FEATURE

Cut flower potential of Sturt's desert pea

Gail Barth discusses the potential for Sturt's desert pea as a cut flower and outlines problems it faces with commercialisation.

To fulfil a market requirement for Sturt's desert pea with long stems, we investigated methods of producing a runner consisting of a spray of flowers.

To contain disease outbreaks, plants were grown in 33 litre polystyrene boxes using pasteurised pine-bark/coarse sand media (3:1). Seeds were sown in Jiffy pots and the seedlings grown for about four weeks before transplanting. Roots were air-pruned by this method and the resulting branched root systems grew rapidly.

Even 50 per cent shadecloth over the glasshouse resulted in etiolated growth and flower abortion.

Day temperatures were maintained between 20 and 35°C and night temperatures kept above 10°C. Plants grew rapidly and flowered freely in this range. They were stressed if temperatures in the greenhouse rose above 35°C, and the incidence of *Fusarium*, a serious disease problem was heightened.

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Trellising

When grown in the bush, seedlings of Sturt's desert pea generally develop a strong central stem which grows upright to an average height of 28 to 30cm. Two prostrate laterals develop at the base and continue to grow as the central stem flowers and ceases to grow. Western Australian seed sources have more strongly upright central leaders than those from South Australia which have a mat-forming habit.

When the central stem is supported on an upright trellis, it does not stop growing but continues to climb on the support, producing a flower at each node. These stems have a mean diameter at 25cm of $1.0 \pm .03$cm compared with $0.7 \pm .02$cm on lateral runners.

Stem lengths of two metres can be achieved in 105 days from planting, and up to 28 flowers have been recorded on a trellised runner. Lateral runners left prostrate form side branches and eventually form the mat of growth typical of vigorous native stands.

Staked lateral runners grow rapidly and flower at each node rather than producing side branches. When the laterals reach a height of 30cm and greater, additional laterals appear at the base of the plant.

With this growth habit, Sturt's desert pea lends itself to manipulation as a trellised plant. The best trellising and pruning system we tried was two plants a box with ▶

three runners staked from each plant — the central stem and first two laterals.

This system was optimal for spacing, yield and labour efficiency.

Early blooming, high quality runners were grown by removal of all laterals. This system is recommended for display work only as yields of runners are severely reduced.

After the three flowering runners are harvested, laterals from the plant's base or new shoots arising from the old runners can be trained as replacements. They can be harvested again in 40 to 68 days.

Plants should then be removed and boxes steam-treated before replanting.

The response of Sturt's desert pea to several categories of growth regulations holds promise in manipulating their growth. Gibberellins applied at high rates (100-250ppm) can almost double the length of internodes. These rates also caused flower abortion and some distortion of vegetative growth.

At low rates (25-50ppm) GA_3 and GA_{4-7} do not affect flower set and have some positive effects on flower size and appearance.

GA_3 at 25ppm increased the internode and total runner length by about 20 per cent and increased flower stalk length by 16 per cent without decreasing the width.

GA sprays at these rates remain effective for about six nodes or 40cm of growth (three to four weeks), which is sufficient for production of a flowering runner. The main practical benefit of GA sprays is the increase in flower size, although increasing total length by 20 per cent can hasten harvest and thus increase yield.

Benzyladenine (BA) sprays at 25-50ppm dramatically increase lateral shoot development at all nodes. This could be a useful tool for regenerating plants after harvest and may also have an application in the production of flowering pot plants. Sturt's desert pea also responds well to Bonzi growth retardant (see side box 2).

A detailed enterprise analysis was ▶

Backround briefing on Sturt's desert pea research

Sturt's desert pea (*Clianthus formosus*) is popular for landscape use but has a reputation of being difficult to cultivate.

It is susceptible to common root diseases. Until 1980 it was not grown seriously either as a pot plant or cut flower.

In Adelaide, Sturt's desert pea was grown as an alternative crop in poly-tunnels and glasshouses and sold on local markets.

In Mildura and Alice Springs, annual crops of Sturt's desert pea have been grown outdoors under close spacing.

The upright central spray of flowers (consisting of three to four flower heads) is harvested. Bunched sprays are sold mainly through Melbourne markets.

With the widespread use of pasteurised potting mixes and hydroponic systems in greenhouses, Sturt's desert pea has proven to be adaptable on a small scale to growth in pots as specimens or as cut flowers.

Dr Brian Hanger, Knoxfield Research Laboratories (in Victoria), has had a collection of Sturt's desert pea in his hydroponic assessment glasshouse for many years.

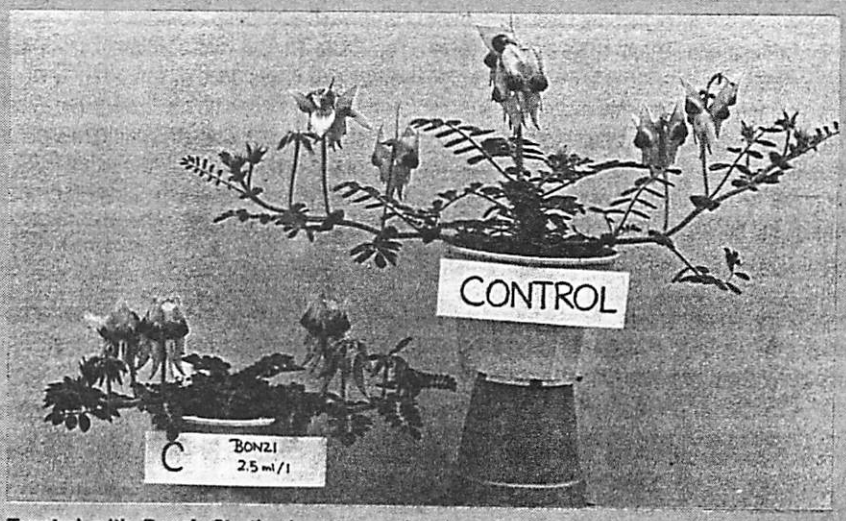
In 1985, Vern and Coral Dutschke of Brinkworth, South Australia experimented with a recirculating hydroponic system to grow Sturt's desert pea on raised benches in poly-tunnels.

Runners were trained out on horizontal benches and over the sides to the floor. Individual flower heads on strong flower stalks were cut and marketed in vials of water for local markets. They aimed to produce an elongated flower stalk (up to 30 centimetres) allowing flowers to be bunched for export potential.

The SA Department of Agriculture began investigating post-harvest treatments to extend vase-life, explore bud-opening, cool storage, packaging and to assess suitability for interstate or overseas transport of flowers.

After one year of post-harvest assessment, funding was obtained from Austrade's Innovative Agricultural Marketing Program to look for optimal cultivation techniques to produce an acceptable export product.

Japan has an extensive import trade in Australian flora. Market assessment of Sturt's desert pea was made with the Japanese.



Treated with Bonzi, Sturt's desert pea develops into a compact pot plant.

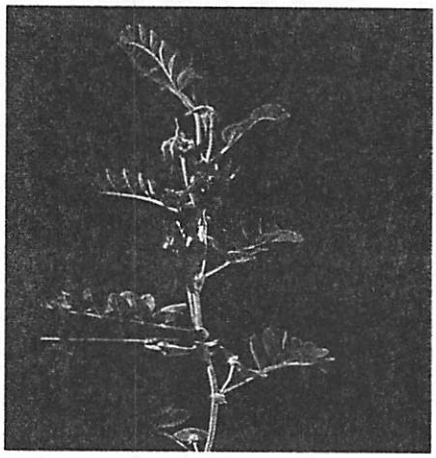
prepared for production of flowering runners in a 60m x 20m greenhouse using the cultivation techniques described above.

For production for export markets, harvesting and marketing costs amounted to 64 per cent of cash costs. Labour involved in cultivation represented 15 per cent of costs.

At nine stems a box per season, price per stem would need to average $3.65 to cover cash operating costs, $4.32 to cover cash and owner-manager labour and $4.82 to also cover capital costs.

Profitability would be dependent on maintaining a high yield and on export prices remaining at levels near $10.00 per stem.

Production of stems for local markets requires $1.58 per stem to cover cash operating costs, $2.05 to cover cash and owner labour and $2.42 to cover capital costs.



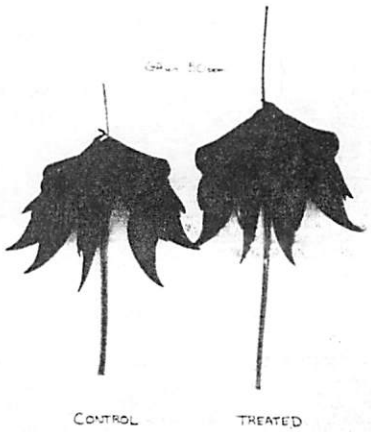


Figure 1: Upright flowering runner of Sturt's desert pea, 60cm long in a Flos preservative solution pack. Figure 2: Individually cut heads have short stalks. This limits their use as a cut flowers. Stalks can be elongated with gibberellic acid.

Post-harvest handling

Vase-life

Postharvest assessments of Sturt's desert pea have been made on the individual cut flower and the flowering runner (consisting of a 60cm terminal shoot with leaves and a minimum of three flower heads).

Preliminary trials in 1987 on cut flowers produced in polyhouses showed that silver thiosulphate (STS) prolonged vase-life by 50 per cent (see Table 1). Work reported by Mor et al. (1984) on sweet peas showed STS increased vase-life 80 per cent over controls.

Trials in 1988 on flowers from controlled environment greenhouses showed consistently greater vase-life over controls for all treatments.

Longest life was achieved by STS pretreatment, overnight pulsing with four per cent sucrose solution and holding flowers in a base preservative solution without sucrose.

These trials emphasise the importance of flower quality at harvest. Flowers stressed by high temperatures or nutrient deficiency never achieve their potential product life.

Post-harvest chemical treatments on flowering runners failed to show the same clear response to STS treatments, but sucrose significantly extended vase-life. At 20°C, control treatments in one trial lasted an average of nine days while those receiving two per cent sucrose in a base solution of chlorine and citric acid lasted for 14 days.

The key factor in prolonging vase-life of runners appears to be the provision of a carbohydrate source to maintain the stems and leaves.

Total vase-life of runners is considerably shorter than for flowers due to leaf and stem deterioration. Compared to major cut-flower crops, it is poor. At moderate temperatures it is, however, sufficient for local markets where the stems can be sold without long storage periods.

Bud opening and storage

Trials were conducted to determine if flowers could be picked as unopened buds and later opened in a sugar solution after cool storage or shipment.

In all attempts, buds did not develop normally in sucrose solutions. Petals were very thin and easily damaged as they opened. Proper pigmentation did not develop when the flowers were moved from the greenhouse to darker laboratories or packing sheds.

Immature buds in the tips of flowering runners present their own post-harvest problems. The soft growth is distorted as the buds develop after picking.

If conditions are favourable for bud development, the young▶

Table 1 : Longevity (days) of Sturt's desert pea individual cut flowers treated with preservative solutions and held at 20°C.

Treatment	Vase-life (days) 1987	1988
DI Control	7.5 ± 0.3 *	13.4 ± 2.9
2% sucrose[A]	9.0 ± 0.6	21.7 ± 4.5
4% sucrose	9.3 ± 0.6	21.7 ± 4.5
STS[B], DI	11.3 ± 0.6	
STS, base solution		26.7 ± 2.8
STS, 2% sucrose	12.0 ± 1.7	
STS, 4% sucrose		23.2 ± 4.4
STS, 4% sucrose[C], DI	12.5 ± 0.8	
STS, 4% sucrose, base		34.5 ± 4.0
STS, 4% sucrose, 2% sucrose		30.3 ± 5.9

** Mean ± s.e.*
[A] All sucrose solutions also contain base solution of 100ppm stabilised chlorine and 250ppm citric acid.
[B] 4mM STS, 10 min pre-treatment
[C] Pulsing solution for 18 hrs (overnight)

buds continue to grow and develop as pale, distorted flowers on twisted stems. Unless temperatures are kept low to prevent this development, young immature buds may need to be pinched from the runners as they are harvested.

Simulated shipping studies found flowering runners with leaves could be stored with little loss of vase-life for three to four days in 1°C coolrooms if kept in water vials.

Wilting is a serious post-harvest problem with flowering runners of Sturt's desert pea. Greenhouse management techniques must produce a 'hardened' runner which is not too succulent when harvested.

Runners must be harvested in cool conditions and immediately placed in water. They rapidly desiccate in 0°C coolrooms, unless sleeved or covered with polyethylene. Prior to packing they should be held in coolrooms 7 to 10°C.

Handling is similar to to that for cymbidium orchid sprays. Runners should be packed in vials of water or preservatives. Wilted runners do not rehydrate without damage to the leaves and shoots.

Removing leaves and the growing tip of the runner will double its vase-life. It could then be marketed without a water vial. Such a 'disbudded' runner may be suitable for some markets but is not acceptable in Japan.

To contain disease, plants for runner production were grown in polystyrene boxes.

Packaging

The petals of leguminous flowers are delicate and can be easily bruised and marked. Also, the complex arrangement of flowers on the inflorescence of Sturt's desert pea can cause additional problems in handling as it is difficult to avoid crushing and tangling flowers as they are sleeved for shipment.

In our trial shipments we found it necessary to use a single layer carton (orchid boxes) or fit single layer trays into a standard flower cartons to ensure sprays were not crushed. Sleeves are essential to prevent tangling of stems and to provide a degree of protection against crushing.

To prevent movement in the cartons, runners need to be packed tightly, with a non-slip protective layer of foam or padded plastic sheeting lining the carton.

In all trial shipments there was an unavoidable degree of physical damage resulting from handling and packing. In addition, quarantine inspection, repacking, auctioning and local handling in Japan caused further damage which resulted in an unsaleable product.

Costs of cushioning stems with air-inflated bags can become prohibitive and quarantine inspection is difficult without opening the bags.

Leaves grow at right angles to the stem and do not adapt easily to sleeving. Large amounts of pollen released from flowers after harvest stains petals and leaves if any moisture is present.

Summary

Our research findings suggest limited potential for Sturt's desert pea as an export flower crop as:

- the flower stalks on individual flower heads are too short to be acceptable overseas.

- Flower runners can be extremely difficult to pack and transport without mechanical damage to petals and leaves. Transport costs become unacceptably high due to the necessity to pack cartons at low densities.
- The product is too fragile to withstand the repeated handling and repacking caused by quarantine inspection and marketing systems overseas.
- Greenhouse production of runners is feasible but taking in to account all costs including labour, the economics of production is limiting. If stem prices in Japan fall below $7.50 per stem, the enterprise will not cover total costs and present an acceptable return.
- The production system of Sturt's desert pea is at risk from an untreatable and unpredictable root disease. Excellent sanitation methods must be employed to prevent the introduction of disease which, once established, will cause high plant losses.

Although these constraints to export exist, it has potential as a domestic cut-flower crop. There is an unfulfilled demand on local and interstate markets for this flower.

Principal uses are for display work related to tourism and promotion of native flora, in addition to floristry uses which would also increase with available supply.

With improvements derived from a plant improvement or breeding program, Sturt's desert pea may become an established minor crop in Australia grown, like sweet pea (*Lathyrus odoratus*) in close proximity to its markets. In this way, improved varieties would be of interest to overseas growers.

Australia could derive the benefits of selling improved, patented material to specialist producers overseas just as we currently import new freesia or gerbera varieties from European breeders.

The author wishes to acknowledge the work of Mike Bennell, Roy Davis, Kerry Sharman and Vicki Roper in this research.

Production of Sturt's desert pea as a flowering pot plant

In our Sturt's desert pea research program at Northfield Research Laboratories, we found seedlings could be grown as attractive pot plants with either manual pinching or growth retardants.

Because of the constraints in producing Sturt's desert pea as a cut flower (discussed in main article), it may be more successful as a flowering pot plant.

With variety selection for uniformity, compactness and colour, Australia could produce patented plant material for overseas sales of a new flowering line.

Seeds are scarified (seed coats are nicked with a scalpel, or a drum scarifier is used) and sown in trays containing a pasteurised seedling mix or in Jiffy pots.

After true leaves emerge, seedlings are transplanted into 150-175mm pots in a pasteurised 3:1 pine-bark/coarse sand media supplemented with dolomite, 2kg/m^3; lime, 1.5kg/m^3; single super P, 0.5kg/m^3; iron sulfate, 750g/m^3; Micromax, 300g/m^3; and 8 to 9 month Osmocote, 2.5kg/m^3.

All plants should receive supplementary liquid feeds until first flowers appear. Full-strength top hydroponic solution twice weekly supplemented with liquid fertilisers Sequestrene (0.5g/L) or Aquasol weekly are suitable.

Plants need good light conditions for flowering but will not tolerate high temperatures in an unshaded greenhouse without damage. In SA, with high winter light levels, plants are best produced in April to November.

In this period, greenhouse cooling can be kept to a minimum, and night temperatures adjusted to influence plant height. By maintaining night temperatures near day temperatures, plant height is controlled and the use of growth retardants is minimised.

Plants grown with a wide fluctuation in day/night temperatures will produce elongated plants unsuitable as flowering pot plants*.

Growth retardants, when used, are applied two weeks after potting on seedlings. Paclobutrazol (Bonzi) drenches (100-200ml) at rates of 2-4mg ai per pot would be recommended to reduce height and elongation of laterals 30-40 per cent over control plants. Chlormequat (Cyclocel) sprays and drenches have not proved effective in our trials.

Mechanical pinching can be used with careful timing and the upright central stem should develop to 15cm before pinching. Many seed lines will stop vegetative growth and initiate flowers at this height and will not require pinching.

Laterals should be pinched at 10cm to encourage branching close to the centre of the plant.

A combination of growth retardants and pinching can be used for dense growth, but production times are increased.

High standards of nursery sanitation must be maintained during production of Sturt's desert pea plants. This is because of their high susceptibility to *Fusarium moniliforme*, a systemic wilt disease which produces spores which are air-dispersed and easily spread once established.

Treatments with the fungicides Fongarid, Alliette, Rovral, Prochloraz and Benlate have not damaged any young plants.

The major insect pests of Sturt's desert pea in greenhouses are two-spotted mite, aphids, mealy bugs and thrips.

**For a detailed discussion of new developments in the control of plant height with temperature, see the following series of articles in Greenhouse Grower: 'Control Plant Growth with Temperature', Feb. 1990 pp 71-78, Mar. 1990 pp 66-74, April 1990 pp 56-64.*