RURAL INDUSTRIES RESEARCH
& DEVELOPMENT CORPORATION

Cutflower Production of Golden Cascade

A report for the Rural Industries Research and Development Corporation

by Dr K.A. Seaton

November 2001

RIRDC Publication No 01/157
RIRDC Project No DAW-76A

ISBN 0 642 58376 5
ISSN 1440-6845

Cutflower Production of Golden Cascade
Publication No. 01/157
Project No. DAW-76A

Researcher Contact Details
Dr K.A. Seaton
Horticultural Science
Plant Research and Development Services
Agriculture Western Australia
South Perth, WA 6151
Phone: (08) 9368 3244
Fax: (08) 9367 2625

RIRDC Contact Details
Rural Industries Research and Development Corporation
Level 1, AMA House
42 Macquarie Street
BARTON ACT 2600
PO Box 4776
KINGSTON ACT 2604

Phone: 02 6272 4539
Fax: 02 6272 5877
Email: rirdc@rirdc.gov.au.
Website: http://www.rirdc.gov.au

Published in November 2001
Printed on environmentally friendly paper by Canprint

Foreword

Corynanthera flava is a unique species indigenous to Western Australia and is a highly sought flower, valued for its long whispery racemes of small golden yellow flowers which flower in time for Christmas. *Corynanthera flava* is predominantly bush picked with on average 150,000 stems sold annually. Development of methods for cultivation of this new wildflower offers the opportunity for marketing a regular supply of product of consistent quality.

Research in this project has shown the positive benefit of surveying natural populations of a little known but valuable Western Australian wildflower species. This has yielded information not only about the population dynamics of *Corynanthera flava* but also provided a basis for making informed judgements on the conservation of this species. Collection of selections and propagation of this species has also helped to conserve the genome and increased the value of the product. New techniques of propagation and irrigation have been investigated for bringing this flower into cultivation. These have a direct relevance to the production of *Corynanthera flava* and also for the development of other valuable but difficult to manage wildflowers.

The project has worked on a complete package; including selection, propagation, field production systems and postharvest handling methods. There is considered sufficient information for development of a cut flower industry using both cultivated and bush managed stands of *Corynanthera flava* and therefore the objective of the project has largely been achieved.

This project was funded from RIRDC Core Funds which are provided by the Federal Government.

This report, a new addition to RIRDC's diverse range of over 700 research publications, forms part of our Wildflower & Native Plants R&D program, which aims to improve the profitability, productivity and sustainability of the Australian wildflower and native plant industry.

Most of our publications are available for viewing, downloading or purchasing online through our website:

downloads at www.rirdc.gov.au/reports/Index.htm
purchases at www.rirdc.gov.au/eshop

Peter Core
Managing Director
Rural Industries Research and Development Corporation

Acknowledgments

The support, cooperation and assistance of Mr Bob Ward manager of Golden West Flowers Pty. Ltd. is acknowledged. Mr Tom and Joyce Glover farmer of Marchagee for assistance with surveys. The support of Mr Digby Growns (Agriculture Western Australia project manager) and of Medina Research Station manager Mr John Ferguson and the technical assistance of Mr J Berston and Mr Chris McMullan (South Perth) is greatly appreciated. The assistance of Mr Chris Newell (Tissue culture lab South Perth) and technical assistants Ms Anouska Cousin and Ms Michelle Crow is acknowledged as well as the editorial comments of Mr Malcom Howes (Agriculture Western Australia).

Contents

LIST OF TABLES

LIST OF FIGURES

Executive summary

Development of methods for introduction of new wildflowers into cultivation offers increased opportunities for marketing a regular supply of product of consistent quality. Golden cascades (*Corynanthera flava*) is one such Western Australian wildflower that is predominantly bush picked with 150,000 stems sold on average annually. *Corynanthera flava* is a unique species indigenous to a restricted region of the mid west area of Western Australia. It is a highly sought flower valued for its long whispery racemes of small golden yellow flowers. It flowers from October to February.

Surveys of natural populations in association with the Department of Conservation and Land Management (CALM) found that picking of *Corynanthera flava* from private property was considered sustainable provided that certain procedures were followed. Licenses are issued provided CALM is satisfied that; picking was sustainable, picking removed no more than 20% of plants in a population, green stems must be left below where the plant is cut and property burns are no more frequent than every eight years. Allowing continued controlled picking from bush stands has had a positive benefit in the conservation of this species. Natural stands have become a valuable and alternative source of income for farmers who have bush areas of *Corynanthera flava* on their properties.

Selections from natural populations of *Corynanthera flava* were made over two seasons and propagated using cutting and tissue culture methods. Response of selections to cutting propagation identified one or possibly two which gave a high strike rate (70%) compared with other selections which had poor strike rates of 0 to 30%. Tissue culture methods developed were successful in introducing seven selections selected from wild populations into culture. The research identified specific culture environment, media and hormone levels suited to the propagation of *Corynanthera flava*. Survival of plants following tissue culture was low,with root systems failing to become established in the nursery. Some selections were identified that were better able to survive potting on from tissue culture.

A protocol was developed for the cultivation of *Corynanthera flava*. Irrigation scheduling using tensiometers was found to be an effective method for managing this plant. Postharvest handling was also investigated and a selection identified with 26% longer vase life. An information package for the successful cultivation and handling of *Corynanthera flava* is available as a farmnote.

1. Introduction

Corynanthera flava or golden cascades is a single species in the genus *Corynanthera* in the family Myrtaceae, it is closely related to the Micromyrtus (Green 1979). It is unique in that it produces long whispery racemes of small golden yellow flowers from October to December. It has restricted distribution in the south-west of Western Australia.

Corynanthera flava are bush picked from natural stands and mainly sold into Japanese markets receiving a premium price. The sustainability of natural stands has been in question and addressed in this study.

Selection of superior clones of *Corynanthera flava* from natural populations will enable the development of *Corynanthera flava* as a cultivated flower. Achieving this involves trials developing propagation techniques suited to *Corynanthera flava*, assessment of new selections in cultivation and the development of protocols for maximising survival and production.

2. Objectives

To provide the wildflower industry with a new, unusual and potentially highly profitable cut flower by studying the biology of golden cascade (*Corynanthera flava*) in its natural environment, selecting commercially desirable forms and developing methods for establishing and cultivating these plants in commercial cut flower production.

3. Methodology

The approach was to:

1. Survey natural populations of *Corynanthera flava* to determine sustainable harvesting methods.

2. Select plants from natural populations of *Corynanthera flava* targeting vigorous growth plus early and late flowering forms. Establish mother stock plants by cutting and *in vitro* tissue culture methods to produce a range of plant types for trialing by the industry. A limited number of new collections will be made where there are found to be gaps in the range of the existing collection

3. Develop methods to propagate commercial quantities of plants for release to the industry. This will involve investigating both cutting and tissue culture techniques. Cutting methods will determine hormone type and concentration and quality and type of plant material most suited. Tissue culture will determine methods of multiplication in culture, root initiation, deflasking and establishment in potting media.

4. Determine plant agronomy including methods of establishment, plant growth, time of flowering and yield.

5. Determine methods of postharvest handling.

Data was analysed using ANOVA and linear regression analysis using Genstat® V statistical package. Mean separation was determined by least significant difference at $P = 0.05$. Means of treatments and standard errors are presented where appropriate.

4. Detailed results

4.1. Sustainable picking of natural populations and selection

4.1.1 Sustainable picking

In cooperation with CALM surveys of natural populations on private property and Crown land have been made to determine the extent and sustainability of those populations subject to bush picking (Table 1). Surveys found that species were abundant in patches on private property. Plants on bush blocks on private property occurred in densities of 10,000 to 20,000 plants per hectare or 1 to 2 plants per m^2. Picking intensity ranged from 0.3 to31.3% with an average of 2.7% and bush blocks were burnt on average every 8 years. In some areas on Crown land and national parks, plant densities were considerably lower than on private property with densities of 0.001 to 1.0 plant per m^2 .However, because of the large areas involved these represent significant reserves of plants.

Table 1. Results of surveys of picking practices of *Corynanthera flava* from natural populations in the south-west of Western Australia. The area of bush sites harvested, plants harvested and the average plants harvested per plants present in the population (%) are also shown.

Characteristic	Parameter		Average
Harvest	Total area of plants harvested (ha)	1105	
	Total number of plants present	14,280,000	
	Total plants harvested	379,500	
	Plants harvested (%)	2.66	
Picking characteristics	Stem length picked (cm)	60- 80	70
	Length retained with leaves (cm)	3 - 20	12
Bush management	Burning frequency (years)	1 - 16	8

As an outcome of these survey results it was decided that given strict adherence to requirements for the harvesting of this species bush picking would be allowed to continue on private property but not Crown land. The conditions set down are summarised below (Table 2).

Table 2. Recommendations (from CALM, 1997) for sustainable harvesting of *Corynanthera flava* from private property for export.

Recommendation	Requirements
1	Ban on all harvesting from crown land
2.	Licenses issued to properties where CALM is satisfied harvesting is sustainable
3.	Fire frequency for areas commercially harvested should be no more frequent than 8 to 10 years
4.	No more than 20% of available flowering stems taken in any one flowering season
5.	Harvest technique must ensure leaves are retained on the cut stem and not bare wood
6.	Further surveys be undertaken

Following the above practices bush picking has allowed the sustainable harvesting of stems. Stem harvest were high in 1995 before restrictions on harvesting and have remained above 100,000 stems from 1995 to 1999 with an increase of stems harvested in 1999 to 175,000 stems (Fig. 1.). Stems are usually 60 to 80 cm long with 15 to 30 stems per bunch, each bunch receives a price of upwards of $8/bunch FOB prices reaching as high as $14/bunch in 1997.

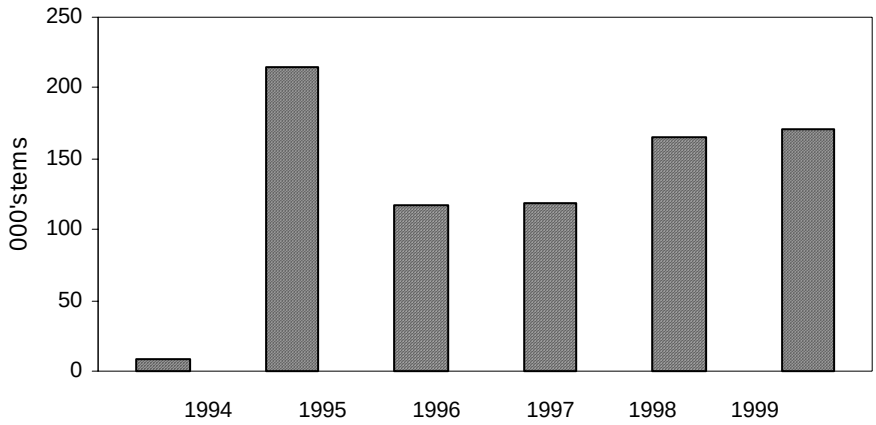

Figure 1. Stems harvested from natural stands of *Corynanthera flava* over the past six years. Source; Department of Conservation and Land Management (CALM) 2000.

4.1.2 Surveys of natural populations and plant selection

The project conducted extensive surveys over two seasons and located a number of natural populations of golden cascades. *Corynanthera flava* is restricted in distribution to the mid west of Western Australia. It occurs in an elliptical area approximately 70 km (E-W) long and 50 km wide (N-S). It belongs to the family Myrtaceae in the sub family Leptospermoideae and is closely related to the genus *Micromyrtus* (Green 1979). Plants occur in the kwongan on sand over gravel, mostly as single plants interspersed with low

heath land.. They mature over several years as tall single leafless stems branching for the upper 30 cm into 5 or 6 branches. Minute flowers (1-2 mm diameter and 3-4 mm long) occur as terminal spikes for the uppermost 50 mm of a branch with upwards of 500 florets arranged opposite. Florets are 5 lobed with entire petals and are yellow. Terminal branches bend over giving a cascading appearance (see Appendix II, Fig. 1.).

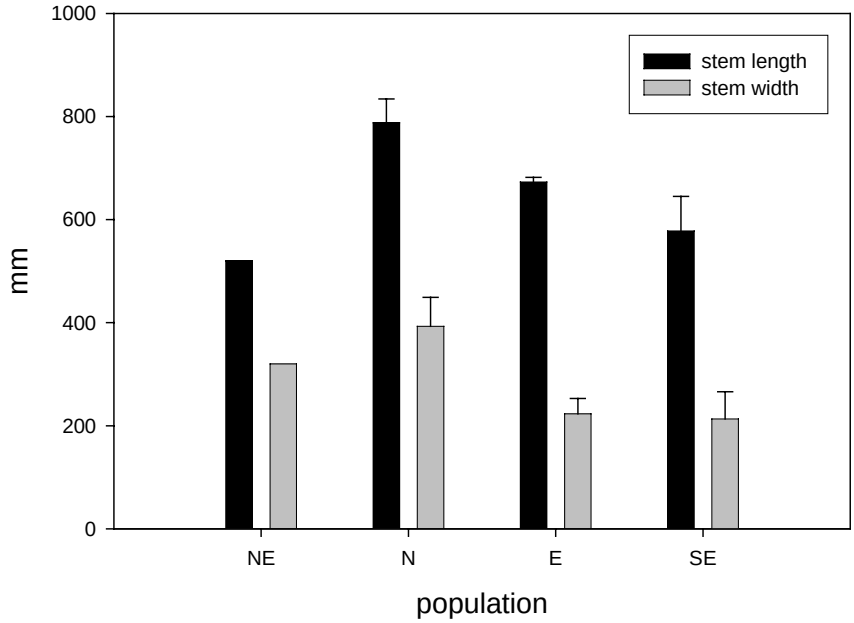

Figure 2. Stem characteristics of *Corynanthera falva* surveyed in north- east (NE), north (N), east (E) and south-east (SE) areas of natural populations. s.e. m. standard error of the means are shown ($P = 0.05$).

Stem length and width varied between selections from different populations from 520 x 320 mm in the north eastern population to 790 x 390 in the south eastern population. . The flowering period was from late September to late February.

--

Green , J.W. (1979) *Corynanthera*, a new genus of Myrtaceae (Subfamily Leptospermoideae, Tribe Chamelaucieae). Nuytsia Vol 2 1979 pp368-374. (Is this meant to be a footnote?)

Flowering time was found to be similar within in each population with plants reaching 25-50% flowering in the first week of November except that the eastern population flowered later than the other populations. These differences may be related to the effect of environment on flower development.

4.2. Propagation

4.2.1 Cuttings

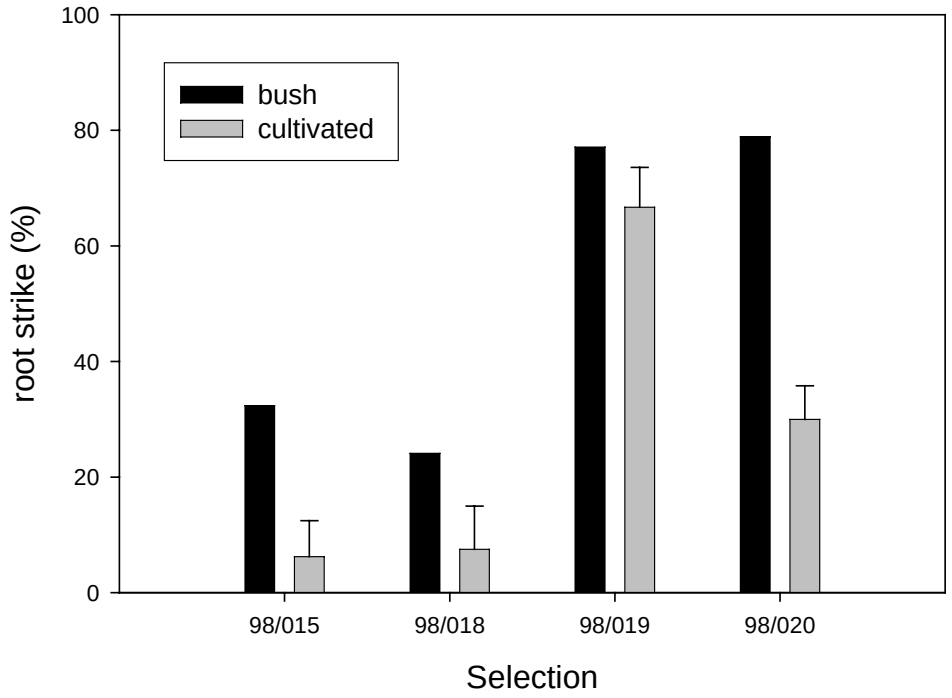

Figure 3. Root strike of cuttings of different selections of *Corynanthera flava* taken from both bush and cultivated plants**.** S.e.m. for different treatments are shown at $P = 0.05$ for cultivated plants.

Propagation from cuttings were made from selections of *Corynanthera flava* collected from bush populations in 1998. The strike rate was between 6 and 78% depending on the selection. These were planted at Medina Research Centre and after 18 months cuttings were taken from the cultivated plants. Strike rate of selection 98/019 was high at 77% and 66% whether taken from bush or cultivated plants respectively. In contrast strike rate of cuttings taken from bush plants of selection 98/020 was 79% while cuttings taken from cultivated plants was much lower at 30% (Fig 3.). For the selections 98/015 and 98/018, whether cuttings were taken from bush or cultivated plants, these consistently gave a low root strike rate of 30% or less. Cuttings were taken in May and took 9 weeks to strike roots.

4.2.2 Tissue culture

A) *Plant initiation*.- Forty one percent (41%) of selections of *Corynanthera flava* initiated into tissue culture survived. This was done effectively using a repeated hypochlorite wash, the first wash was a 5 sec dip in 0.1% sodium hypochlorite with no rinsing followed after 24 hours by a 1-minute dip in 1% sodium hypochlorite solution with 0.05% Tween80® detergent added. This was followed by several rinses in sterilised water. *Corynanthera flava* has many small leaves (2-3 mm) close to the stem and careful treatment was required to ensure that all crevices between leaves and under leaves were reached by the disinfesting solution. Low levels of 6-benzylaminopurine (BAP) and indole-3-butyric acid (IBA) were found to be effective in giving an almost two fold multiplication rate on a 6 weekly rotation. The multiplication rate varied from 160 to 225% depending on the selection. Selections were identified that performed better in culture and these were used for root initiation trial work. Cultures also had less vitrification (hyper hydration of cells) by adding aeration vents to jars and by plants being held under high (2 fold) light intensity (90 µmole/m^2/sec) than standard culture conditions used for other plant species.

B) Hormone treatment.- rooting percentage depended on the type of hormone used with hormone treatment number 3 giving significantly higher strike rates than the other treatments (Fig. 4).

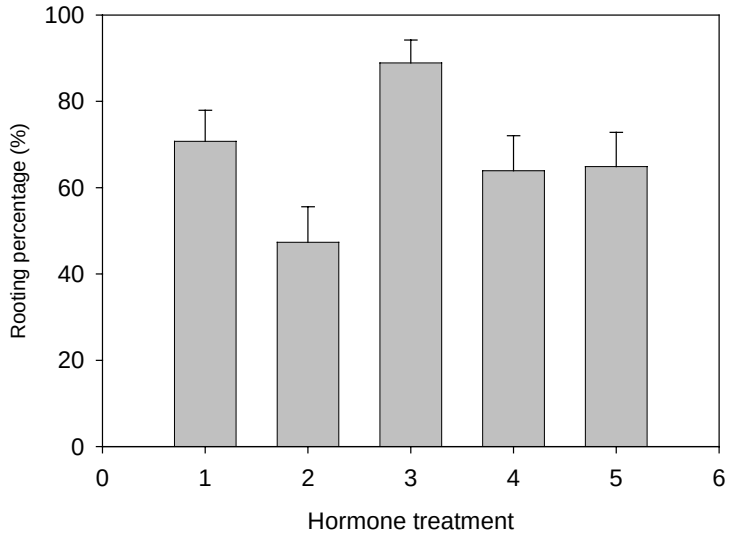

Figure 4. Root strike (%) of *Corynanthera flava* following different hormone treatments *in vitro*. S.e.m. for different treatments are shown at $P = 0.05$.

Best results were obtained in using shoot material with a main stem rather than branches. Cuttings were placed under low light (45 µmole/m^2/sec) for the first 2 weeks then moved to higher light to encourage stronger roots.

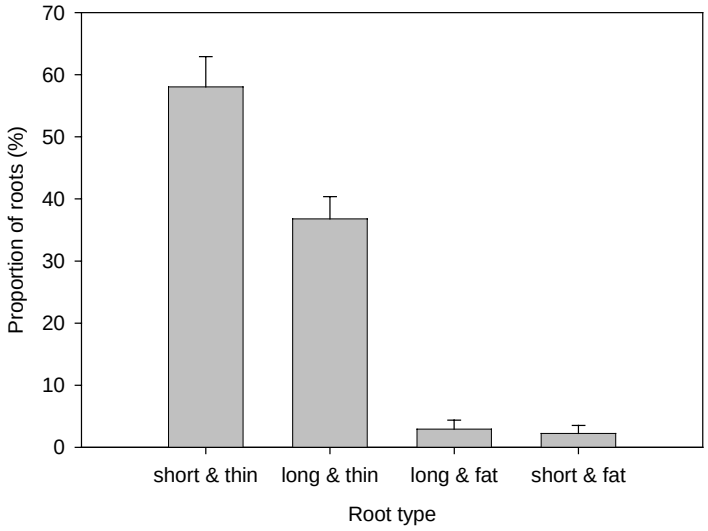

Figure 5. Effect of hormone treatments on root quality. S.e.m. for different treatments are shown at $P = 0.05$.

The majority (58%) of roots produced were short (<5 mm) and thin (type 1) followed by long and thin roots (38%) (Fig 5.). Hormone treatment 3 encouraged significantly more long and fat roots and less short and thin roots than the other hormone treatments (data not shown). This was considered an advantage in giving the plant a more robust root system to survive deflasking from tissue culture.

C) Root development.- Corynanthera flava appears to root freely in *in vitro* with roots beginning to appear after 2 weeks and continue to develop up to 6 weeks after initiation. (Fig. 6).

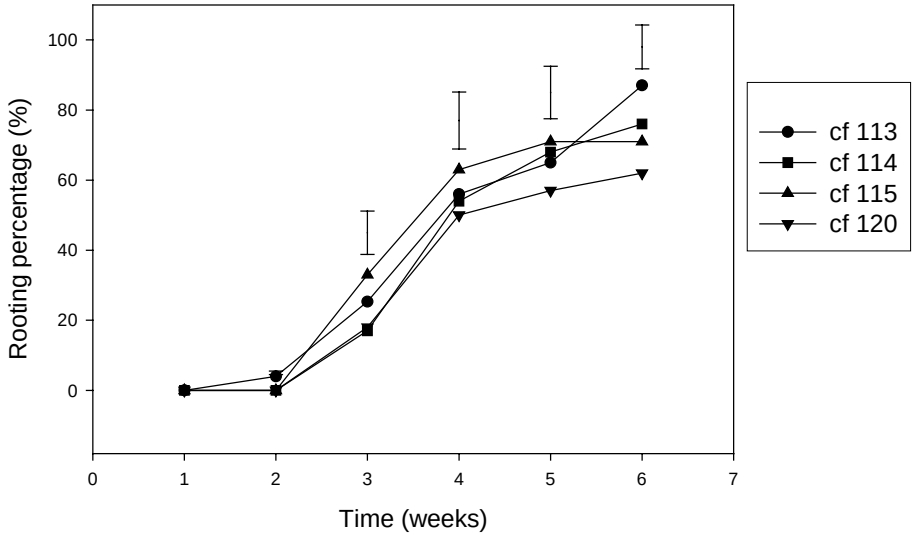

Figure. 6 Rooting percentage with time after placing shoots on root initiation medium comparing four selections of *Corynanthera flava*. L.s.d.. for different treatments are shown at $P = 0.05$.

After six weeks on rooting media selections cf 113 (87%) and cf 114 (76%) had similar root strike rates. While cf 113 had significantly higher rooting percentage than selections cf 115 and cf 120 with 71% and 62% respectively.

D) Plant survival on deflasking.- Following root initiation, survival from deflasking was 0-20% after 6 weeks (Fig. 7). After this time (6 weeks) plant numbers had stabilised. Selection cf113 had a significantly higher survival rate after 6 weeks in the propagation house than the other selections. Plants began to die after one week under fog. Examination of plants showed that that there were roots present, but that these had started to rot and were unable to maintain water supply to tops. . It was found that survival of *Corynanthera flava* in the long term in pots was poor, with possible 50% losses after 6 months particularly if held over winter, and it was better to plant out in the field as soon as possible after propagating.

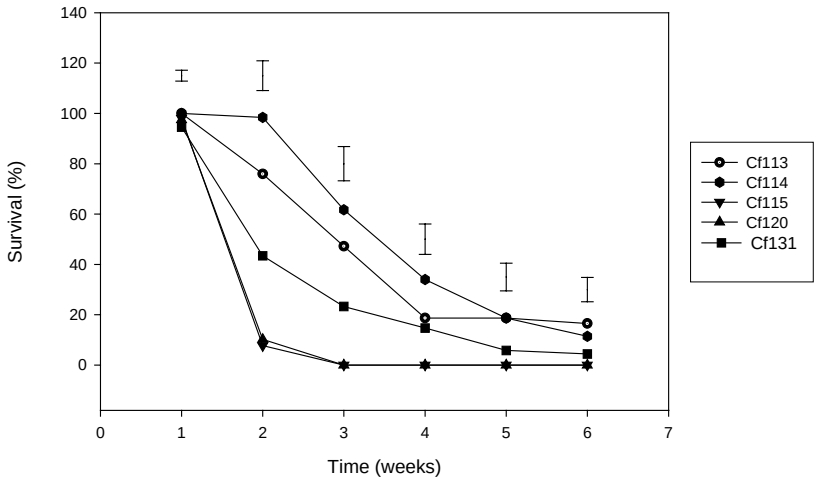

Figure 7. Survival of *Corynanthera* selections following deflasking from tissue culture. L.s.d.. for different treatments are shown at $P = 0.05$.

4.3. Field evaluation

4.3.1 Establishment

Large losses occurred in plant numbers (75%) over summer following a spring planting (Fig 8.) However, following this loss, plant numbers stabilised with only a further 10% loss over the next two years. Planting with mulch was found to be less effective than the use of bare soil and maintaining bare soil around plants allowed better water penetration to the root zone.

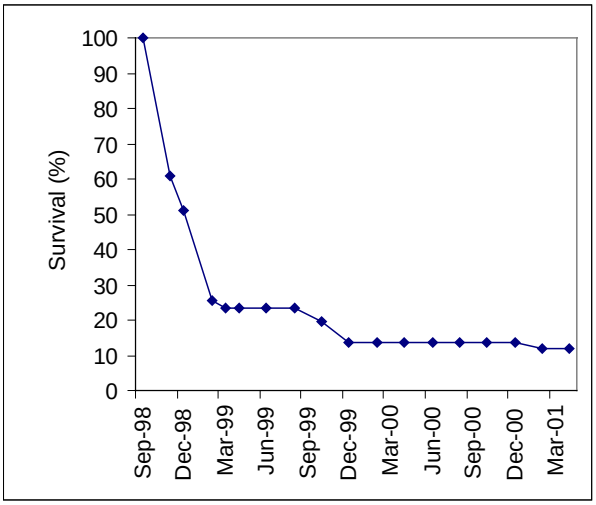

Figure 8. Survival of *Corynanthera flava* following establishment and growth.

4.3.2 Growth and flowering

Growth of *Corynanthera flava* at Medina was slow, taking 2 years to reach a height of 60 cm and a width of 50 cm. Plants flowered in the first year with flowering occurring from October to February.

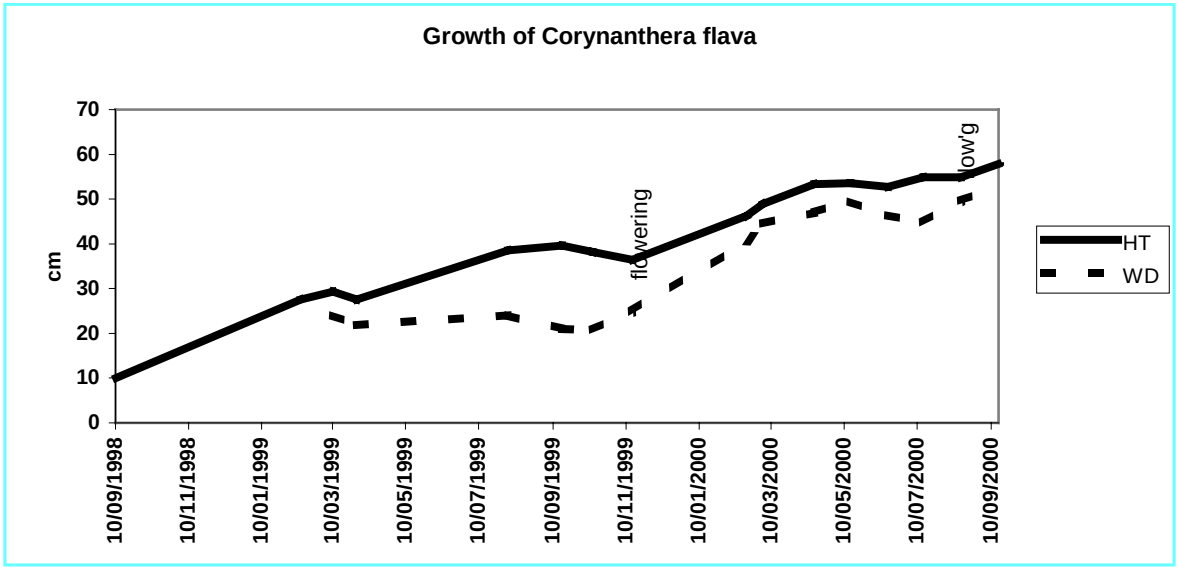

Figure. 9 Growth of *Corynanthera flava* over two flowering seasons at Medina Research Station

In the second year two forms of *Corynanthera* were distinguishable cf 98/018 and cf 98/020 which were 60% wider than 98/015 and cf 98/019. Selection cf 98/0200 had 2.5 time as many stems as cf 98/018 (Table 3). It also flowered 1 week later (50% flowers open) than cf 98/018 and cf 98/019.

Table 3. Comparison of different selection of *Corynanthera flava* in terms of plant height and width, yield (stems/plant), and time of 50% flowering. Means followed by the same letter are not significantly different at $P = 0.05$.

Selection.	Plant height	Plant width	Yield (stems/plant)	Time of 50% flowering
Cf98/015	54.5 a	41.5 b	7.0 b	mid Nov
Cf 98/018	48.0 a	63.0 a	10.0 b	Early November
Cf 98/019	49.3 a	48.2 b	8.7 b	Early November
Cf. 98/020	65.0 a	81.0 a	25.0 a	mid Nov

4.3.3 Irrigation management

Tensiometers were placed in the surface 15 cm down to 60 cm under *Corynanthera flava* plants in the field. Irrigation was applied once the soil moisture tension reached 14 centibars (cb). Water was applied by micro sprinklers. The frequency and duration of irrigation depended on the weather. Plants required irrigating from November 1999 to June in 2000 and November 2000 to May 2001 (Fig. 10). The frequency of irrigation was weekly through summer adding 15 litres per m^2/week.

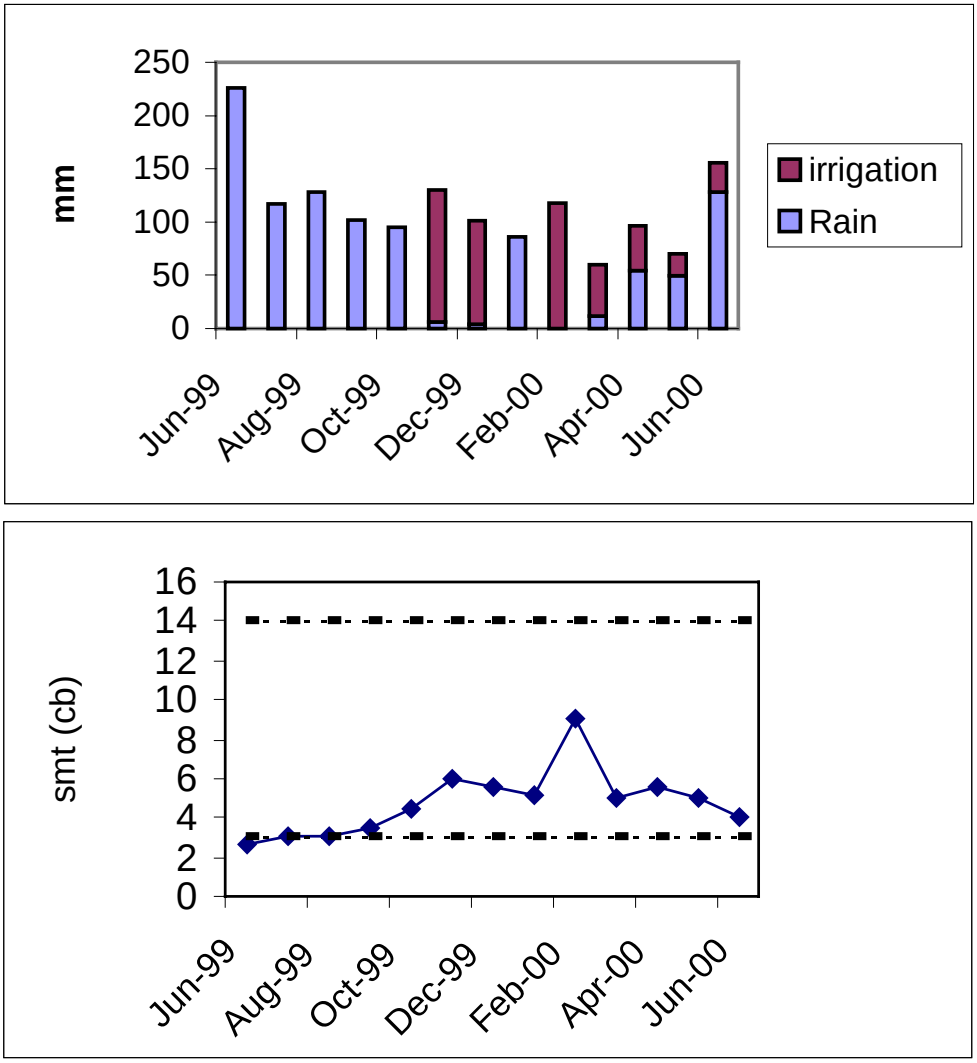

Figure 10. Irrigation applied and rainfall from June 1999 to June 2000. Also shown are the soil moisture tension (smt) tensiometer readings during that time.

By this irrigation method savings of about 50% on water use were achieved compared with a set program of applying water on a daily basis. Also *Corynanthera flava* did not show any signs of stress through the hot summers at Medina Research Station and appeared to benefit from wetting and drying cycles. Using tensiometers to control when plants are irrigated took the guesswork out of judging whether a shower of rain, particularly in summer, was effective. The tensiometer is an invaluable tool as the readings reflect what is happening in the root zone..

4.4. Postharvest

Vase life of *Corynanthera flava* selections ranged from 8 days to 12 days. Vase life of cf 98/019 and cf 98/020were significantly longer than (on average by 29%) cf 98/015, and cf 98/018 (Table 4). None of the selections were sensitive to ethylene exposure although selections exhibited some flower drop. This occurred irrespective of whether flower had or had not been treated with ethylene. *Corynanthera flava* was found to be easy to handle, packing well into boxes and not requiring any special postharvest treatment.

Table 4. Comparison of vase life, flower drop and ethylene sensitivity of different selections of *Corynanthera flava*. Means followed by the same letter are not significantly different at $P = 0.05$.

Selection	Vase life (days)	Flower drop (%)	Ethylene sensitivity
Cf98/015	9.3 b	5.3 a	negative
Cf 98/018	8.3 b	5.2 a	negative
Cf 98/019	12.0 a	4.5 a	negative
Cf. 98/020	10.8 a	5.5 a	negative

Generally insect levels were low and fumigation using Insectigas® and/or Pestigas® was effective for disinfestation. The tendency for some flower drop indicates a need to handle the flower with care. Flower drop may be minimised by putting stem ends into water as soon as possible.

5. Discussion

Corynanthera flava is an exciting new wildflower unique to a restricted area of Western Australia. It represents one of the spectacular flowers which is being bush picked and recieves good returns on export markets. During the early stages of the project concerns about the long-term sustainability of picking this flower from natural populations were addressed. The option of banning bush picking was averted. From surveys of picking practices and bush management of natural populations on private property, it was concluded that with adherence to sound conservation practices it was possible to sustainably pick this flower from bush areas with the exception of Crown land. A key finding was that it was essential to leave green shoots below where plants were cut for stems. Plants cut to bare wood generally fail to regenerate. Another finding was that, on average, only 20% of stems are picked in an area in a season. This is an important constraint on picking practice as field surveys indicate that *Corynanthera flava* is a slow growing species in the bush, taking a number of years to regenerate.

The challenge of the project was to bring this plant into cultivation. This would allow reliable production of consistent quality and selection for different types. The rewards for being able to achieve this would be great. There were no precedents from other wildflowers on how to tackle the problem. The closest relative to *Corynanthera flava* that has been successfully cultivated is Geraldton waxflower, however, this plant was found to be much easier to bring into cultivation than *Corynanthera flava*. Challenges to be overcome were (a) propagating plant material from the wild and developing reliable propagation methods, and (b) developing irrigation and fertiliser protocols to maintain plants in cultivation.

Corynanthera flava selections varied in their ability to strike roots from cuttings. Some did not strike roots while others gave in excess of 70%. Tissue culture of new selections of *Corynanthera flava* were successful in initiating new selections into culture. Plants remained healthy when grown in tissue culture under special high light conditions. This may be related the high light conditions under which they grow during summer north of Perth. Auxin treatments appropriate to *Corynanthera flava* were identified. Also selections varied in their ability to initiate roots and the quality of roots produced. Treatments were identified which favored the production of stronger thick roots rather than the weaker thin roots. It may be possible to relate differences between performance of selections in potting on to differences in root quality between selections.

Corynanthera flava plants appear to grow best planted under micro sprinkler irrigation in bare soil in spring without a mulch. Occurring naturally on sand over gravel, growing this plant on deep sand poses a challenge for irrigation management. Managing the water demand of plants on deep sand using tensiometers was found to be successful, plants were adequately watered but not over watered. This method also had the advantage of preventing waste of water.

The vase life of selections of *Corynanthera flava* is adequate without the requirement for special postharvest vase solution treatments. There is some petal drop but this is not caused by ethylene sensitivity and appears to be related to the senescence of older petals. The good packing density of this flower provides a freight advantage.

The ability of *Corynanthera flava* to flower over an extended period under cultivation given adequate water offers a marketing advantage for the cultivated flower. *Corynanthera flava* selections can be distinguished agronomically as well as in terms of their ability to propagate either in tissue culture or from cuttings. These selections have been identified in the project. The propagation methods and cultivation methods defined in this project will provide the cut flower industry with an opportunity to commercialise this valuable wildflower.

6. Implications

This project has demonstrated that the selection and cultivation of *Corynanthera flava* has posed some difficult challenges. To achieve success, some new techniques had to be developed. The plant did not respond to standard propagation and cultivation techniques used for other wildflowers.

Differences in propagation response between selections has been an important development in this project. Identification of those with a high strike rate or the ability to survive in tissue culture opens up opportunities for their propagation and cultivation.

To commercialise this plant would require propagators who are willing to adopt the propagation protocols developed. This will require applying special attention to detail and maintenance of quality control. The propagator will need to decide whether this crop is sufficiently economical to warrant this sort of effort and expense.

Irrigation management using tensiometers has application to a wide range of wildflowers. This technique is simple to apply and provides an accurate assessment of the water requirement of plants. Allowing tensiometers to dry down to a predetermined level before irrigating avoids over watering, which can kill many wildflowers. Saving of 30-50% in water application can also be made by this method without causing the plant to wilt.

The robust postaharvest characteristics of *Corynanthera flava* with its insensitivity to ethylene makes handling this flower easy. Although there is no cause for complacency as poor handling may extenuate senescence petal drop. Also the good pack out of the stems offers considerable freight advantage.

7. Recommendations

Several selections of *Corynanthera flava* have been identified which are recommended for further development. Two of these (cf 98/019 and cf 98/020) have different flowering times (early and mid) and a vase life of 11-12 days (Table 5.) These selections can be grown to spread the flowering time and widen the marketing window. This will ensure a consistent supply, avoid gluts, and give the best chance of securing the highest price.

Table 5. Summary of propagation, production, flowering time and vase life characteristics of different selections of *Corynanthera flava* identified in the project.

Selection	Propagation (%)	Production (stems/plant)	Flowering time	Vase life (days)
Cf 98/015	<30	7	mid	9
Cf 98/018	<30	10	early	8
Cf 98/019	65-75	9	early	12
Cf 98/020	30-80	25	mid	11

Commercial production of *Corynanthera flava* requires appropriate protocols to be followed. We are now aware that some the *Corynanthera flava* selections are not easily propagated using tissue culture techniques or from cuttings. However at least one selection (cf 98/019) and possibly another (cf 98/020) have been identified that easily propagate from cuttings. One of these selections (cf 98/020) has high stem production.

Field management protocols have been worked out and these should be closely followed to ensure that growers and exporters achieve the best result out of growing *Corynanthera flava.* Also plants perform best with low levels of fertilisers, particularly phosphate and benefit from infrequent irrigation using micro sprayer. It is recommended that best plant performance will be achieved by the use of tensiometers to regulate irrigation application.

Appendix I – Agriculture Western Australia Farmnote

Golden cascade (*Corynanthera flava*) for cut flower production

By Kevin Seaton, Research Officer, Agriculture Western Australia

Introduction

Golden cascade (*Corynathera flava*) is a species unique to the northern sand plain of southern Western Australia. It belongs to the family Myrtaceae and is closely related to the genus *Micromyrtus*. It has minute golden-yellow flowers, and has versatile use as a filler. Flowering in late spring to early summer it offers a flower for the approaching Christmas festival season.

It is entirely picked from natural populations and exported fresh to markets in Asia and Europe. Picking is banned from crown land and supplies of flowers are only available from managed bush stands on private property. Picking is under licence with strict guidelines to ensure the conservation and sustainability of *golden cascade*

Research at Agriculture Western Australia has developed methods to reliably propagate plants of golden cascade for cultivation. Golden cascade plants take several years to reach their full potential in cultivation. The current higher value of the flowers may compensate for the long lead times. Cultivating golden cascade opens up more reliable sources of flowers for exporting.

Bush management

The conditions set down for bush harvesting are summarised in Table 1.

Table 1. Recommendations (CALM, 1997) for sustainable harvesting of *golden cascade* for export from private property.

Recommendation	Requirements
1	Ban on all harvesting from crown land
2.	Licenses issued to properties where CALM is satisfied harvesting is sustainable
3.	Fire frequency for areas commercially harvested should be no more than 8 to 10 years
4.	No more than 20% of available flowering stems taken in any one flowering season
5.	Harvest technique must ensure leaves are retained below the pruning cut
6.	Further surveys be undertaken to assess sustainability

Following the above practices bush picking has allowed sustainable harvest of stems. Stems are usually 60 to 90 cm long with 15 to 30 stems per bunch.

Plant selection

AGWEST has selected at least one form with a higher yield than bush-picked plants, a good propagation rate and good vase life. Cultivating this selection offers scope for increasing the marketability of golden cascade.

Site selection

Golden cascade prefers a sand over gravel site, and warm dry climates with average minimum/maximum temperature of 12/23°C. Growing golden cascade on deep sands requires accurate irrigation practice. The site chosen for growing golden cascade should be free of diseases, particularly dieback (*Phytophthora* spp.) and weed free as plants do not compete with weeds during establishment.

Planting and establishment

Plants perform better on sandy soils with a bare weed free sandy surface. Use of wind breaks such as 'grow cones', or similar individual plant guards are advantageous in the first six months of establishment. Once guards are removed it may be necessary on windy sites to support plants for the first year

Plants are best established at high density of 13,200 to 9500 plants per hectare depending on the selection used. This can be achieved by planting in a double row 0.6 m apart with 0.5 to 0.7 m between plants on a staggered grid.

Plants do not benefit from a mulch, rather the soil surface should be kept bare. This allows deeper penetration of irrigation water via micro sprayers. The soil surface surrounding the plant must be kept free from weeds by regular spraying or hand weeding.

Fertilisers

At planting, 10 gram of low phosphorus, slow release fertiliser, such as Osmocote™ or Nutricote™, should be spread on the soil surface adjacent to plants. Once established, plants (after 2 -3 months) require a regular feed, preferably through the irrigation lines such that plants receive 100 kg/ha/annum of nitrogen and potassium and 6-8 kg/ha/annum of phosphorus and calcium together with a balance of trace elements.

Injecting fertilisers during watering (fertigation) to meet the requirements of *Corynathera flava* can be achieved by making up a stock solution of the following fertilisers in a 200 litre drum of water.	
Fertiliser	**Amount (kg/200 litres)**
Agran	6.5
Potassium nitrate	10.2
MAP (mono ammonium phosphate)	1.2
Calcium nitrate	1.9
trace elements (Librel BMX ®)	0.2
During each watering allow the irrigation system to run for 10 minutes, then inject over the next 60 to 90 minutes 10 litres of the stock solution per 3200 litre of water used, followed by 10 minutes of watering without fertiliser. Acclimatise young plants to the above fertiliser program by gradually increasing the frequency of injection i.e. first inject fertiliser one day out every three days for a two week period, increasing the frequency until plants are fertigated daily. From mid spring to autumn (October to April) fertigate plants on an approximately weekly basis as indicated by tensiometers (see under irrigation). The frequency of irrigation should be scaled back during autumn to winter (refer to Farmnote 99/94 for selection of fertigation equipment).	

Irrigation

Micro sprayers are preferred to trickle as they allow the whole soil profile to be wet up evenly. Irrigated plants of *golden cascade* at Medina have a low evaporation replacement of 20 –30%. Tensiometers can be used to schedule irrigation. . Sufficient water is applied to recharge the root zone to a pre determined reading on the tensiometer gauge. Install tensiometers to a depth of 15 cm directly below the plants. See Farmnote Number25/90 entitled Tensiometers preparation and installation(can be accessed on web via; enquiries@agric.wa.gov.au). Tensiometer readings should be monitored daily and once it has reached 12-14 cb turn on micro sprinklers for 1 to 2 hours (delivering 15 litres/m^2/hour). Following irrigation wait an hour and then check tensiometers again, if necessary turn on sprinklers again until reading returns to wet (less than 5 cb). At Medina during October to April it was sufficient to irrigate plants approximately weekly. From May to September rainfall was sufficient to keep tensiometers within the prescribed limits.

Pruning

Plants respond to light pruning in the first year and this is necessary to establish a good branch structure. Care needs to be taken to not pick to bare wood and leave a green stem below the pruning cut.

Pest and diseases

Few pests and diseases appear to affect *golden cascade*, however, in wetter areas they may be a problem and it would pay to closely monitor plants. *Botrytis* spp. has not been detected on this flower. If pests are found then follow insect management practices outlined in Farmnote 1/96.

Postharvest treatment

No special vase solutions are necessary although good posharvest practice is necessary to prevent petal loss particularly in bush picked material. Stems should be stood with ends in clean water after picking to maximise vase life and quality. No anti ethylene treatment such as STS is necessary for golden cascade.

Following picking, flowers should be quickly cooled to 2°C and kept at below 5°C once packed to maximise quality. Flower bunches of 15 to 30 stems, 60 to 80 cm long can be densely packed into flower cartons.

Further reading

- Farmnote no. 110/99 ' Smokebush (*Conospermum* spp.) for cut flower production '
- Farmnote no. 99/94 ' Selection of fertigation equipment '
- Farmnote no. 1/96 ' Pests of export wildflowers and proteas '

Note: The support of the wildflower industry and funding from Rural Industries Research and Development Corporation and Golden West Flowers Pty. Ltd. to carry out this work is gratefully acknowledged.

Appendix II - Photographs

1. Mature *Corynanthera flava* bush showing flower display.

2. Location of tensiometer at base of *Corynanthera flava* plant.

3. Comparison of two selections of *Corynanthera flava* in cultivation at Medina Research Centre.

4. Root initiation *in vitro* of *Corynanthera flava* shoots.