Growth Regulators. We have used rooting hormone in our early stages in growing tea, but of late have found it not required unless the cutting material is very hard.

Containers and Media. The containers used are tree tubes about 50 mm square and 150 mm high. These containers are ideal as the plants can be grown in them to planting-out stage if required, and also lower the cost to growers.

Environment. We have three glasshouses all running North/South, each having a different pitch on the roof. Rooting varies slightly between each house and light levels are higher in the smaller house with the greater pitch. We use the small house for the tea to speed up the rooting time.

The propagating benches are 900 mm high with a sand bed with in-bench electrical cables supplying bottom heat maintained at 24 °C during propagation. Overhead mist irrigation maintains the humidity at approximately 87%. Because this mist operates for 8 sec at 5-min intervals, the humidity will rise and fall during this period, giving an average of 87%.

Cuttings treated as outlined will usually callous within 15 d with full root initiation within 5 to 6 weeks. If required to pot into larger size pots it is important this be carried out as soon as possible, as tea can be very hungry and unless well fed will get pot bound and damaged.

Propagation and Cultivation of Selected Central Australian Wildflowers©

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INTRODUCTION AND BACKGROUND

Central Australia is home to over 2000 species of plants, many of which exhibit remarkable adaptations to the harsh climate. Rain may not fall for long periods and then arrive in flooding quantities. Plants have evolved under these conditions and many survive the dry times by reproducing and growing opportunistically. The deserts are known to produce masses of ephemeral flowering plants after autumn and winter rain (Urban, 1990), which transform the desert landscape with a variety of flower forms and colour.

The first impression of a visitor to Central Australia is usually the vast scale of the landscape and the drabness of the dominant schlerophyllous (Jessop et al., 1981) vegetation. These visitors are unlikely to witness the floral bounty of rare precipitation. These reproductive events occur during the cooler months of the year when heavy rains cause dormant seeds to emerge and grow.

The Botany Team at the Alice Springs Desert Park is using some of the more showy species in horticultural displays and as potted plants.

HORTICULTURE IN CENTRAL AUSTRALIA — ENVIRONMENTAL FACTORS

Availability of water and nutrients affects the distribution of natural vegetation in the arid zone (Jessop, 1981) and also provides the greatest challenges to horticulturalists looking to produce plants in the extreme conditions. Summers are characterised by high temperatures and low humidity, whilst winter temperatures regularly drop below zero and frost is common in Alice Springs.

Irrigation water is obtained from underground aquifers, and can require treatment to remove dissolved salts and make it potable.

Under the naturally low water regimes, many of the plant species found in horticulture perform poorly or require heavy daily watering. High temperatures and drying winds cause plants to wilt and leaves to drop; plants are damaged by frosts and nutrient deficiencies develop due to the changing of pH from salts deposited in irrigation water.

These conditions require that landscape plants be hardy to drought, frost, and to saline conditions, and able to grow over a range of pH levels, as well as being aesthetically pleasing.

Summary of Growing Conditions.

- Climate: 46 °C summer maximum, -8 °C winter minimum.
- High diurnal range approx. 25 °C average at any time of year.
- Soil temperature can reach 50 °C at 50 mm depth. Temperature can be higher at soil surface.
- Alkaline (pH 7.6), salty water (500 ppm dissolved salts) in "town water".
- Wind is a factor — contributing to the evaporation rate. This can be problematic, especially with planting unhardened nursery stock.
- Rainfall: Long term annual average 240 mm; evaporation rate 3700 mm.

THE SOUTHERN BIOREGION AND THE ALICE SPRINGS DESERT PARK

The Alice Springs Desert Park is set in the foothills of the MacDonnell Ranges, 10 min from the centre of Alice Springs.

It is a bio-park focused on replicating the complexities of the southern bioregion of the Northern Territory, a massive area from latitude 18'S to 26'S and 129'E to 138'E (Albrecht et al., 1997).

The park showcases flora and fauna as they are found in their natural habitat: desert rivers, sand country, and woodland. Aboriginal cultural interpretations and presentations provide another perspective for the visitor.

The Desert Park nursery specialises in developing propagation and cultivation techniques for over 2000 species of central Australian plants. This specialised focus is unique in the Alice Springs district.

WILDFLOWERS

Wildflower displays are produced via direct seeding and by planting of tubestock produced by the Desert Park nursery. Seed is collected from plants grown at the Desert Park, and augmented from wild-collected sources. Seeds are stored in calico bags at ambient temperatures over summer (30 °C to 40+ °C).

Wildflower displays include: *Othonna gregorii* (annual yellow top), *Leucochrysum stipitatum* (saltspoon daisy), *Schoenia cassiniana* (pink everlasting), *Rhodanthe floribunda* (white paper daisy), *Lawrencella davenportii* (Davenport's daisy), *Polycalymma stuartii* (poached egg daisy), and *Swainsona formosa* (Sturt's desert pea) amongst others.

Wildflower species are also produced in 140-mm pots for sales to retail nurseries. They are promoted to home gardeners and landscapers as well suited to local conditions.

Polycalymma stuartii has been grown as a flowering annual over summer in Adelaide, and it will also survive the central Australian summer if it receives adequate water.

Nursery production includes approximately 15,000 indigenous plants per year for plant displays and commercial wholesale nursery sales.

The technique for direct-sown wildflowers was developed based on anecdotal evidence from the Park's Senior Horticulturalist.

It was observed that when the ambient minimum overnight temperature was approximately 12 °C, and when autumn rains of 25 to 40 mm were recorded, germination occurred. Further winter rains are important.

These conditions produce masses of desert ephemerals that cover the landscape with a breathtaking floral display. The dormant seeds rapidly germinate, grow,and flower, in a race to set seed before the change of season, and the summer heat returns.

NURSERY SEEDLING PROPAGATION METHODS

Breaking Seed Dormancy. Nursery trials have shown that some species require pretreatment to break dormancy and promote uniform germination. Propagation trials at the Desert Park, and published reports (Bell, 1999; Bunker, 1994) have helped to improve germination rates, although there are still wildflower species that are difficult to grow.

Pre-treatment techniques include the following:

***Gibberrellic Acid*:** ProGibb GA (100 $g \cdot L^{-1}$) diluted to make a solution of 500 $mg \cdot L^{-1}$ GA, in which seeds are soaked for approximately 24 h.

***Rubbing*:** Textured rubber mats and a rubber block are used to break up ripened flower heads and separate seeds from fruits. This facilitates even sowing of seeds.

***Boiling Water*:** Seeds are covered with boiling water and allowed to achieve imbibition.

Species	Treatment	Time to Germinate
Leucochrysum stipitatum	500 $mg \cdot L^{-1}$ gibberrellic acid, 24 h	4 to 5 days
Lawrencella davenportii	Gibberrellic acid has shown positive response	7 to 8 days
Othonna gregorii	500 $mg \cdot L^{-1}$ gibberrellic acid, 24 h	4 to 5 days
Polycalymma stuartii	No pretreatment.	6 to 7 days
Rhodanthe floribunda	Rubbing.	4 to 5 days
Schoenia cassiniana	500 $mg \cdot L^{-1}$ gibberrellic acid, 24 h	4 to 5 days
Swainsona formosa	Boiling water scarify.	4 to 5 days
Xerochrysum bracteatum	No pretreatment.	8 to 9 days

Examples:

Leucochrysum stipitatum Pretreatment	Germination (%)
Cold water/no treatment	<1%
Gibberrellic acid	>50%

Schoenia cassiniana Pretreatment	Germination (%)
Cold water/no treatment	16%
Gibberrellic acid	47%

Swainsona formosa Pretreatment	Germination (%)
Cold water/no treatment	<2%
Boiling water	>70%

Sowing, Pricking-out, and Growing on. Seeds are sown in a seed-raising medium and are covered with a thin layer (1 mm) of seed-raising media.

Germination can be observed after 4 to 5 days or longer depending on species.

Seedlings are pricked out into 50-mm square tubes containing potting medium and placed into the glasshouse for 10 days.

Seedlings are grown in full sun until plant-out.

Media Used.

- Seed raising media: Washed river sand and coco-peat (3 : 2, v/v).
- Potting Media: Pasteurised blend of composted pine bark and washed sand; pH 5.5 to 6.2, air filled porosity 16% to 23%; water holding capacity 45% to 55%.

Direct Seeding Methods. Seeds are sown in April when the nightly minimum temperature falls below 12 °C. This allows replication of conditions which produce germination and flowering in the wild. To ensure ideal conditions for plant growth the sites are prepared as garden beds with soil aeration, pH testing, and fertilizing:

- Soil Preparation: Rotary hoed and then raked to achieve a fine tilth.
- Fertiliser: pH specific, 8+ add Ammonium sulphate; pH 7 add Dynamic lifter.
- Seed Sowing: Hand sown, then raked to thinly cover the seeds.
- Irrigation: Irrigation of 25 to 40 mm following seed sowing imitates a soaking autumn rain, initiating germination.

Once germinated, pop-up sprinklers irrigate every 2nd day, which is soon weaned back to twice weekly as the seedlings grow. The plants are given a boost by applying a supplementary fertilisation in winter, then another in spring with a soluble all-purpose fertiliser.

The faster growing and flowering plants, *Othonna* and *Schoenia*, initially dominate wildflower displays. The rapid growth quickly turns the landscape bright green with abundant yellow and pink. *Polycalymma*, *Rhodanthe*, *Swainsona*, and *Xerochrysum* require warmer temperatures for growth and as a result produce their blooms later.

As the weather turns towards spring, growth accelerates and flowers are everywhere. A myriad of insects take advantage of the conditions to forage across the meadows of colour, ensuring pollination and seed set.

After flowering, plant activity turns to fruit production. The colours drain from the landscape as the seeds fall, to be replaced with the red sands and the grasses of summer.

The Botany Team ensure that ample seed is collected for the next season's wildflower display. Collection by hand is the main method used, although collection via the use of an electric vacuum cleaner has been used to good effect.

CHALLENGES

1) Timing of production of seedlings, for plantout, requires close liaison with the landscaping staff.
2) Hygiene levels within the nursery must be kept high, as seedlings are susceptible to damping-off and grey mould.
3) Seedlings of *Leucochrysum*, *Polycalymma*, *Rhodanthe*, *Swainsona*, and *Xerochrysum* are susceptible to *Pythium* at pricking out stage. *Schoenia* and *Othonna* seem comparatively less susceptible to *Pythium*. *Xerochrysum* taxa are susceptible to *Botrytis* when conditions are cool and humid.

CONCLUSION

With horticulture moving towards sustainability and water conservation, arid zone plants may provide an excellent source of new species.

Many species have been trialled at the Desert Park as cut flowers and used in interstate displays. Excellent cut flower properties such as long stem length and long vase life have been observed.

Limited experimental data on propagation, cultivation, ecology, and distribution, requires further research in order to answer many questions regarding this fascinating group of beautiful wildflowers.

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