are not the most spectacular Australian native plants, yet hybrids of these two genera are the biggest selling Australian plants overseas.
While petunias, calibrachoas, begonias, impatiens and geraniums are the predominant players in the huge potted colour market, look closely at the plants tumbling from hanging baskets and window boxes and you'll likely spot some *Scaevola* and *Brachyscome* getting in on the act.

Although German and Israeli breeders lead the way in establishing markets for these two plants, that can be produced and sold in flower in 12 weeks (or preferably less), a number of Australian breeders are now competing for a slice of the market. Not surprising, given the size of that market, estimated by Rodger Elliott as around 10 million Scaevolas sold annually in Europe and 5 million in the USA and perhaps 5 million Brachyscomes in Europe and 4 million in the USA.

Outback Plants, which has long concentrated on improving these genera, "aims to continue to be the world's number one breeder in Brachyscomes and live in hope that we will get interesting colour breaks in Scaevolas". Merricks Nursery annually sells overseas some 250,000 plants of one such break, 'Strawberry Mousse'.

Outback Plants hopes to continue breeding Scaevola with new colour breaks such as this *S. albida* 'Pink Mist'

New and hopeful

If a tough, beautiful flowering plant that requires minimal water and fertiliser is the holy grail of plant marketers everywhere, then it's not surprising that recently a flurry of *Ptilotus* hybrids, with their unusual, feathery flower spikes, have created interest. Some species, especially *P. exaltatus*, have been in cultivation, but have not been particularly reliable or well known, even in Australia. Since the German bred *P. exaltatus* 'Joey', attracted awards and accolades at overseas trade shows in 2008 local breeders are aiming for superior forms for the bedding plant, potted colour and cut flower markets.

The Centre for Native Floriculture released three different coloured cultivars of *P. nobilis* in it's 'Outback Princess' series. *P.* 'Phoenix', bred by Peter Abell of Passionwood Perennials is marketed by Humphris Nursery in Australia and overseas by Proven Winners as *P.* 'Platinum Wallaby'. Peter says "We are aiming for more compactness and different colours and forms, ideally a prostrate form that can be cutting produced." Humphris Nursery has a sizable breeding program with "a great pipeline of products over a very broad range of plants" that they hope to sell internationally.

Tissue culture specialist Vitroflora P/L is using sophisticated scientific techniques to develop new native varieties for multiple uses such as pot plants, landscape, cut flower and foliage for both local and international markets. The Biodiversity Conservation Centre (BCC) at Kings Park and Botanic Garden in Western Australia are targeting *Scaevola*, *Grevillea*, and small myrtles including *Verticordia, Darwinia* and *Hypocalymma* as possible plants for the world market. Director, Horticulture and Conservation, Digby Growns, says there is a global trend to use woody rather than herbaceous plants for potted colour and landscaping, and that W.A. has a huge species base of floriferous, drought tolerant plants to explore for this market.

The team behind *Ptilotis* 'Phoenix' hope it will do well overseas.

Not only natives

Not all our breeding successes have been confined to Australian natives. NuFlora has had great success in the overseas potted colour market (see text) and Proteaflora Nursery sells 60,000 of its selections of *Protea, Leucospermum* and *Serruria* annually in Japan, Italy, Portugal, Spain, South Africa and USA as flowering potted colour and as hardy garden plants. Paradise Plants is noted for an eclectic range of plant introductions, including lavenders, michelia, poppies, polyanthus and primulas sold in Australia plus camellias and photinias that have found export success.

Bonza Botanicals, a joint venture between Oasis Horticulture and Japanese company Suntory, has resulted in sales of Australian bred *Argyranthemum* and chillies to USA, Japan and Europe, as well as native plants including Geraldton Wax, *Bracteantha* and *Scaevola*. The company is currently involved in the world's first breeding of interspecific poinsettia varieties with the US company Ecke.

Bambino Bougainvilleas have found a permanent place in the Australian market, and breeder Jan Iredell has hopes of them spreading internationally, with initial sales in New Zealand, the USA, South Africa, Italy and UAE. Nurseryman Edward Bunker has had considerable success marketing his *Gaura* 'Lillipop Pink' overseas, and Darwin Plant Wholesalers has introduced some new colour selections of *Plumeria* and a large red flowered hybrid of *Euphorbia millii.*

Proteaflora has had success marketing new Proteaceae varieties at home and overseas. Their hybrid *Serruria* 'Pretty 'n' Pink' is in the centre with its parents *S.* 'Blushing Bride' (left) and *S.* 'Sugar 'n' Spice' (right). 'Pretty 'n' Pink' has darker and denser foliage with dainty pink flowers on strong upright stems.

The breeding process

The most basic plant breeding technique involves selecting plants with new or desired features from a divergent population and cross pollinating them. The progeny of the selected individuals is grown and screened and the process is repeated for several generations until a uniform plant population with the desired characteristics is produced and multiplied.

Hybridisation is the crossing or mating of two related plants to produce new varieties with desirable properties. Progeny from the cross are then backcrossed with the favoured parent to ensure that the progeny is most like that parent. Backcrossing is repeated until the desired result is obtained. Interspecific and intergeneric hybrids are produced by crossing distantly related species or genera that do not normally sexually reproduce with each other. Tissue culture techniques may be needed to assist germination and propagation. Embryo rescue involves rescuing immature hybrid embryos to prevent them aborting and germinated them in tissue culture.

Molecular biology techniques can be used to select, or in the case of genetic modification, to insert, desirable traits into plants. Traditionally breeders relied on the visual identification of plants with desired characteristics. Now sophisticated laboratory procedures using tools such as molecular markers or DNA fingerprinting can distinguish the genes that influence a desirable trait and identify plants that possess the trait.

Bracteantha (now *Xerochrysum*) trials at Outback Plants. Selection requires the human ability to choose the best plants or a plant with new and desirable features from a population of many.

Time and cost

Plant breeding, especially of woody plants, is a lengthy process. A new hybridisation project may involve three to four years of selection, crossing, recrossing, field evaluations and pot trials before making final selections for a full commercial trial. Plants sent overseas may be for trialled for another two or three years, then the chosen plants must be multiplied. So it can be eight or nine years before a plant starts to be sold in large numbers.

Of the organisations we surveyed only the three university based operations and two private companies had breeding budgets in excess of $100,000 per annum. Four companies said they spent between $50-100,000p.a. and four more between $10-50,000. Many of the individuals or nurserymen that work part time on breeding barely count labour or other costs.

Most breeders agree that Plant Breeder's Rights and patents are essential to protect their products and for them to gain royalties from sales. But plant protection comes at a price, PBR registration costs around $3000 per variety plus $300 annual ongoing fee for the 20 years of protection. Add to that the development and trialling costs and some claim PBR costs $7-10,000 per variety.

Too high a price, say some, including those that achieve export success. Kerry Bunker says "not enough comes back to the breeders given the number of years that are committed to developing each product." Graham Brown of NuFlora says a critical issue is the lack of sufficient capital for their breeding program and low international royalties that haven't increased in 20 years. Jeff Cooke from Ramm Botanicals says they achieve results despite zero financial support from government. At the very least, says Shaun O'Brien of Vitroflora "People need to recognise the costs associated with breeding work and be willing to pay higher royalties for new plant varieties."

Acknowledgments

This Nursery Paper was written by Helen Moody with input from 30 people that responded to a survey of plant breeders. Particular thanks to Rodger Elliott and Jeff Cooke who helped develop the questions for the survey and to those that supplied photos. Next month a second Nursery Paper on plant breeding will examine in greater detail the strengths and weaknesses in Australian plant breeding and ways to overcome current restraints and assist plant breeders.

Compiled and edited by Sarah McMahon, NGIA Communications & PR Coordinator; banner photography by Anthony Tesselaar.