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# Getting Started in Wildflower Growing

*How to grow native Australian and South-  
African species for the cut flower market*



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RIRDC Publication No. 12/O90





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# **Getting started in wildflower growing**

**How to grow native Australian and South African  
species for the cut flower market**

**First edition**

By Bettina Gollnow

July 2013

RIRDC Publication No 12/090



**Department of  
Primary Industries**

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*Getting started in wildflower growing - How to grow native Australian and South African species for the cut flower market (first edition)*

Publication No. 12/090

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# Foreword

This guide brings together both published and unpublished information, industry expertise and the authors' experience in the Australian flower industry to assist potential and new growers in their efforts to become profitable commercial growers of flowers and foliage from native Australian and South African species. It aims to make potential investors well aware of the risks, challenges and costs ahead, guiding them through the requirements of a feasibility study and business plan. This guide provides new growers with practical information about growing, harvesting, and postharvest handling and treatment of wildflowers. This is a practical 'how to' manual that covers all aspects from selecting the site to marketing the blooms. The advice on crop maintenance, postharvest care and information sources will assist new and established growers alike. While focused on NSW, reflecting the experience of the various authors, much of the information applies to wildflower growing on the east coast of Australia and beyond.

Established growers will also benefit from the information about crop maintenance and postharvest handling, and the information sources and references.

The project was funded from RIRDC Core Funds, which are provided by the Federal Government, supported by the former NSW Department of Primary Industries (now part of Industry & Investment NSW). Many members of the Australian wildflower industry—growers, wholesalers, exporters and researchers—have generously shared their technical knowledge.

This publication, an addition to RIRDC's diverse range of over 2000 research publications, forms part of our Wildflowers and Native Plants R&D program, which aims to improve the profitability, productivity and sustainability of the Australian industry.

Most of RIRDC's publications are available for viewing, free downloading or purchasing online at [www.rirdc.gov.au](http://www.rirdc.gov.au). Purchases can also be made by phoning 1300 634 313.

Craig Burns  
Managing Director  
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# Acknowledgements

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Edited by Matthew Stevens, ScienceScape® Editing, Sydney

This publication includes information previously published by the former NSW Agriculture as *Getting Started in Native Flower Growing* (ISBN 0 7347 1020 8). This was first published in October 1996 and reprinted with minor revisions in August 1997. A second edition was published in January 1999 and reprinted with minor revisions in May 2001. This new manual contains new and more extensive information. It incorporates information published in the Flowers and Ornamentals section of the NSW Department of Primary Industries' website and technical information prepared for various grower workshops, publications and conferences. It also covers South African species which are grown and marketed similarly to Australian native flowers.

David Wood and the Sapphire Coast Producers Association are acknowledged for information included in Chapters 2, 8, 9, 10, 14 and 15, first published in their *Native Flower Growers Starter Kit*.

Chapter 3 includes information adapted in part from workshop notes prepared for flower growers by Geoff Cresswell (former plant nutrition chemist, NSW Agriculture), and from the Australian Flower Growers Seminar Proceedings 1999 (produced by IHM Pty Ltd).

The information in Chapter 6 is adapted from an earlier NSW Agriculture Agfact (H9.1.19), *Growing Proteas Commercially*, which was originally adapted with acknowledgement from the WA Department of Agriculture Farmnote *Growing Proteas*.

Chapter 8 includes information from the NSW Agriculture Agnote DPI/157, *The Economics of Cut Flower Production* (1997), by Philippa Mathias and Bettina Gollnow.

Chapter 14 includes information from Neil Wade published in the Flowers and Ornamentals section of the NSW DPI website ('Postharvest care of cut flowers').

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## About the authors

Bettina Gollnow provided extension support to the commercial NSW cut flower industry as the Industry Development Officer (Floriculture) for the NSW Department of Primary Industries for over 18 years until her retirement in 2010. During that time, Bettina sought to bring industry members together through publications, regular industry events and a range of technical resources. She has completed two projects for RIRDC. One developed the current industry R&D plan and reviewed the achievements of the previous Wildflower and Native Plants R&D Plan. Most recently, she produced the quality specifications for Australian wildflowers and the supporting postharvest manual.

Dr Ross Worrall was Special Research Horticulturist, NSW DPI, until his retirement in 2010. Over a 40-year career, Ross worked on the commercial development of Australian native plants. He conducted research in the areas of plant physiology, potting mixes, breeding systems, new product development, postharvest management and plant propagation.

Jonathan Lidbetter works with NSW DPI and has spent almost 20 years researching problems and opportunities faced by the nursery and cut flower industries, with a particular emphasis on native plants and their propagation. His work has included research on plants in the Goodeniaceae, Rutaceae, Myrtaceae, Proteaceae, Thymeleaceae and Arecaceae. His most recent research project with RIRDC focused on grafting native species with potential for floriculture, including *Boronia*, *Corymbia*, *Pimelea*, *Geleznowia*, *Chamelaucium* and *Eremophila*.

Len Tesoriero is Industry Leader (Greenhouse and Ornamentals) with NSW DPI, fostering industry development. He maintains an active interest in plant health diagnostics and integrated disease management research and is known to many in the flower industry for his work in NSW DPI's Plant Health Diagnostic Service. Len currently manages several research projects in protected cropping, where his contributions gained him the 2007 researcher of the year award from the Australian Hydroponics and Greenhouse Association.

David Wood and his son Michael established and operate Tarrawood Native Nursery, located near Bega, NSW. This wholesale nursery grows a wide range of Australian species for the nursery and cut flower industries. Tarrawood Native Nursery specialises in grafting Australian native plants—over 20 species from 7 genera. It is NIASA-accredited and has state-of-the-art facilities, including extensive use of computer-controlled undercover growing areas and capillary irrigation beds. In 2002, David produced the *Native Flower Growers Starter Kit* for the Sapphire Coast Producers Association, with funding from the Federal Department of Transport and Regional Services. Selected parts of that publication have been included in this new manual.

Bill Yiasoumi has many years' experience in farm water management and works within NSW DPI. His expertise lies in irrigation and drainage works, including effluent reuse and general farm hydrology. He has contributed to both national and state best management guidelines for vegetable production, nursery production, beef cattle feedlots and the cut flower industry. Bill is co-author of the popular *Managing Water in Plant Nurseries* and has written several articles related to farm water management and water quality. He has also presented conference papers and conducted workshops on farm-related water management issues across Australia.

# Abbreviations

## Units

°C	degrees Celsius
%	per cent
/	per
cm	centimetre
g	gram
g/L	grams per litre
ha	hectare
kg	kilogram
L	litre
mg	milligram (1000 mg = 1 g)
mg/L	milligrams per litre
mm	millimetre (1000 mm = 1 m)
mL	millilitre (1000 mL = 1 L)
mL/L	millilitres per litre
ppm	parts per million

## Other abbreviations

APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine and Inspection Service
DECCW	NSW Department of the Environment, Climate Change and Water
DEWHA	Australian Department of the Environment, Water, Heritage and the Arts

DPI	Department of Primary Industries
EPA	Environment Protection Authority
MSDS	Material Safety Data Sheet
No.	number
NPWS	National Parks and Wildlife Service
pH	measure of acidity
®	registered trade name
syn.	synonymous with
Vol.	volume of written publication, journal etc.
Ⓓ	Plant Breeders' Rights symbol

## Chemical names

N	nitrogen
P	phosphorus
K	potassium
S	sulphur
Ca	calcium
Mg	magnesium
Fe	iron
Mn	manganese
Cu	copper
Zn	zinc
B	boron
Mo	molybdenum
Cl	chlorine



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# Executive summary

## What the guide is about

This guide provides advice aimed at assisting potential wildflower growers to make a realistic assessment of their capacity to enter the industry and be successful. It also provides information on all aspects of setting up a plantation and then the growing, harvesting and postharvest handling of wildflowers (flowers and foliage from native Australian and South African species).

## Who is the guide targeted at?

This 'how to' guide has been produced for potential and new members of the Australian wildflower industry who plan to grow and market wildflowers commercially.

## Where are the relevant industries located in Australia?

Wildflower growers are located in regional Australia. Established growers operate in all states, with significant production areas in south-west Western Australia, South Australia, Victoria, the NSW South Coast and North Coast regions and south-east Queensland.

## Background

Wildflower growing appeals to many people. However, detailed and reliable information about what is involved in establishing a productive farm and growing and marketing the products successfully is scarce. Many have joined the industry only to find the challenges much greater than they expected.

## Aims

The aim of this work was to produce a guide that includes up-to-date industry information and advice about all aspects of establishing and operating a wildflower farm. The information aims to prepare people for the challenges ahead and to reduce the risk that their plantation will fail or be unprofitable owing to a lack of information and guidance.

## Methods used

This guide is based on information previously published by the former NSW Agriculture in *Getting Started in Native Flower Growing* (ISBN 0 7347 1020 8). It contains new and more extensive information. It also incorporates information published in the Flowers and Ornamentals section of the NSW Department of Primary Industries' website and technical information prepared for various grower workshops and conferences. It also covers South African species which are grown and marketed similarly to Australian native flowers. Information was gathered from industry members, including growers, extension specialists, researchers, wholesalers and exporters.

This work was undertaken in association with the broader 'Quality Specifications for Australian Wildflowers' project and the 'Growing Flannel Flowers All Year Round' project, for which a production guide was also produced. These projects were conducted by the former Industry & Investment NSW – Primary Industries (now NSW DPI) (RIRDC projects PRJ-000331, PRJ-000498).

## Results

This project has produced an important resource that provides new and intending growers with practical information about getting set up to grow, harvest and market wildflowers. This is a practical 'how to' guide that assists potential growers to review their situation and to build a business based on a solid business plan. It covers all aspects from selecting the site to marketing the blooms.

### **Implications for relevant stakeholders**

The information in this guide will allow potential entrants to the commercial wildflower industry to decide whether or not they should join the industry. If they decide to get started, the guide takes them through the potential crops they can grow, and tells them where to source plants, how to set up their plantations and how to maintain their crops. Information about harvesting, postharvest care and marketing is also provided. The information should benefit the Australian industry by ensuring that new growers are profitable through efficient production and marketing practices.

There is a need for ongoing extension of this information and for it to be regularly updated.

The guide can also be an extremely valuable resource for students.

### **Recommendations**

The availability of this guide needs to be made widely known, by RIRDC, the authors, industry leaders and bodies, and government bodies.

We recommend that new and intending industry members follow the advice on assessing the feasibility of growing wildflowers and establish a sound business plan before they start. They need to explore the various contacts and sources of information provided to gain a wide appreciation of the costs and technical skills involved. New industry members need to adopt production, postharvest and quality management practices outlined in the guide to ensure they market good-quality products at a profit.

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# Chapter 1. Introduction

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**Bettina Gollnow and Ross Worrall**

What is special about flowers, and how are they used?

What makes a flower suitable for commercial growing?

The wildflower industry in Australia

The wildflower industry in NSW

Should you join the industry?

Production issues   Limiting factors

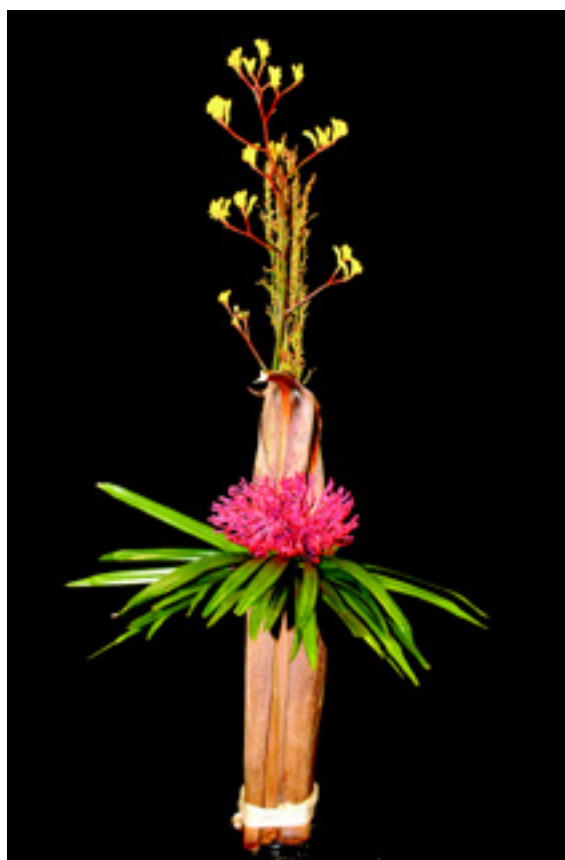
Markets   Checklist of requirements

## What is special about flowers, and how are they used?

Fresh flowers play a unique role in our lives, both in celebration and in sorrow. Unlike most other horticultural crops, demand for fresh flowers is often related to fashion trends. Our growing multicultural population has seen an increased use of flowers outside of the traditional peaks of Valentine's Day, Mother's Day and Christmas. For other festive occasions like Chinese New Year and Orthodox Easter, fresh flowers are used extensively. Buyers are constantly seeking new flower lines and cultivars.

Flowers can be sorted into several groupings, according to their function in a floral arrangement:

**Line material** forms the outline for the design. Longer stems with tapered lines are usually selected, for example kangaroo paw, leucadendron, and traditional flowers like *Delphinium* 'Pacific giant', stock and gladioli.



This modern design by Richard Go illustrates the various functions of different materials in an arrangement.

**Focal flowers** are placed next, creating a feature in the design. Suitable flowers include proteas and banksias (and such traditional flowers as carnations and roses).

Sometimes smaller focal flowers follow the line material already placed, strengthening the design, with further placements of larger focal flowers towards the central axis of the design, for example banksias.

The composition is completed with **transitional materials** that link the other flowers. Foliages with solid leaves or soft leaves or flowers such as *Erica*, multi-cone leucadendron and Geraldton wax can be used.

Focal flowers are generally the largest flowers and achieve the highest price per stem, and may be sold individually. The other flowers and the foliage are sold in bunches and sell for a lower price.

## What makes a flower suitable for commercial growing?

Most traditional flower crops grown commercially today are the result of many years of intensive selection and breeding. For example, carnations have been grown for over 2000 years and have been improved by breeders since the 16th century, making the carnations that a florist uses today very different from the original wild parents. This means that a wide range of flower colours and forms is available to cater for the fashion trend of the moment. Also, a great deal is known about the cultivation needs of these crops—growers can adapt this information to suit their situation and market needs.

In sharp contrast, relatively few native Australian and South African plants have been the focus of rigorous improvement programs. We have an estimated 30 000 Australian native species, and any selection programs have begun only relatively recently (in the UK in the 1850s and during the last hundred years in Australia and elsewhere). Many commercially grown wildflowers are basically still 'wild' plants. While some improved selections are vegetatively propagated (grown from cuttings or in tissue

culture), many others are grown from seed. Some species, for example kangaroo paw and wax flower, have already become 'world crops' and offer the market a great diversity of form and colour. For many other wildflowers, there is limited knowledge about how to grow them successfully and in different parts of Australia.

Wildflowers and traditional cut flower crops differ in the length of the flowering season. Under outdoor conditions in much of Australia, many crops, such as roses and carnations, produce flowers throughout most of the year. Other crops, such as chrysanthemums, have a short flowering season, but commercial growers can produce flowers for most of the year by choosing early- and late-flowering varieties and by artificially controlling the day length under which they are grown.

Native Australian species have a relatively short flowering season, and most flower in spring. Little is known about what triggers flowering in these plants, so the ability to get most species to flower on demand is a long way off. Undoubtedly there are benefits of applying production technology developed for traditional crops to wildflower growing. Many of their South African protea relatives also flower for a relatively short season, but some, such as king proteas, flower for much of the year. Flowering season in terms of time of year and duration will vary with geographical location.

## The wildflower industry in Australia

The commercial cultivation of Australian native and South African plants for cut flowers and foliage is an established industry producing product for sale on both domestic and export markets. This industry is often referred to as the 'wildflower'<sup>1</sup> industry to distinguish it from the traditional flower industry (also called the exotic or soft flower industry). Traditional flowers include annuals, roses, chrysanthemums, bulb crops, lilies and the like. The traditional flower industry forms the larger part of the Australian flower industry, with a longer history, significant-

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<sup>1</sup> The term 'wildflowers' is used throughout this guide to refer to flowers and foliage from native Australian and South African species.



ly greater production and value, and a greater number of growers.

Cultivated Australian native product is mostly of better quality and more environmentally sustainable. Reliance on bush-picked product is rapidly diminishing for all but foliage products, for which the economic viability of propagating plants from cuttings or seed is questionable or technically too difficult. The industry is becoming increasingly competitive. Research and development of new products has concentrated on species with proven market appeal. Propagation systems are improving, and the focus is on new varieties or forms with improved cut flower features. A good visual reference is *Flowers from Australia* (AFEC 2008).

Most native Australian and South African flower and foliage crops are currently produced as open-air crops in the ground. Some are produced under rain shelters. The latter system has the potential to greatly increase the supply of flowers and thus the profits, but only certain species (for example, flannel flowers and certain kangaroo paws) warrant the higher investment required.



**Cultivated waratahs have replaced wild-harvested flowers in the marketplace.**

The greatest profits are potentially made from growing and marketing new flower products. But these new lines also present a greater risk. Their market appeal needs to be assessed early, and efforts must be made to build market awareness of them as something novel and therefore deserving of a higher price. Once a flower line is grown by a larger number of growers and has become well known in the marketplace, the returns per bunch or stem tend to be lower. In times of high volume or oversupply, only the best-quality product will sell, and on the export market this price may not

cover all growing and marketing costs.

Most of Australia's flower exports are native Australian and South African flowers and foliage. Worldwide production of these species is significant, but Australia's share is currently about 10% of the total. Accurate statistics are difficult or impossible to obtain, because 'wildflowers' are a minor component of the world flower trade, where the 'top' flowers are dominated by traditional species such as roses and chrysanthemums, and flowering pot plants are often included in floriculture data.

Interest in growing wildflowers remains strong for several reasons, including:

- a greater local demand for high-quality, cultivated native flora
- compatibility of South African products with natives, as they require similar growing conditions and are used together in floristry
- stronger targeting of key crops
- greater availability of basic production information
- development of crop-based and locally based grower networks
- wholesalers and exporters fostering grower development through better feedback and crop recommendations
- stronger collaboration between the research and development institutions and industry
- increased pressure to reduce bush-picking
- restructuring or downturns in other agricultural industries.

While accurate industry statistics are not available, the Australian wildflower industry is believed to have a domestic market share of 10% to 15%. In 2006–07 the gross value of production of the Australian wildflower industry was valued at \$40 million, with exports worth \$29.88 million (Foster 2009). There have been no reliable assessments since, but the values above will have fallen owing to the global economic downturn and adverse weather. Unlike the traditional flower industry, which is a mature industry, the wildflower industry still has the characteristics of a developing industry, with a high percentage of new, inexperienced growers. However, it is a more export-focused industry.

To date, growers have tended to work cooperatively, and a number of active grower networks and associations have been formed. Unfortu-

nately, the industry is still very fragmented, with a large number of small businesses involved and a multiplicity of marketing channels; it also lacks accurate industry statistics and forecasts. Many growers are part-time flower growers who have other business or farming interests. To date, the industry has not invested adequate funds in research, development or promotion.

## The wildflower industry in NSW

Between 1995 and 2005, most of the growth in the NSW flower industry came from new entrants choosing to grow wildflowers. Up to 250 farms were established in NSW. In 2010, this number has fallen to an estimated 100 farms. Many growers were overwhelmed by the work of growing and marketing. Several years of drought, crop losses due to frost and an unfavourable exchange rate on the export market have forced many to reconsider their place in the industry. This contraction has occurred across the Australian industry. A number of growers noted that their lack of technical skills and capital caused them to lose money to a point where they could no longer continue in the industry.

Most of the industry today is located along the coast, with a strong focus on the North Coast. Here crops come into production at a key time to satisfy the prime market opportunities in Japan and before competitors elsewhere in Australia or overseas have product to sell. In contrast, traditional flower growing is focused mainly in the Sydney region, with regional producers located on the North and South Coasts, Southern Tablelands, and several centres further inland. Many growers produce exclusively for the export market, while others sell on both the domestic and export markets.



**A wide range of flowers native to Australia and South Africa are grown in plantations in NSW.**

The main crops grown in NSW are:

- Australian species: *Actinotus*, *Alloxylon*, *Anigozanthos* and *Macropidia*, *Banksia*, *Boronia*, *Ceratopetalum*, *Eriostemon*, *Eucalyptus* and *Corymbia*, *Grevillea*, *Philotheca*, *Ozothamnus* and *Telopea*.
- South African species: *Leucadendron*, *Leucospermum*, *Protea* and *Serruria*.

## Should you join the industry?

Flower growing appeals to many because it provides both a lifestyle and a business. However, financial institutions these days finance what they perceive as viable businesses, so be prepared to conduct a lot of research before deciding whether this is for you. The industry needs professional growers who can operate a profitable business through the marketing of top-quality products.

The key aim of your business should be to make a profit rather than just to produce flowers. Failure to make a (real) profit means you either go out of business or have an expensive rural life style. It is important to consider all risks—not just the physical ones. As a potential grower you should develop business and financial plans to control risks, which may be physical, financial, marketing, legal or business related.

With the benefit of hindsight, experienced growers have listed as their 'worst mistakes' when starting out:

- not treating wildflower growing as a business
- lack of good-quality research
- lack of good-quality marketing
- failure to establish the demand for the crop
- not getting independent sources of advice
- working excessive hours and not allowing for holidays
- not controlling credit
- falling foul of regulations and planning requirements
- lack of quality control
- under- or over-capitalisation
- inability to pay for additional labour
- exceeding future financial limits
- growing the wrong species or varieties
- choosing the wrong site
- poor basic knowledge.

Any business plan should address all these.

**In summary, flower growing is high risk, labour intensive, resource intensive, capital intensive and subject to global market forces.**

- good access for machinery
- plantation sites that face north or north-east
- power for irrigation pumps, the cool room and the packing shed.

Infrastructure requirements for a successful cut flower operation include:

- skilled labour for crop management, picking, grading, bunching and packing
- technical advice on production, postharvest treatment (exported flowers may be in transit and out of water for up to 5 days before reaching the overseas consumer), and legal, financial and marketing aspects
- adequate cool room capacity
- reliable supplies of high-quality planting stock
- constant supplies of packaging materials
- postharvest disinfestation facilities (many export destinations have zero tolerance for pests and diseases)
- refrigerated transport to market or airport where appropriate
- a reliable freight forwarder
- a reliable specialist exporter.

## Production issues

NSW and many parts of regional Australia have a wide range of climates and soil types well suited to wildflower production. Areas along the coastal strip are especially suitable, as they have a mild climate and summer rainfall. Most inland areas have a drier climate, predominantly winter rainfall, and are often subjected to winter frosts.

If your property is located inland, you should conduct comprehensive varietal trials to ensure suitability for your region. Effects of climate and location on growth and flowering are not fully defined for all species. Some, such as Christmas bush, will not tolerate frosts more severe than  $-4^{\circ}\text{C}$ . Local trials are strongly recommended in order to establish the best combination of species to plant.

Any farm site selected for cut flower growing should have:

- adequate good-quality water
- well drained soil, with a pH of 5.5 to 7.0

## Limiting factors

Cut flower production is a specialist, capital-intensive industry, and potential investors must consider factors carefully. Several factors can limit potential entrants to the industry:

**Expertise:** Entrants require some knowledge or staff with a background in flower production.

**Capital:** Successful establishment of a viable cut flower operation requires a high initial capital flow and commitment for a number of years before returns are realistic. In recent times, rulings by the Australian Taxation Office have required growers to demonstrate more clearly the lead time for a particular crop to become commercially viable.

**Market research:** A detailed understanding of key markets is crucial to exploiting sales opportunities. The success of any horticultural enterprise depends firstly on the **market demand** for your product. This is linked to your access to capital, choice of site, crop selection and management, access to information, and technical

and marketing skills.

**Scientific data:** Reliable data about the suitability of varieties to certain situations and regions is patchy. More research needs to be conducted on potential new areas and varieties, but to date the industry has been unable to afford the research effort needed.

**Economies of scale:** While the industry has traditionally been served by a number of small operations, some people believe the future lies in larger producers with high capital and land investments who are able to take advantage of the obvious economies of scale as well as consistency of supply. Alternatively, growers can join forces to market their product under a single trading name.

**Success rate:** The industry has a traditionally low success rate of new entrants, due mostly to the factors mentioned here. Effective quality management and marketing are extremely important. In recent years exporting has become less profitable owing to higher freight costs, less favourable exchange rates and competition from lower-cost producers in other countries.

## Markets

Many of the flowers produced are sold on the domestic market, in NSW mostly through the Sydney Flower Market at Flemington. There, florists and consumers are able to buy a wide variety of fresh flowers direct from growers or sellers, some of whom specialise in wildflowers.

Australia has a number of specialist flower exporters who target key markets in Japan, South-East Asia, Europe and North America (see Chapter 9). Only top-quality flowers should be exported. Major overseas producers such as the Netherlands have set extremely high standards for flowers traded throughout the world.

## Checklist of requirements

### Business and market research

- Define major potential markets and their requirements.
- Define how these markets will be reached.
- Define your competitive edge.
- Define gross margins for potential crops.
- Carry out a feasibility study.
- Define risks and how they will be managed.
- Define ability to expand production.
- Assess funding options.
- Obtain any necessary approvals for land clearing, water access and construction of buildings.
- Obtain any required license(s), e.g. for growing and selling native flora.

### Farm site selection

- Adequate good-quality water.
- Well drained soil, pH 5.5–7.0.
- North to north-east aspect.
- Good access for machinery.
- Power for cool room, packing shed, irrigation pumps.

### On-farm support

- Skilled labour for crop management, picking, grading, bunching and packing.
- Technical advice—production, postharvest treatment, legal, financial, marketing.
- Packing shed and cool room.
- Suppliers of good-quality planting stock.
- Suppliers of packaging.
- For export—postharvest disinfestation facility.

### Transport

- Refrigerated transport to market or airport.
- Freight forwarder.
- Exporter.

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# Chapter 2. Is growing wildflowers commercially for you?—a questionnaire

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David Wood<sup>2</sup>

Introduction

Part A. Are you suited to operating an agricultural enterprise?

Part B. Is your land suitable for horticulture?

Part C. What is your financial position?

## Introduction

How do you know whether you're suited to working as a primary producer? Or whether that block of land you own or want to buy is really suitable for what you want to grow?

This questionnaire will help you consider carefully what you're getting into and make a better-informed decision as to whether to proceed.

In addition, you may like complete the interactive scenarios for wildflower growers produced by the former Centre for Native Floriculture. There are five in the series and all are worth reviewing before you start:

- I think I want to grow native flowers
- Why do good flowers go bad?
- Smart marketing – the way to success

- Developing new plants for marketing
- Pest & disease management issues in native flower plantations.

Go to [scenarios.sblinteractive.org](http://scenarios.sblinteractive.org) and search on the name of the scenario of interest.

The questionnaire starting on page 21 will give you a rough indication of your suitability as a flower grower and your land's suitability for producing adequate returns. In this regard, you may also find the factsheet 'Precautions when buying rural land' useful ([www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)).

The answers are for your own private use; they need not be shared with anyone else.

All the issues raised below can have a bearing on the success or otherwise of an enterprise in terms of immediate or long-term hidden costs.

While positive responses are a good indication, if you have too many negative responses a

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<sup>2</sup> The information in this chapter was first prepared by the author on behalf of the Sapphire Coast Producers Association for their *Native Flower Growers' Starter Kit*. This questionnaire serves solely as an indication of the issues involved in operating a flower growing business, but it is not an all-inclusive or infallible guide to any person's suitability or otherwise, for any type of agricultural production business.

serious reconsideration may be warranted. The factor that cannot be determined here is your persistence and will to succeed at any cost.

It is well documented that many people start small businesses without knowing fully what they are getting into. Sometimes they do it for all the wrong reasons and succeed, and sometimes they do it for all the right reasons and fail.

While the worst, most unsuitable piece of land can always be forced into production, its limitations and the resultant costs of production will see your net returns diminished compared with those of people working more suitable land. The moral of the story is that cheap land can become very expensive land over time.

There's money to be made out there, but do your research first. This questionnaire may help you.



**Dream or reality? A lot of hard work is required to create a commercially viable wildflower farm.**

## Part A: Are you suited to operating an agricultural enterprise?

Physical health at present	<input type="checkbox"/> excellent	<input type="checkbox"/> average	<input type="checkbox"/> poor
Any back or other health problems that will limit your working ability?	<input type="checkbox"/> no	<input type="checkbox"/> maybe	<input type="checkbox"/> yes
Are there family time demands that could limit your work?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Are family members available to help and support?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
How much time per week can you <i>realistically</i> make available for the enterprise?	..... hours		
Have you discussed this enterprise thoroughly with your partner?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
If yes, was the result ...	<input type="checkbox"/> positive	<input type="checkbox"/> neutral	<input type="checkbox"/> negative
Are you happy to work long or flexible hours?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Do you tend to see solutions rather than problems?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Do you normally finish what you start?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Would others regard you as a hard worker?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Would others regard you as being thorough in your work?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know



Are you prepared to take some investment risks with factors beyond your immediate control?	<input type="checkbox"/> yes	<input type="checkbox"/> maybe	<input type="checkbox"/> no
What experience/interest/skills/training have you in your chosen enterprise?	<input type="checkbox"/> a lot	<input type="checkbox"/> not much	<input type="checkbox"/> none
Would others regard you as willing to learn new technologies?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Have you any experience with marketing?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Have you any management skills?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Can you effectively manage your time?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Can you prioritise tasks easily?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Can you prepare and manage budgets?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Are you proficient with computers?	<input type="checkbox"/> yes	<input type="checkbox"/> maybe	<input type="checkbox"/> no
Are you prepared to invest in membership of support groups and further training?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Do you have an ABN?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Are you registered for GST?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know
Do you know how to prepare a business plan?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Are you aware of the services offered by your local Business Enterprise Centre?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Are you aware of that primary production can be adversely affected by natural disasters (e.g. storms, hail drought)?	<input type="checkbox"/> yes	<input type="checkbox"/> no	
Have you a fallback position ready in case of problems?	<input type="checkbox"/> yes	<input type="checkbox"/> no	

Scoring:

a) If you have ticked a majority of the **left-hand** boxes, this indicates that either:

- you have some positive attributes that may assist in running an agricultural business
- or you have adequate preparation or experience to be a small business operator.

b) If you have ticked a majority of the **right-hand** boxes, this indicates that either:

- there could be significant obstacles for you to operate a small business successfully
- or you need to do some more research or preparation.

**If option 'b' applies, it may be wise to reconsider your options.**

## Part B: Is your land suitable for horticulture?

Have you discussed the capabilities of your land with anyone, say the DPI, a consultant or local farmers?	<input type="checkbox"/> yes	<input type="checkbox"/> no		
How much good horticultural land have you got (suitable for growing flowers)?	..... ha			
What is the average topography of the land?	<input type="checkbox"/> flat	<input type="checkbox"/> undulating	<input type="checkbox"/> steep	
What is the soil type?	<input type="checkbox"/> loamy	<input type="checkbox"/> clay loam	<input type="checkbox"/> gravelly	<input type="checkbox"/> sandy <input type="checkbox"/> rocky
Have soil tests been done?	<input type="checkbox"/> yes	<input type="checkbox"/> no		<input type="checkbox"/> don't know
Have the results been discussed with soil experts?	<input type="checkbox"/> yes	<input type="checkbox"/> no		
Are there any serious soil problems (e.g. high pH, acid sulphate soil)?	<input type="checkbox"/> yes	<input type="checkbox"/> no		
What is the site aspect?	<input type="checkbox"/> north	<input type="checkbox"/> east	<input type="checkbox"/> west	<input type="checkbox"/> south
Does the soil drain well?	<input type="checkbox"/> excellent	<input type="checkbox"/> average	<input type="checkbox"/> poor	<input type="checkbox"/> don't know
Is water accessible?	<input type="checkbox"/> yes	<input type="checkbox"/> no		<input type="checkbox"/> don't know
If yes, what is the source? <sup>3</sup>				
Is <b>town water</b> available?	<input type="checkbox"/> yes	<input type="checkbox"/> no		
Is there a drought-proof <b>creek</b> ?	<input type="checkbox"/> yes	<input type="checkbox"/> no		<input type="checkbox"/> don't know
Is there a <b>dam</b> big enough to irrigate from?	<input type="checkbox"/> yes	<input type="checkbox"/> no		<input type="checkbox"/> don't know
Is there a <b>bore</b> ? Do you know anything of the quantity and quality of the water?	<input type="checkbox"/> yes	<input type="checkbox"/> no		<input type="checkbox"/> don't know
If there is no water available, are there suitable dam sites or other sources?	<input type="checkbox"/> yes	<input type="checkbox"/> no		<input type="checkbox"/> don't know
Do any of these sources require a licence?	<input type="checkbox"/> yes	<input type="checkbox"/> no		<input type="checkbox"/> don't know
Road access to land?	<input type="checkbox"/> excellent all-weather	<input type="checkbox"/> good	<input type="checkbox"/> poor (4WD only)	<input type="checkbox"/> none
Is the access suitable for large trucks?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	

<sup>3</sup> Adequate and drought-proof water is critical for any enterprise, and will require its own comprehensive assessment. Many other aspects raised by this questionnaire also warrant more thorough assessment.



Is the electricity connected?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
Is there a phone line?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
If there is no electricity, how far is it away from your site?	..... km			
If there is no phone, how far is it away from your site?	..... km			
Have you got quotes to connect both?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
Is the site subject to frosts?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
... If yes, how severe?	<input type="checkbox"/> light	<input type="checkbox"/> moderate	<input type="checkbox"/> severe	<input type="checkbox"/> don't know
Is there good air drainage?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
Can the site be protected from prevailing winds?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
How do you rate the bushfire threat?	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high	<input type="checkbox"/> don't know
Noxious weeds or animals threats?	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high	<input type="checkbox"/> don't know
Has the land been competently inspected for threats?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
Is any immediate work necessary on threats?	<input type="checkbox"/> no	<input type="checkbox"/> yes	<input type="checkbox"/> don't know	
Are suitable house, shed, work area sites available?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	
Is land clearing necessary?	<input type="checkbox"/> no	<input type="checkbox"/> yes	<input type="checkbox"/> don't know	
... If yes, what restrictions will apply?	<input type="checkbox"/> none	<input type="checkbox"/> some	<input type="checkbox"/> don't know	
Are there any restrictive easements etc. on land?	<input type="checkbox"/> no	<input type="checkbox"/> yes	<input type="checkbox"/> don't know	
Is there a history of fertiliser usage?	<input type="checkbox"/> never used	<input type="checkbox"/> yes, used	<input type="checkbox"/> don't know	
What is the condition of the fencing?	<input type="checkbox"/> excellent	<input type="checkbox"/> good	<input type="checkbox"/> poor	<input type="checkbox"/> none
Is there an opportunity to expand the cultivated area?	<input type="checkbox"/> yes	<input type="checkbox"/> no	<input type="checkbox"/> don't know	

## Scoring:

- a) If you have ticked a majority of the **left-hand** boxes, this indicates that either:  
 —the land probably has favourable features that make it a suitable base for a business  
 —or you have researched the land well.
- b) If you have ticked a majority of the **right-hand** boxes, this indicates that either:  
 —the land could present significant obstacles to being an easily sustainable business  
 —or you need to do more research.

**If option 'b' applies, it may be wise to reconsider your options.**

## Part C: What is your financial position?

How much money do you owe now?	\$
How much finance do you have in reserve (investments etc.)?	\$
How much collateral do you have if you have to borrow?	\$
How much money do you have available now for starting the enterprise? (not borrowings)	\$
What are your current earnings? (per week)	\$
How much of your weekly income is required for family or other basic necessities?	\$
What percentage of your income would you like the business to provide eventually?	%
Do you have an accountant or financial adviser?	<input type="checkbox"/> yes <input type="checkbox"/> no
... If yes, have you discussed this enterprise with them?	<input type="checkbox"/> yes <input type="checkbox"/> no

We strongly recommend that you prepare a business plan with the help of your accountant, financial adviser or local Business Enterprise Centre representative.

A business plan will match your current financial situation with the requirements and projections for the enterprise, and enable you to make an informed decision about proceeding. For more information on business planning, see Chapter 8.

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# Chapter 3. How plants grow

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**Bettina Gollnow**

Natural climatic range

Some basic botany

Soil    Nutrients and plant nutrition

Soil and plant tests

Plants are fairly adaptable, but as a commercial flower grower you are expecting optimum yields that will generate a reasonable income for you. Therefore you need to understand how plants grow and must manage your plantation accordingly. Relatively few commercial wildflower growers have had formal training in horticulture, and have learnt by trial and error, which can be expensive. Even people with horticultural skills find growing Australian and South African species commercially a challenge, because any published information (if it is available at all) must often be fine-tuned to local conditions.

## Natural climatic range

Few plants naturally grow 'anywhere and everywhere'. Most occur naturally within a defined climatic range on a specific soil type. For example, waratahs grow in 'sandy soils with brown or yellow clay at depth over sandstone in dry sclerophyll forest from Ulladulla to the Watagan Mountains and in the Blue Mountains' (Harden 2002). This means that successful cultivation of a given plant species in an area outside of this natural range may not always succeed. While a

few individual plants may struggle and survive in a marginal area, establishing a viable commercial planting may not be feasible.

This means that when choosing species to plant in your plantation, you must consider their optimum environmental conditions. What is the climate like in the natural range or where other growers are successfully growing this species commercially? How does this compare with the location of your proposed plantation? You need to consider the temperature maxima and minima; whether or not the species is naturally exposed to frost, fog, snow or strong wind; and at what times of the year these events are expected. You also need to check the preferred soil type, pH and water needs (and things such as whether or not the plants will cope with periodic flooding or waterlogging of soil). While it is possible to modify existing soil conditions, this may require specialist advice and can be expensive—for example, changing a very alkaline soil to an acidic pH. Similarly, planting most wildflower species near a riverbank where the soil may be subject to periodic flooding or waterlogging may be unwise.

## Some basic botany

Most species grown for the cut flower market are classified by botanists as flowering plants. Above the ground, they consist of a stem—a mostly rigid structure which branches in various ways and holds leaves, flowers and fruit. The stem conducts water and nutrients from the roots to the rest of the plant and takes sugars from the leaves throughout the plant. The tip of each stem tends to grow towards the light. The stem on new growth is usually soft and becomes harder and thicker with age. This means that when the plant is stressed, the shoot tips will be first to show it by drooping. The stems produce and support leaves and may also store food reserves.

The leaves are most commonly flattened structures, with a large surface but relatively thin. This provides a large surface area onto which sunlight can fall. The plant leaves convert the energy from sunlight into sugars by **photosynthesis**. Excessive shade on and within your crop caused by adjoining trees or inadequate pruning will reduce photosynthesis and hence crop growth. The leaf blade may be attached to the stem via a stalk or may arise directly from the stem. There may be obvious differences in colour and structure between the upper and lower leaf surfaces. Newly emerging leaves are softer than mature ones and more susceptible to burning due to excessive heat, wind or salinity. The leaf is supported by veins.

Associated with the leaves are buds, which eventually grow out into new stems with their leaves or flowers. In pruning, it's important to make cuts to shorten stems just above a bud, rather than leaving a long stub of stem that may later die and become an entry point for disease. If you don't know where on the plant the buds for your next crop of flowers are, you could easily remove them during pruning.

The roots anchor the plant in the ground, but also take up water and nutrients from the soil. They can also store food reserves for the plant. The root tips and fine root hairs are especially important for their water and nutrient uptake functions, which is why root tip death due to attack by fungi has such a serious impact. The first signs of disease are often plant wilting and yellowing, the result of impaired root tip function, and not a signal that the plant needs more

water and fertiliser. The roots require oxygen for respiration. In waterlogged or compacted soils, the roots may become starved of oxygen, stop growing and die.

Key internal structures throughout the plant are the conducting tissues. The **xylem** forms the 'woody' tissues in the centre of the stem or leaf vein and conducts water and nutrients from the soil into the shoot. The **phloem**, which is often located close to the xylem, moves sugars from the leaves to elsewhere in the plant.

Cutting a flowering shoot off the plant obviously disrupts the flow of sap and water to it. Unless proper postharvest handling occurs (see Chapter 14), the detached shoot and flower quickly wilt and die. In addition, tiny air bubbles are drawn into the xylem tissues when the stem is cut, causing a blockage. These bubbles (known as air embolisms) form a barrier that stops water moving up the stem once the cut end is again placed in water. The longer the cut stem is kept dry, the more difficult it is for water to flow past the bubbles, so cut stems must be placed in buckets of water as soon as possible after harvest. This water must be clean, because dirty water often contains bacteria and other microbes that can also cause stem blockages. This is especially important for woody stems, which are more prone to bacterial plugging. Cutting the stems with sharp rather than blunt blades limits the damage done.

## Plant physiology

**Photosynthesis** is the process by which green plants produce organic compounds from water (absorbed via the roots) and carbon dioxide (from the air) using the energy from sunlight absorbed by chlorophyll, which is green. Nitrogen is an essential constituent of chlorophyll, so failing to provide adequate nitrogen in your fertiliser program will reduce crop productivity.

**Transpiration** is the process by which plants release water as vapour, mainly from the leaves. Transpiration is essential in a healthy plant, but excessive transpiration can cause wilting and even plant death. The **transpiration stream** is the flow of water up through the plant as a result of the water lost by transpiration, and draws water from the soil through the roots and distributes it throughout the plant.



**Most species grown for the cut flower market are classified as flowering plants.**

**Respiration** is the process by which plants absorb oxygen (not carbon dioxide) from the air and convert it to carbon dioxide, water and heat. In both photosynthesis and respiration, the gases pass through specialised pores, called stomata (singular: stoma), on the leaves (mainly the under surface). When the plant is under stress, for example due to heat or lack of water, the stomata will close to conserve water. By the time you notice that a plant is actually wilting, it will have been under stress for quite some time. But this also means that photosynthesis has slowed, reducing the plant's growth. Harvested shoots continue to respire (that is, take in oxygen and lose carbon dioxide), meaning that unless they are cooled quickly, they will lose a lot of water and deteriorate. Similarly, if stems are packed into a box and left to cool gradually in a cool room (as opposed to being cooled quickly by forced-air cooling), they will heat up for quite some time before the temperature starts to drop, and can 'cook' in their box, again losing quality.

## Features of flowers and stem

In the botanical sense, the term 'flower' means the individual flower (sometimes called a floret) on a stem or within a flower head. However, many wildflowers have a complex flower head composed of hundreds of florets arranged in a distinctive structure. Others have sprays of individual flowers massed along the stem (for example, waxflower or *Chamelaucium*). Other wildflowers feature bracts (which are modified leaves) rather than petals, for example *Protea*, waratah and flannel flowers.

For simplicity in this manual, the words 'flower' and 'stem' both refer to the whole commercial

product, including the stem, leaves, bracts, flowers and flower head (made up of individual florets). For example, the commercial flower of the waratah includes stem, leaves, bracts and a single flower head of many individual flowers.

The different parts of a commercial flowering stem may develop and age differently after harvest. You will need to understand the botany of the flowers you are growing to ensure that you harvest stems at the right stage of opening, and provide the right postharvest treatments to ensure that your customers will be happy. Some postharvest issues are specific to wildflowers and need particular management by you as the grower. For example, as the florets in a complex flower head (e.g. *Banksia*, *Protea*, *Leucospermum* and *Grevillea*) develop and open, they draw on food reserves in leaves, they produce nectar (which in turn attracts birds and bees), and the appearance of the flower head changes completely. You will find more information on harvesting and postharvest care in Chapter 14.



**Harvesting at the right stage and providing correct postharvest management requires a good understanding of the unique features of wildflowers. The spectacular king protea is an example of a complex flower head composed of hundreds of individual florets surrounded by attractive bracts.**

## Soil or growing medium

The growing medium, be it soil or potting mix, provides the plant with support, air, water and nutrients. As well, at least in soils and composted materials, it supports an active population of microorganisms that can have either beneficial or detrimental effects on crop performance.

### Support

The view that the soil's prime function is to simply hold the plant up is fortunately fading. This preoccupation with the top of the plant has been responsible for many mistakes in soil, fertiliser and disease management. Growers should think of the soil as a living system which must be managed sensitively if their horticultural enterprise is to have a long-term future.

### Air

Roots need to breathe fresh air if they are to function efficiently. The soil must, therefore, have pockets and channels for gases to be stored in and to diffuse to the surface. These spaces must not be filled with water for long periods after rain or irrigation but must drain freely. Roots will drown if waterlogged conditions persist, and damaged roots are more likely to suffer from disease infection.

Some disorders, such as tip burn, growth distortions and vein clearing on leaves, are caused by lack of oxygen. High soil temperatures increase these problems, because oxygen becomes less soluble in the soil water and respiration by the roots increases.

### Water

All the metabolic processes performed by plant cells depend on water. Flower buds open and stems lengthen by plant cells filling with water. Nutrients taken up by the roots are moved to the tops in a stream of water powered by evaporation. Water is needed for cooling. Finally, nutrients are absorbed mainly from water held in the soil. When water is in short supply, plant growth is often dramatically reduced. Inadequate water is probably the major reason why the growth of most crops is reduced. An improved supply of water is arguably the most

likely reason for the faster growth of plants in hydroponic (soilless) systems.

## Soil texture and structure

The soil texture and structure are critical to the success of your flower growing. Soils high in clay are generally unsuitable for wildflowers, because they easily become waterlogged, and most Australian and South African species need good drainage. Clay soils are also hard to cultivate, and tend to be sticky when wet and to form hard clods when dry.

Very compacted or shallow soils may need to be improved through deep ripping and through the growing of a green manure crop before planting. As well as improving the structure, the organic matter from the green manure crop will stimulate microbial activity, which assists in the breakdown and release of nutrients. A diverse population of microorganisms will include some with beneficial effects for plants; for example, they can successfully compete with plant disease species. Sometimes the activity of microorganisms can influence the availability of nutrients. For example, when fresh, uncomposted organic material is added as mulch, the microorganisms may use up significant amounts of nitrogen and phosphorus decomposing the mulch, thereby causing nutrient deficiency symptoms in the plants (called 'nutrient drawdown').

## Biological properties of soil

The biological properties of a soil depend on the organisms living in it. Of particular concern are the range of soilborne pathogens, including *Pythium*, *Phytophthora* and *Rhizoctonia*.

One of the major attractions of growing in soilless media is the possibility of excluding these pathogens. However, research has revealed that many diseases are more easily controlled in non-sterile media. Organic-based media populated by benign organisms have been shown to suppress diseases. This finding supports the use of organic mulches and building up organic matter in soils.

For some crops, certain fungi associated with the roots are important for obtaining nutrients, especially trace elements. These partnerships (called mycorrhizal associations) have been

reported in some plants but may be relevant to most plants.

## Soilless media

Soilless media such as perlite, sand, vermiculite and gravel have effectively no nutrients. Crops grown in soilless or hydroponic systems are therefore susceptible to a much wider variety of nutrient disorders. Although these systems allow far better control of crop nutrition, the choice and quantities of fertilisers used are more critical than in soil. If you use soilless media, you must provide all nutrients in the fertiliser program in precise quantities. Because these media hold nutrients much less strongly than soils do, the nutrients are both more available for uptake and more likely to be leached and lost.

## Nutrients and plant nutrition

Plants can obtain adequate amounts of most of the essential nutrients from the soil. Soil reserves of nitrogen, phosphorus and potassium are normally adequate, but are depleted by growth and harvesting, so these nutrients must be supplied to maintain production. Calcium and magnesium are also low in some acidic soils and must also be supplied. Trace element disorders are uncommon in NSW soils but must be addressed when they develop.

Nutrient uptake occurs mainly from the **soil solution**—the water in the soil that has dissolved the nutrients and salts. So the supply of nutrients to the crop depends a lot on how soluble the nutrients are. There is no point in having high soil reserves if the nutrients taken up by the crop are replenished very slowly into the soil solution. The capacity of a soil to buffer (i.e. maintain levels in) the soil solution against change is a very desirable quality.

Nutrients available for plant uptake may come from inorganic pools such as undissolved salts (fertilisers or natural) and soil minerals or from organic pools consisting of dead and living organisms. Nutrients may be held firmly and be relatively unavailable to plants, or be held loosely. There is a balance between available

and unavailable pools of nutrients in most soils.

In many soilless media, all the nutrients are readily available to the roots. This might seem like an advantage, but it means that nutrient availability is balanced on a knife edge. Thus, when too much fertiliser is given, toxicities develop; and when too little is given, deficiencies occur. By comparison, soils are very forgiving, because they can buffer available amounts.

Thirteen elements are known to be essential for normal plant growth. Three others (silicon, sodium and cobalt) have beneficial effects on growth or health under special circumstances, but are not considered important for commercial horticulture.

The essential elements fall into two groups according to their relative abundance in plant tissues. Those found in highest concentrations are called the major nutrients or macronutrients: nitrogen (N), phosphorus (P), potassium (K), sulphur (S), calcium (Ca) and magnesium (Mg). Those found in lowest concentrations are called the micronutrients or trace elements: iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), boron (B), molybdenum (Mo) and chlorine (Cl).

Plants absorb many other elements from the soil, but their presence in tissue is not necessary for the proper development and functioning of tissues. On the other hand, the lack of any one of the essential elements will significantly impair the growth of a crop. Maximum yields, optimum flower quality and tolerance of pests and diseases are possible only when all 13 essential nutrients are adequately supplied throughout the life of the crop. Nutrient supply will limit growth when it is either too low (deficient) or too high (toxic or excessive).

Plants absorb most nutrients through their roots. This is why fertilisers must be soluble in water and why proper irrigation scheduling is so important, not only to prevent water stress but also to maintain nutrient supply.

## Soil and plant tests

In the same way as your GP might send blood samples to a pathology lab for analysis to aid in a diagnosis, diagnostic tests are available for your plants and soil. A broad range of tests is available to help you understand your soil and

how your crop is growing. These are provided by specialist laboratories (see Chapter 16). Some must be done **before** you get started to assess the suitability of your land and water source (see Chapter 10 for more information).

## Soil tests

Soil testing provides a guide to the general health or condition of a soil. Chemical and physical tests are available. A test will show whether there are sufficient reserves of nutrients to carry the crop through its life. You can use the results to fine-tune the fertiliser program, to minimise nutrient losses and to prevent individual nutrients from accumulating to toxic levels in the soil. Remember that by the time you see visible symptoms of nutrient deficiency or excess, the growth of your plants is already adversely affected.

Physical testing gives information about soil structure. The structure of the soil affects the development of roots and the availability of air and moisture in the soil.

Soil can also be tested for the presence of plant pathogens and parasitic nematodes.

## Plant analysis

Plant analysis is a reliable guide to the current condition of a crop in conjunction with soil

testing. It is useful for identifying nutritional disorders and for assessing how suitable your current fertiliser practices are. Unlike a soil test, no guessing is involved in assessing nutrient availability. Instead, plant tissue (usually leaves) is chemically analysed to see exactly what the crop has absorbed from the soil. Plant testing is therefore a more reliable guide to crop nutrient conditions, but it is important to keep in mind that plants will move nutrients around to cope with deficiencies.

The analysis of the leaves from your crop is compared with leaf analysis standards developed from laboratory analyses of 'normal' or 'healthy' leaf samples of the same species. Unfortunately, for many wildflower crops there are limited, if any, published standards available for comparison.

Tissue samples from a diseased plant can also be tested to determine the cause of the problem and suggest remedies (see Chapter 13).

## Reference cited

Harden GW, ed. 2002. Flora of New South Wales, volume 2, revised. University of NSW Press, Sydney.



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# Chapter 4. Growing Australian native flowers commercially

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**Bettina Gollnow, Jonathan Lidbetter and Ross Worrall**

What makes a native Australian species suitable as a cut flower?

Australian natives in the cut flower industry

Protected plants and licensing

Our unique and beautiful native flowers have captured attention for a long time. Today a significant volume and range of species are grown commercially for cut flower markets around the world. Growers overseas (especially in California, Africa, Israel and South America) are growing much greater volumes of native Australian flowers than we are growing in Australia, and the research and development input into these species overseas is greater than local investment. Foster (2009) gives an economic assessment of the industry.

## What makes a native Australian species suitable as a cut flower?

To be suitable as a commercial cut flower, a flower must meet some basic requirements:

- The blooms must be decorative and potentially be available in a range of colours and shapes.



**Cultivated kangaroo paw.**

- The stems need to be strong, usually straight and in proportion to the bloom in terms of length and diameter.
- The flower must have a suitable vase life after harvest to give the end customer value for money. A vase life of 7 days or more is preferred. It may be possible to extend vase life by using preservative solutions or other postharvest techniques. The postharvest characteristics of many Australian native species are still poorly defined. Flowering stems that have a tendency to drop parts or that have petals that shrivel quickly are not suitable for floristry, nor are plants with prickly foliage or offensive odours.
- A species must be suited to cultivation; that is, it should be easy to propagate in large numbers and show vigorous growth in both nurseries and commercial plantations. This is necessary so that a large volume of uniform product can be offered to the market.
- A suitable species will have a long flowering season, or have several cultivars which have different but slightly overlapping flowering seasons, or even flower all year round.
- Prolific flowering early in the life of the crop is also desirable; otherwise, growers need to be prepared for significant inputs of labour and money to care for the plants over a number of years before any marketable product is produced.

Most commercial flower crops are grown in beds, with a large number of individuals of the same type massed together. This means that pests and diseases can become a problem and result in severe crop losses if not managed. As customers demand a product free of blemishes, pests and diseases, the crop must be managed constantly to keep pests and diseases to a minimum.

While many traditional flowers have been bred for their tolerance to pests and diseases, native species are at a very early stage of improvement, and for many, pest and disease tolerance is undefined. Many native species are susceptible to severe root and stem diseases caused by *Phytophthora* and other related organisms. Knowledge of the susceptibility of native flower crops to various pests and diseases, and of the management of these pests and diseases, is still at an early stage.

Last, but most important, the economics of commercially growing native flowers need to be considered. The economics are related to a range of factors, including:

- number of blooms produced per unit area per year
- net price received per bloom or per bunch
- cost of production—the cost of setting up the flower farm infrastructure and the ongoing costs of fertilisers, irrigation, pest and disease management, weed control, pruning, picking, grading, postharvest handling and transport.

## Australian natives in the cut flower industry

Australian flowers have long been appreciated by humans. Indigenous Australians long ago incorporated native plants into their diet, medicine and customs, and many myths tell the story of particular flowers. Since colonial times, many of our unique flowers have been celebrated in architecture, literature and art, featured on coats of arms and studied by botanists. Christmas bush was adopted early as a local substitute for the winter holly used at Christmas time in England, and by the 1880s was well established as a symbol of Christmas in the colonies.

The first cultivation in row crops was undertaken by the Parry family in 1913 at their property 'Floralands', located at Kariong, on the NSW Central Coast. Family members Perc and Olive Parry, who took over the business in the mid 1920s, dedicated their lives to the cultivation of our native flowers, and both received the Order of Australia Medal for their efforts. At the 2000 Olympics and Paralympic Games in Sydney, native flowers were used in over 4000 victory presentation bouquets and featured prominently in hotels and Olympic venues throughout the country.

Many native flowers and foliages now being grown commercially were initially bush-picked to establish market acceptance. Overseas interest and commercial cultivation of our flora preceded the development of a local industry, with Californian and Israeli growers in particular turning their attention to growing Australian species in

the 1970s. Today most Australian species are grown in beds or rows in commercial plantations, and most growers produce more than one type of flower crop. The industry also supplies a range of foliage products to the floristry industry.

A steadily growing number of Australian natives satisfy all the criteria that make a species a good candidate for commercial flower farming. Those species listed in Chapter 5 are being grown commercially and may be suitable for testing by new growers. For most, there is limited published information on their cultivation as a plantation crop, and even less on the economics of growing them. Plants may need to be sourced from specialist nurseries or seed suppliers (see Chapter 11), and often ordered well in advance to ensure that the number of plants required is available at the appropriate planting time.

The east coast of Australia has an extremely rich flora, but ironically many of the initial commercial plantings of native flowers in NSW were based on species sourced from WA. Species endemic to NSW which have become important commercial crops include NSW Christmas bush, flannel flower and waratah.

## Protected plants and licensing

Some Australian native species are protected by law in the interests of protecting rare and endangered species and of protecting species diversity and ecological sustainability. Various state and territory authorities administer legislation that restricts the commercial use of these species. A licence or permit is needed to pick, trade in and sometimes grow protected species. Fines apply for unauthorised picking.

There may be restrictions on wild harvesting on Crown Land and on harvesting of some species on private land.

In NSW, a formal state plan describes management procedures aimed at ensuring sustainable harvesting of native species. Called the *Protected and Threatened Plants in the Cut Flower Industry—Sustainable Management Plan 2008–2012*, it includes details of licensing regimes affecting growers of cultivated flowers and bush harvesters. Growers and marketers of Australian native species need to be aware of their obligations under this plan, which is administered by the Wildlife Licensing and Management Unit of the NPWS (NSW Office of Environment and Heritage): for current details see [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au) and search for 'Plant licensing FAQs'. Similar management plans exist for several other states. In addition, the Australian Government, which requires that growers and exporters have permits to export certain native flower products, insists that state regulations be complied with. For more information on export permits see [www.environment.gov.au](http://www.environment.gov.au).

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# Chapter 5. Crop snapshots—Australian native species grown commercially in NSW

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Bettina Gollnow, Jonathan Lidbetter and Ross Worrall

Major crops    Minor crops

Newer crops    Potential crops

Commercial growers have increasingly invested in species that occur naturally in NSW, as more local selections have become available and more is learnt about their cultivation. Important crops are waratah, NSW Christmas bush, flannel flower, banksia (especially *B. plagiocarpa*), grevillea and riceflower. Plantations established within the natural range of these species have generally experienced fewer problems than those planted further afield. A number of the crops that have forged ahead in the last 10 years are 'old crops' such as Christmas bush and waratah that have been 'reinvented' to build product appeal.

Some species that grow naturally in WA and are grown commercially there will also grow in NSW; for example, kangaroo paws, Geraldton wax and Dryandra. Many more are likely to achieve this status as a result of research by growers, breeders and propagators. One of the biggest opportunities is the use of grafting to bring difficult species into cultivation.

Many of the crops profiled in this chapter can be

considered for production along the east coast of Australia (and possibly elsewhere), as long as local conditions are suitable and flowering season suits target markets.

Key references for each species can be found in Chapter 15. For many of the species (marked \*), a detailed product description and guidelines for harvest and postharvest care are available in the *Quality Specifications* (Gollnow et al. 2010). For others (marked †), more information can be found in the product fact sheets published in *Postharvest Handling of Australian Flowers from Australian Native Plants and Related Species* (Gollnow et al. 2010).

## Major crops

*Actinotus helianthi* (flannel flower)\*

*Anigozanthos* and *Macropidia* (kangaroo paw)\*

*Banksia* species\*

*Ceratopetalum gummiferum* (NSW Christmas bush, festival bush)\*

Eucalypt foliage, bud and nut species†

*Grevillea* flowers and foliage\*

*Ozothamnus diosmifolius* (riceflower)\*

*Telopea speciosissima* (waratah)\*

## ***Actinotus helianthi*** **(flannel flower)**



### ***Actinotus helianthi*.**

Substantial improvements in the understanding of propagation and cultivation have allowed increased production of this crop, which bears velvety, white, daisy-like blooms. An increasing array of varieties, including year-round flowering selections grown in greenhouses, provide a vastly superior product to field-grown flannel flower. Strong demand for high-quality product exists both domestically and in Japan.

Flannel flower is best treated as a biennial crop. Major problems encountered in growing this crop involve soil drainage and root diseases, but these can be overcome by growing plants in containers in simple greenhouses.

## ***Anigozanthos* and *Macropidia*** **species (kangaroo paw)**



### ***Anigozanthos*.**



### ***Macropidia*.**

Several species of kangaroo paw, the related black kangaroo paw (*Macropidia*) and numerous hybrids are grown for their striking cut flowers, with most commercial plantings based on tissue-cultured plantlets. Kangaroo paws have a relatively short production cycle, with plants flowering for the first time about 6 months after planting. Well drained, frost-free sites are needed. In the past, kangaroo paws were a major export crop for NSW growers, but increasing competition from overseas producers



and unfavourable exchange rates have significantly reduced their profitability. Selected varieties are being grown more intensively in potting mixes in simple greenhouses.

Australian breeders have produced a large number of varieties with attractive flower colours and forms as well as disease resistance, as have Israeli breeders.

Successful marketing requires a good understanding of crop scheduling and the selection of varieties to suit a particular market, especially as kangaroo paws are being grown on a large scale by producers based in Israel, Japan, the USA, South Africa and South America.



**Kangaroo paws can be grown intensively in bags or pots of growing media on mesh benches in a simple greenhouse.**

## ***Banksia* species**

Banksias are used for both their flowers and foliage. Banksias need to have a terminal flowering habit to be suitable for blooms. Those being grown in NSW include:

*B. ericifolia*<sup>†</sup>

*B. integrifolia*

*B. plagiocarpa*<sup>\*</sup>

*B. robur*

*B. ×*'Giant Candles'<sup>†</sup>



### ***Banksia plagiocarpa.***

*Banksia plagiocarpa* (the Hinchinbrook or silver banksia) is the most important banksia grown. It originates from the tropical coastal area of north Queensland, and performs well in coastal NSW. The flower heads are typically an attractive metallic grey. Foliage can also be marketed.

The related *Dryandra* (recently reclassified as *Banksia*), native to WA, will also grow in parts of NSW.

## ***Ceratopetalum gummiiferum* (NSW Christmas bush, festival bush)**

This is a major export crop in eastern Australia. As the common name suggests, this has been a traditional seasonal favourite in Sydney, where for many years high prices were achieved during the 2 weeks before Christmas. In recent years, the availability of good-quality product has extended domestic acceptance to the whole month of December, and even longer in export markets, particularly Japan. Christmas

bush can be an extremely lucrative crop, and there has been an exponential rise in plantings.



### ***Ceratopetalum gummiferum*.**

There is strong reliance on one variety, 'Albery's Red', which is well received in markets world-wide, but new varieties are becoming available. This crop is susceptible to frost and does not tolerate hot weather after flowering if water supply is inadequate.

## **Eucalypt foliage, bud and nut species**

Eucalypt foliage has a good vase life and can also be dyed and preserved (dried or glycerine-treated). Selections with blue or silver foliage are preferred. Other eucalypts are grown for their attractive buds, blossoms or nuts.



### **Eucalypt foliage.**

Several eastern *Eucalyptus* species are well established as foliage lines, both in Australia and on the world market, including:

- E. cordata* (heart-leaved silver gum)
- E. cinerea* (Argyle apple)
- E. globulus* (Tasmanian blue gum)
- E. gunnii* (cider gum)
- E. perriniana* (spinning gum)
- E. pulverulenta* (silver-leaved mountain gum).
- E. gillii* (silver mallee)
- E. polyanthemos* (red box).

## **Grevillea flower and foliage species**

*Grevillea* is another genus that is well known in Australia, but many species have an unacceptably short vase life. Improved postharvest protocols and the selection of varieties with a long vase life are expanding the use of grevillea in floristry. Some of the tropical hybrids such as *G. 'Moonlight'* and *G. 'Majestic'* have an acceptable vase life on the domestic market. There are opportunities for further breeding of grevilleas to obtain more cut flower varieties. *Grevillea* foliage can also be marketed.

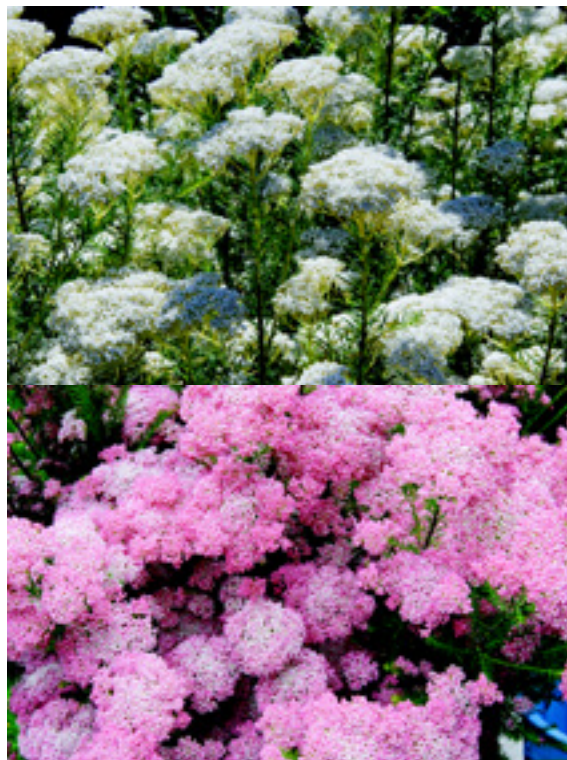


*Grevillea* 'Moonlight'.

### ***Ozothamnus diosmifolius* (riceflower)**

This plant is a member of the daisy family and produces terminal heads of white or pink blooms. Leaf form and colour vary between selections, and the performance of individual varieties is often site specific. Flower heads must be marketed at the correct stage for good vase life.

Nematodes and root diseases remain major problems, along with the larvae of the beetle *Acalolepta argentata* (Crofton weed borer), which cause significant damage to the crown of the plant and can be a major problem in established plantings along the coast of NSW and Queensland.



*Ozothamnus diosmifolius*. White and pink forms.

### ***Telopea speciosissima* (waratah)**



*Telopea speciosissima*.

The NSW waratah is one crop that has returned to favour, partly on the basis of NSW patriotic fervour and also because more superior flower selections are now available. Owing to strong prices on the domestic market for large-headed varieties, large numbers of waratahs have been planted in the last 20 years. Although large-headed varieties command higher prices at the Sydney Flower Market, it appears that returns for export are lower, particularly after freight costs are deducted.



On the export market, waratahs are hindered by:

- their relatively short season of availability
- a relatively high freight cost per stem
- competition from other Southern Hemisphere producers.

In contrast, smaller-headed waratahs such as the green-bracted variety, which often have higher yields per plant, are providing better returns.

The best returns on both the domestic and export markets have been achieved with good-quality red flowers (no bract browning) and white and pink selections. Good flower grading on-farm and improved quality are needed to achieve premium prices. Bract browning remains a serious problem, affecting marketability on both domestic and export markets. It can be reduced by growing waratahs in a shade house.

## Minor crops

*Acacia* species<sup>†</sup>

*Baeckea behrii*

*Backhousia*<sup>†</sup>

*Blandfordia grandiflora* (Christmas bells, festival bells)\*

*Boronia*\*

*Chamelaucium uncinatum* (wax flower)\*

*Corymbia ficifolia* hybrids, syn. *Eucalyptus ficifolia* hybrids (flowering gum)\*

*Crowea exalata*

*Doryanthes excelsa* (Gynea lily, giant lily)\*

*Eriostemon/Philotheca*<sup>†</sup>

*Ixodia achillaeoides*<sup>†</sup>

*Leptospermum* species and hybrids (leptospermum, tea tree)\*

*Spyridium* (formerly *Cryptandra scortechinii*, syn. *Stenanthemum scortechinii*) (corroboree flower, cotton bush, snow balls)<sup>†</sup>

*Thryptomene* (thryptomene, Victorian lace flower)\*

*Xerochrysum bracteatum*, syn. *Bracteantha bracteata* (strawflowers, paper daisies)

## Acacia species

Several species and selections of acacias, or wattles, are sold as foliage or as flowering stems.

The following are grown for their foliage: *A. aphylla*, *A. baileyana* (Cootamundra wattle), *A. covenyi* (blue-bush), *A. cultriformis* (knife-leaf wattle), *A. holosericea* (velvet leaf wattle), *A. merinthophora* (zigzag or twisted wattle) and *A. podalyriifolia* (Queensland silver wattle).

The following are grown for flowers: *A. baileyana* (Cootamundra wattle), *A. buxifolia* (box-leaf wattle), *A. cultriformis* (knife-leaf wattle), *A. dealbata* (silver wattle), *A. floribunda* (white sallow wattle) and *A. retinodes* (wirilda, swamp wattle, silver wattle).

There is still comparatively little *Acacia* sold in late-bud to early-flower stage owing to:

- a poor general understanding of how to handle this type of product
- a relatively short vase life, because flowers (and foliage) dry out
- lack of production of the selected 'florist's mimosa' in Australia
- lack of selection work on other species.

For commercial production, grow only those species with vase lives of >7 days, such as *A. buxifolia*, *A. cultriformis*, *A. floribunda*, *A. retinodes* and forms of *A. dealbata*.

## Baeckea behrii

This species is a promising alternative to *Thryptomene calycina* and *Chamelaucium*, as it is frost tolerant and flowers from October to January. This delicate-looking species generally prefers to be grown in well drained acidic soils in areas without heavy rainfall. It fails to flower well in Queensland. Other related species such as *Baeckea densifolia* may be better suited to coastal areas. At the time of writing, *Baeckea* does not appear to be cultivated in any significant quantity in NSW.

### ***Backhousia myrtifolia***



#### ***Backhousia.***

*Backhousia myrtifolia* is grown and marketed in a similar way to Christmas bush, but market demand is limited. It can be grown in south-east Queensland and in NSW coastal areas as far south as Bega. Postharvest problems with leaf blackening remain an issue. The foliage can also be marketed.

### ***Blandfordia grandiflora*** (Christmas bells, festival bells)



#### ***Blandfordia grandiflora.***

These produce striking, bell-shaped terminal flowers that can be red, yellow or commonly red with a yellow edge. Plants are slow growing and require careful attention to weed management. To date, only a few dedicated growers are successfully cultivating this species.

## ***Boronia***



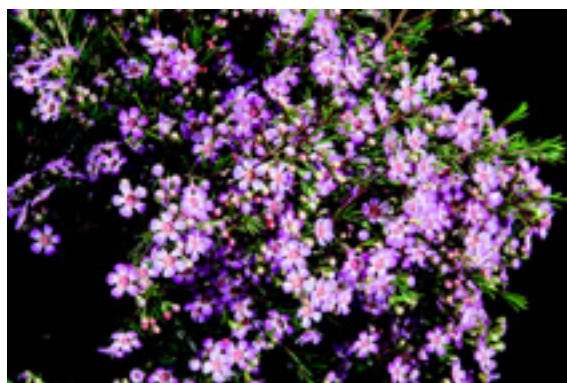
### ***Boronia*.**

Several boronia species (mostly *B. heterophylla* and hybrids such as *B.* 'Lipstick' and *B.* 'Carousel') are cultivated for their cut flowers. The flowering season of each variety is relatively short (up to 2 weeks in a given location). In NSW it performs well on the far South Coast, yielding high-quality long stems early in the season.

Boronia is a medium-term crop (up to 5 years), but severe losses due to root rot diseases have been experienced early in the production cycle. Grafting cut flower varieties onto disease-tolerant rootstocks offers great potential to overcome this.

Currently US market access for boronia and other cut flowers from the family Rutaceae is restricted owing to disease concerns.

## ***Chamelaucium uncinatum* (wax flower)**



### ***Chamelaucium uncinatum* 'Purple pride'.**

Wax flower forms a large spreading bush. A wide range of colours and varieties are available as a result of extensive breeding and selection in Australia and overseas. Wax flower is considered suitable only for selected parts of NSW—large producers in WA and Queensland have competitive advantages in terms of flowering season and scale of operation.

Wax flower requires well drained soils and is susceptible to root diseases.

## ***Corymbia ficifolia* hybrids (syn. *Eucalyptus ficifolia* hybrids)**



### **Eucalypt blossom.**

Flowering gum blossom is relatively new to floristry as a seasonal focal flower. Stunning new selections are available, mainly hybrids in the 'Summer Beauty' group, which feature dense terminal masses of large blossoms. Colours range from cream, through pink, peach



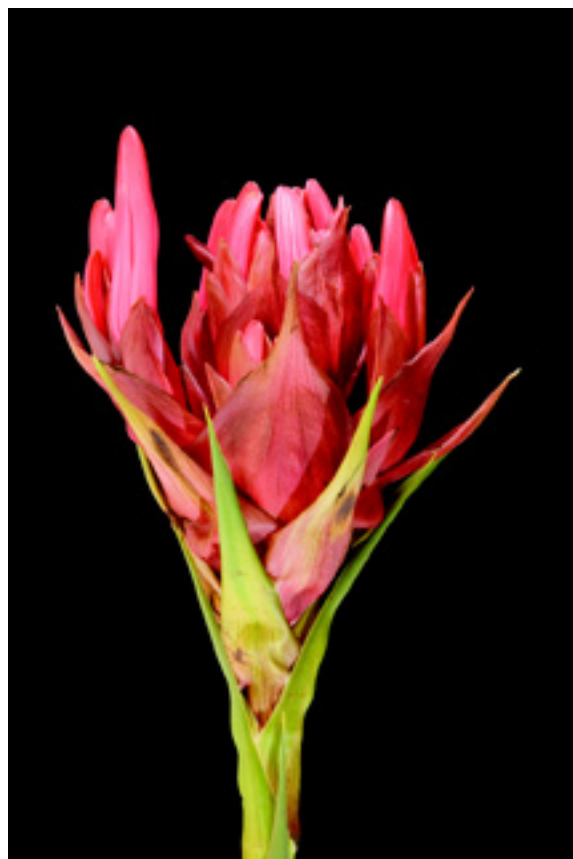
and salmon, to red and deep crimson. Flowering stems must be marketed at the correct stage for a reasonable vase life.

### ***Crowea exalata***

This crop features pink, waxy star-like flowers and has a relatively long flowering period (late summer to winter).

Croweas are susceptible to root and collar rots, but they are more tolerant than boronias.

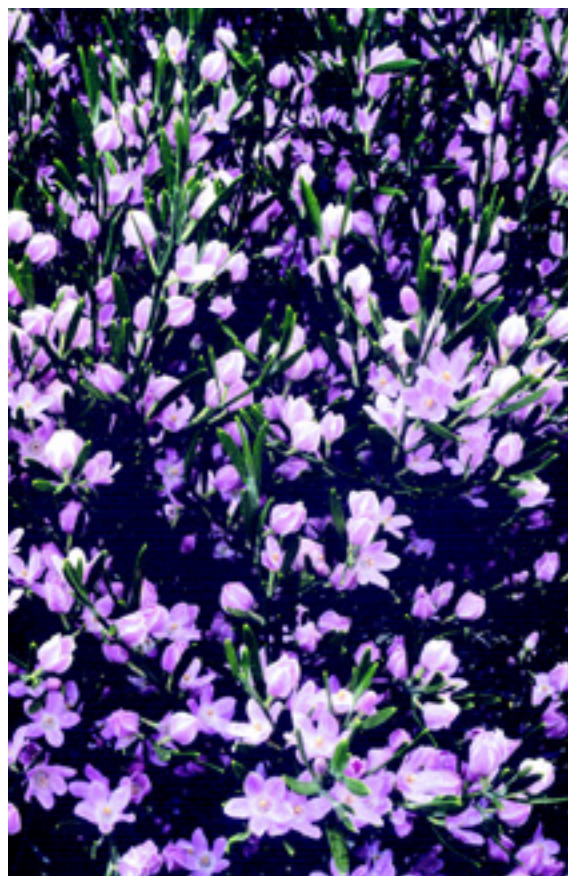
### ***Doryanthes excelsa* (Gynea lily, giant lily)**



#### ***Doryanthes excelsa*.**

This monocot species is increasingly sought after for its enormous long-lasting flower and its versatile strap-like leaves. Currently most of this product is picked under license from wild populations. The major limitations to commercial cultivation are the long, variable time period to flowering and a lack of understanding of the mechanisms controlling flowering.

### ***Eriostemon/Philotheca***



#### ***Eriostemon australasius*.**

This group provides a number of species suitable for use as cut flowers. In recent years most species have been removed from the genus *Eriostemon* and placed in *Philotheca*. *Eriostemon australasius* is an excellent cut flower, with flowers that close and remain on the plant after pollination. The flowering stems are attractive for several weeks and have a longer vase life than *Philotheca* species. However, *Eriostemon* is difficult to cultivate successfully. Grafting has allowed new selections to be brought into cultivation.

One of the most promising *Philotheca* selections is 'Flowergirl'. This variety appears to be adaptable to a wide range of soil types and is less prone to petal drop than other philothecas. Excellent breeding and selection opportunities exist for these plants.

Some markets, such as the USA, currently do not accept flowers or plants belonging to the Rutaceae family, which includes *Eriostemon* and *Philotheca*.

## ***Ixodia achillaeoides***



### ***Ixodia achillaeoides*.**

*Ixodia*, native to coastal South Australia and Victoria, features terminal heads of white papery flowers. Historically it has been sold as a dried flower picked from bush stands, but is now a cultivated crop.

The species is known to be susceptible to the pathogens *Verticillium dahliae*, *Phytophthora cinnamomi* and *P. cryptogea*, to nematodes, and to the foliage diseases botrytis and powdery mildew. However, soil fumigation, strict hygiene and appropriate use of fungicides have made this an economical crop.

With new selections available and a greater understanding of production requirements, this crop can see further significant expansion, particularly as a fresh flower product. There are opportunities for this crop to be grown on a wider range of sites.

## ***Leptospermum* species and hybrids**

New varieties and hybrids, combined with a better knowledge of postharvest care, have improved market prospects in recent years. *Leptospermum*, related to wax flower, is an attractive feature filler. There are significant varietal differences in susceptibility to ethylene-induced flower drop. In susceptible forms such damage can be prevented by using commercial anti-ethylene treatments. Rapid postharvest handling and marketing are critical to ensure market satisfaction.



***Leptospermum* 'Cherish'<sup>Ⓢ</sup>.**

## ***Spyridium* (formerly *Cryptandra scortechinii*, syn. *Stenanthemum scortechinii*) (corroboree flower, cotton bush, snow balls)**

This crop, to date produced mainly in Queensland, is generally sold as a fresh, dyed product, although freshly opened flowers can be marketed as 'natural'. Various varieties extend the season from late June to October.



## ***Thryptomene*** **(thryptomene, Victorian lace flower)**



### ***Thryptomene calycina*.**

*Thryptomene calycina* is grown for its dense sprays of small white or pink tea-tree-like flowers. While commercial production is centred in western Victoria, it can be grown successfully in parts of NSW.

Other species of *Thryptomene* also have potential for the cut flower market (e.g. *T. saxicola*), but relatively little work has been done to develop improved forms or to determine their cultivation needs.

## ***Xerochrysum bracteatum*,** **syn. *Bracteantha bracteata*** **(strawflowers, paper daisies)**

This product has received more market interest in recent years because sturdy, long-stemmed, large-headed forms have been produced by breeders. A wide range of colours and flower forms is also available. It is a labour-intensive crop to grow and market.

## **Newer crops**

*Alloxylon flammeum* and *A. pinnatum*

*Ptilotus* species<sup>†</sup>

*Pycnosorus globosa*, syn. *Craspedia globosa*  
(billy buttons)

Riceflower alternatives

Tropical foliages<sup>†</sup>

## ***Alloxylon flammeum* and *A. pinnatum***

These two tropical relatives of waratah have the potential to be an excellent competitor for the standard waratah, with a flower halfway between a waratah and a grevillea. The striking flowers have the bonus of a much higher pack-out rate than waratahs (allowing more cost-effective freight). Both species are currently grown in small numbers only.

## ***Ptilotus* species**



### ***Ptilotus*.**

This crop produces feathery cylindrical flower spikes with a long vase life. They can be used fresh as well as dried. Both *P. exaltatus* and *P. obovatus* are being grown, and new superior selections are available. As a field crop, *Ptilotus* is best suited to drier inland regions with a low incidence of frost, but undercover production in simple greenhouses is expanding potential growing areas. This crop is unusual in that the first harvest can be achieved in as little as 12 weeks from planting.

***Pycnosorus globosa*,  
syn. *Craspedia globosa*  
(billy buttons)**



***Pycnosorus globosa*.**

The plant produces globular heads of bright yellow flowers on long, straight, bare stems.

**Riceflower alternatives**

Other species of *Ozothamnus* and related genera provide products that can extend the range of forms of riceflower-style product. However, as with the early development of riceflower, much work still needs to be done before many aspects relating to the cultivation of these species are well understood. These flowers are available in white, yellow and green, and include the following:

*Ozothamnus diotophyllus*

*Cassinia laevis*

*Cassinia aureo-nitens*

*Chrysocephalum semipapposum*.

**Tropical foliage**



***Stenocarpus* 'Forest Lace'.**

Many new tropical foliage types, particularly of proteaceous species, have started to reach the domestic market in recent years. They mix equally well with traditional and native flowers and generally have a long vase life. Some may need to be grown in shade houses to achieve top-quality product. They can be grown on the North Coast of NSW. Species of particular note include:

*Athertonia diversifolia*

*Darlingia darlingiana* (brown silky oak)

*Grevillea baileyana*

*Lomatia fraxinifolia*

*Opisthiolepis heterophylla* (goldbacks)

*Stenocarpus* 'Forest Lace' and 'Forest Gem'.

Their acceptance by the market will depend on their availability and on the education of florists.

## Other crops with potential

Many other species have the potential to be cultivated for the flower trade:

*Epacris microphylla*, *E. obtusifolia*

*Helipterum roseum* (*Rhodanthe chlorocephala* ssp. *rosea*, *H. manglesii*)

*Isopogon* species (drumsticks)

*Melaleuca uncinatum* (e.g. 'Wattle Gold')

*Persoonia* species (geebungs)

*Pimelea*

Sedges, ferns and mosses

*Xanthorrhoea* (grass tree, steel grass).

### ***Epacris microphylla*, *E. obtusifolia***

These plants flower from winter to summer and require moist, well drained soil.

### ***Helipterum roseum* (*Rhodanthe chlorocephala* ssp. *rosea*), *H. manglesii***

These are pink, red and white paper daisies, grown as an annual spring-flowering crop. They are raised from seed. They can be used fresh or dried.

### ***Isopogon* species (drumsticks)**

NSW species grown for the flower trade are:

*I. anemonifolius*

*I. anethifolius*

*I. dawsonii*.

They produce cream or yellow flowers. The foliage and the fruit (cones) are also marketed.

WA species have more spectacular flowers (e.g. *I. cuneatus*), but they are harder to grow in much of NSW.

### ***Melaleuca uncinatum* (e.g. 'Wattle Gold')**

Several melaleuca species can be grown for year-round foliage as well as spring-flowering stems.

### ***Persoonia* species (geebungs)**

Several persoonias have an established demand in the domestic market for their foliage and sprays of flowers owing to the availability of bush-harvested product; for example *P. pini-folia*.

Persoonias are difficult to propagate, and this is limiting commercialisation. To date they are being cultivated by only a small number of growers.

### ***Pimelea***



Some species, for example *P. physodes* (Quailup bells), produce terminal flower heads and are suitable as cut flowers. However, to date, most have been bush-harvested rather than cultivated. *P. physodes* is a promising new cut flower and can be grown relatively easily when grafted. It is grown for its bell-shaped, bracted inflorescences. *Pimelea nivea* is grown for its foliage.

### **Sedges, ferns and mosses**

Many of the interesting plants in this group have previously been market-tested using bush-picked product. With changing legislation and potential opportunities to improve quality, this area is beginning to attract interest. Genera and species of possible interest include:



*Caustis blakei*

*Sticherus flabellatus*

*Restio*

*Gleichenia*

*Lycopodium*.

## ***Xanthorrhoea* spp. (grass tree, steel grass)**

The foliage from a number of *Xanthorrhoea* species is used extensively, and the flower spike can be used as a feature flower. There is demand on both domestic and export markets. However, most product offered for sale has been wild-harvested. It is advisable to check the current status of this species in the NSW management plan *Protected and Threatened Plants in The Cut Flower Industry* management plan (see [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au) and search for 'plant licensing FAQs'). You may need to check with the Wildlife Licensing and Management Unit of the NPWS.

*Xanthorrhoeas* grow readily from seed, but the plants grow very slowly, so the economic viability

of raising plants from seed is questionable. Successfully transplanting mature plants from their natural habitat can be done as long as care is taken to avoid excessive root disturbance or damage and infection by *Phytophthora*. A plan to regulate commercial harvest of whole plants from the wild is in preparation. Plants need extra care to minimise stress for a long time until new roots have developed. Good drainage is important. Plants may be attacked by scale insects and longicorn beetle larvae, which can burrow through the crown and down the trunk.

## **Sources of information**

- [Rural Industries Research and Development Corporation](#)—*Quality Specifications for Australian Wildflowers* (2010) and *Postharvest Handling of Australian Flowers from Australian Native Plants And Related Species* (2010) are published here.
- [Department of Agriculture and Food, Western Australia](#).

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# Chapter 6. Growing proteas and other South African species commercially<sup>4</sup>

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**Bettina Gollnow**

Introduction

Climate

Soils and site selection

Species selection

Sourcing plants

Planting

Pruning

Nutrition

Pests and diseases

Harvest and postharvest handling

Leaf blackening—a specific postharvest problem

International Protea Association

## Introduction

In Australia the term ‘protea’ is used as a generic term to refer to members of the Proteaceae family that are native to South Africa. These mostly belong to the genera *Berzelia*, *Brunia*,

*Protea*, *Leucadendron*, *Leucospermum*, and *Serruria*. Some cultivars have been bred in Australia, for example *Protea* ‘Pink Ice’. Most established growers have developed their irrigation, fertiliser and crop production methods on the basis of experience, as there is relatively little published information specific for Australi-

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<sup>4</sup> Adapted from information first published as *Growing Proteas Commercially*, Agfact H9.1.19, reprinted February 1998, by Bettina Gollnow, NSW Agriculture. Members of the then NSW Branch of the Australian Flora and Protea Growers Association provided technical advice for this Agfact.

an conditions. This chapter highlights issues specific to growing South African species. Information in the later chapters applies equally to South African species.



### A mixed arrangement featuring proteas and Australian native flowers and foliage.

Related Australian Proteaceae genera grown commercially for flowers and foliage include *Banksia*, *Telopea* (waratah) and *Grevillea*.

Protea 'flowers' are more correctly 'flower heads', or inflorescences, consisting of many florets (individual flowers). These florets are densely packed on the receptacle (the expanded top of the stalk bearing the flower head) and may be surrounded by single or multiple whorls of bracts. These bracts are grouped into different numbers of rows, depending on the species. The bracts of the lower (outer) rows are shorter and scaly and are called scaly bracts. The bracts of the inner rows are longer and are usually attractively coloured, and called the inner or coloured bracts.

In *Protea* species, the inner bracts are very striking and surround a mass of crowded florets arranged in a spiral. In *Leucospermum*, the inner bracts are relatively insignificant, and the prominent styles of the individual florets stick out from the bloom like pins in a pincushion, giving these proteas their common name of 'pincushion'. In *Leucadendron*, male and female flowers are borne on separate plants. Female flower heads become cone-like when mature, and are often surrounded by colourful inner bracts and small brown lower bracts. Male flower heads are less conspicuous.

Most proteas start producing flowers within 2 to 5 years of planting, with peak production achieved between years 5 and 8, depending on the species. As with other perennial flower

crops, it's what you do at the beginning that will determine how productive your protea plants will be. Careful choice of species, sourcing good-quality plants and caring for them properly are critical in achieving good financial returns.

Some proteas flower for a relatively short season, while others, such as king proteas, flower for much of the year. Flowering season and duration will vary with geographical location. Verify time of flowering by local trials. In choosing species and types to plant, aim for a mix of types that flower at different times of the year. This allows you to spread your income over a longer period, to target key market opportunities, and to get maximum benefit from your investment in infrastructure.

## Climate

South African Proteaceae prefer a mild climate with low humidity, but plantations have been established successfully in areas with hot summers. While some species can tolerate frosts to around  $-4^{\circ}\text{C}$ , considerable losses due to frost have been documented. Young foliage and flowers of some species are especially vulnerable, notably *P. neriifolia* and *P. cynaroides*. *Leucadendrons* have been found to perform well in cooler inland areas, where the bracts develop strong colours.

Flowering proteas can be damaged by persistent high temperatures, although adequate irrigation can reduce the damage. *Leucadendrons* and *leucospermums* are generally less affected by high summer temperatures.

## Soils and site selection

Optimum growth and production of proteas occur in deep, well drained soils with a pH of 5.0–6.5 and low phosphorus (P) availability. Species vary in their tolerance to soil moisture levels, frost, humidity and soil pH.

Before planting a new area to proteas, get soil tests done to determine the soil P level. Avoid old poultry farms and orchards, which have a history of P application.

See Chapters 10, 11, 12, and 13 for more

information on site selection, setting up and maintaining your plantation.



A young protea plantation, showing mulch and drip irrigation line. Weed control is especially important when young plants are establishing.

## Species selection

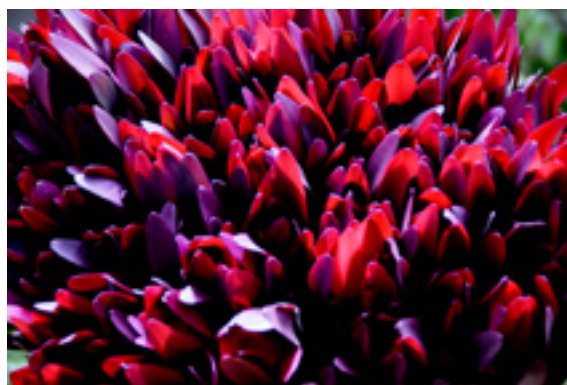
Proteas commonly grown for cut flowers:

- *Berzelia* (Button bush).
- *Brunia*.
- *Leucospermum* (pincushions): e.g. *Leucospermum* hybrids and selections such as 'High Gold'<sup>Ⓛ</sup>, 'Scarlet Ribbons', 'Tango', 'Veldt Fire'; *L. cordifolium* and selections; *L. lineare*; *L. reflexum*.
- *Leucadendron* (conebrush): e.g. hybrids and selections such as 'Pisa', 'Inca Gold', 'Jubilee Crown', 'Safari Sunset'; *L. discolor*; *L. lauro-lum* hybrids and selections, e.g. 'Inca Gold', 'Katie's Blush'<sup>Ⓛ</sup>; *L. salignum* hybrids and selections.

- *Protea*: e.g. hybrids and selections such as 'Candy', 'Frosted Fire', 'Pink Ice'; *P. compacta* and selections; *P. cynaroides* and selections (king protea); *P. grandiceps* (princess protea); *P. magnifica* (queen protea); *P. eximia* (duchess protea); *P. neriifolia* (mink protea: selected hybrids and cultivars); *P. repens* (honey protea, 'repens'); *P. scolymoccephala* (mini protea).
- *Serruria florida* (blushing bride) hybrids and selections.



*Berzelia*.



*Leucadendron* 'Safari Sunset'.



*Leucospermum* 'High Gold'.





*Protea cynaroides* (king protea).



*Protea* 'Pink Ice' (mink protea).

When deciding which species and how many plants of each to grow, check with wholesalers, exporters, specialist protea nurseries, experienced growers and grower associations. Find out likely returns, market trends and expected demand. Planting a trial bed of several types is advisable, allowing their performance under local conditions to be assessed. This approach also lets you assess market demand for various proteas.



*Protea repens*.



*Serruria florida* (blushing bride).

Growing proteas is a long-term investment. Your initial selection of species is critical, since substantial product will not be harvested for 2 to 5 years. Time to flowering varies with the species and the type of planting material.

Increasing numbers of named varieties of proteas are becoming available. Most commercial plantings are based on cuttings from 'improved' forms of selected species grown from seed. Vegetatively propagated plants ensure more uniform production.

## Sourcing plants

Most plants are bought from specialised nurseries. Plants should be disease free, 200–300 mm high (usually in 75- or 150-mm pots), with well formed roots. Ensure plants are not pot-bound, and avoid buying overmature plants. To minimise root disturbance, remove plants carefully from the pots.

There are a number of specialist protea nurseries, including those listed below. Some also provide growing guides and have websites with images of different types and varieties of proteas. New cultivars are being released regularly and may achieve better returns for their novelty value. Note that some cultivars are protected by Plant Breeders' Rights, which means you cannot legally propagate your own plants from them. See also Chapter 11.

### **Ausflora Pacific**

PO Box 72, Gembrook Vic 3783  
Phone: 03 5968 1650; Fax: 03 5968 1676  
[www.ausflorapacific.com.au](http://www.ausflorapacific.com.au)

### **Brimstone Waratahs**

(white and pink king protea selections grown to order)

Email: [info@brimstonewaratahs.com.au](mailto:info@brimstonewaratahs.com.au)  
[www.brimstonewaratahs.com.au](http://www.brimstonewaratahs.com.au)

### **Marindale Proteas**

65 South Bank Rd, Bunyip Vic 3815  
Phone: 03 5629 5339; Fax: 03 5629 5771

### **Proteaflora Nursery Pty Ltd**

PO Box 252, Monbulk Vic 3793  
Phone: 03 9756 7233; Fax: 03 9756 6948  
[www.protea.com.au](http://www.protea.com.au)

Major disease losses in proteas are due to infection by a root rot organism called *Phytophthora*. To minimise the risk of introducing or spreading this disease, purchase plants from a reputable nursery.

## **Planting**

Plant proteas at a time of year when conditions are least stressful to plants. Timing varies with local climatic conditions, but spring or early to mid autumn is usually favourable. Strong winds can damage young plants, so you may need artificial or living windbreaks to shelter them.

The planting layout will depend on irrigation design and the species selected. In general, use single rows 3–4 m apart, with 1–2 m between plants. This gives a hedge effect and gives the plants more protection from wind. Single rows make management easier, especially for pest, disease and weed control.

Some growers alternate their plants along double rows. Double rows may use smaller areas more effectively and better suit certain species. However, they may also favour disease, especially in humid areas, as there is poorer air circulation and less effective spray penetration between plants.



**Established king protea plantation showing the challenges of ongoing weed management.**

Distance between rows depends on the ultimate size of the species grown and machinery to be used, for example tractors for mowing, spraying and fertilising.

Weed control is a major time cost and is especially important when young plants are establishing. It is best to avoid disturbing and damaging roots by cultivation.

More information about setting up and maintaining your plantation can be found in Chapters 10 and 12.

## **Pruning**

Tip-prune new plants 2 weeks before planting out or 2 weeks after planting, when they have established. The aim is to develop a strong basic framework on the plant. Thereafter, regular pruning is essential for maximum plant growth and flower yield. Pruning time strongly influences flowering time.

On mature bushes, harvesting is the main pruning operation. Perform any additional pruning or general cleaning up as close as possible to the beginning of the vegetative growth phase, which usually starts soon after flowering. There will always be a number of stems on each bush that will not need pruning.

Avoid severe pruning as this usually affects subsequent plant growth (and may even kill the plant), restricting flowering for 1–2 years afterwards. Do not remove more than one-third of a plant's total foliage at any one pruning time.

Use sharp secateurs. If disease is suspected, disinfect the secateurs between plants with a biocide such as 1% sodium hydroxide, Dettol or sodium hypochlorite (use clean water to make a 10% dilution of a commercial bleach solution containing 12.5% available chlorine). Several fungi can cause dieback from pruning wounds, so avoid pruning during wet weather to minimise the risk of infection.

Some plants do not respond to pruning and remain twisted and misshapen. These should be removed.

Successful shaping of the bush begins with careful pruning of the young plant to establish a base framework for multiple flowering branches. More information on pruning proteas can be found in *Growing Proteas for the Cut Flower Market* (2010).

For convenience, each of the main genera can be divided into five groups:

### **Group 1: *Protea* spp. needing early tip pruning**

On *P. neriifolia*, *P. repens*, *P. compacta*, *P. 'Pink Ice'*, *P. longifolia*, *P. eximia* and *P. obtusifolia*, remove the growing tip soon after planting to promote side shoot development. Tip-prune the side shoots when they reach 150–200 mm.

Regularly tip-prune for the first 2 years. In frosty areas, time the pruning to avoid tip burn of regrowth. The plants should flower in the third year, and additional pruning should be done after harvest.

### **Group 2: Self-branching *Protea* spp.**

Leave *P. magnifica* and *P. grandiceps* alone unless only one stem grows. In this case, tip-prune it.

### **Group 3: *Protea* spp. with lignotubers**

Lignotuber species such as *P. cynaroides* initially produce only one stem that flowers. After harvest, several side shoots will develop.

Some growers prefer to remove the main stem back to 200–250 mm 6 months after planting. This allows four to six stems to develop. These can be pruned 12 months after the first pruning and then hard-pruned back to the base after the flowers have been harvested.

### **Group 4: *Leucadendron* spp.**

Prune leucadendrons in the same way as Group 1 proteas. Thin the plants to remove excess and poorly positioned stems, thereby encouraging strong growth of remaining flowering stems. For low-growing species such as *Leucadendron* 'Inca Gold', thin out by thumb pruning as necessary, thereby promoting development of the maximum numbers of straight stems.

### **Group 5: *Leucospermum* spp.**

Prune leucospermums in the same way as Group 1 proteas from an early stage to promote multiple branching. Depending on the selections and growth form, some leucospermums can produce sprawling, horizontal growth. Prune this growth back to allow new growth to develop from leaf nodes.

When harvesting, leave four or five leaf nodes at the base of strong-flowering stems, and cut back weak-flowering or poorly positioned stems to the main stem.

## Nutrition

Young plants respond to moderate levels of nitrogen and potassium, but their phosphorus

requirement is very low. Conduct a leaf analysis each year to monitor the nutrient status of the crop. There are few reliable standards available at present to help interpret leaf analyses, but Table 1 can be used as a guide.

**Table 1. Plant analysis standards for assessing the phosphorus status of *Protea* 'Satin Mink', *P.* 'Pink Ice' and *Leucadendron* 'Harvest'. Values are expressed as the percentage P by tissue dry weight.\***

Nutrient range	Stems	Recently matured leaves	Old leaves
<i>P.</i> 'Satin Mink'			
Low/deficient:	<0.19	<0.19	<0.21
Desirable:	0.19–0.35	0.19–0.29	0.21–0.44
High:	0.35–0.40	0.29–0.36	0.44–0.53
Toxic:	>0.40	>0.36	>0.53
<i>P.</i> 'Pink Ice'			
Low/deficient:	<0.06	<0.06	<0.16
Desirable:	0.06–0.29	0.06–0.27	0.16–0.46
High:	0.29–0.52	0.27–0.57	0.46–0.95
Toxic:	>0.52	>0.57	>0.95
<i>L.</i> 'Harvest'			
Low/deficient:	<0.05	<0.15	<0.14
Desirable:	0.05–0.34	0.15–0.42	0.14–0.49
High:	0.34–0.60	0.42–0.45	0.49–0.73
Toxic:	>0.60	>0.45	>0.73

\*G. C. Cresswell, Assessing the phosphorus status of proteas using plant analysis, International Protea Association, 6th Biennial Conference, Perth, 22–27 September 1991.

Apply fertiliser mainly during vegetative growth. Established growers report success with a wide range of fertiliser types. Final selection is related to local soil type, climate and species. Therefore, do your own trials and seek advice from a commercial soil analytical laboratory. Slow-release fertilisers similar to 20% N : 0% P : 10.8% K are popular because they are considered less likely to cause P toxicity.

## Pests and diseases

The most devastating disease of proteas in NSW, commonly known as 'root and collar rot', is caused by *Phytophthora*. Warm, wet and humid conditions, especially in summer, favour this disease. It has the potential to kill plants at

any age. The plants may die suddenly or become yellow and grow poorly. Plants may wilt during periods of water stress. For more on this disease, see Chapter 13.

Other diseases are listed in Table 2. Regular spraying with fungicides may be required to minimise losses from fungal foliar and stem diseases in coastal plantations. Once established, these diseases can be difficult to control.

Major insect pests of proteas are stem-boring and leaf-eating larvae of moths and beetles. Other pests include black beetle, various scale insects, and sometimes nematodes and termites. Birds, especially parrots, can cause serious damage in some areas.

In addition, stem borers, scale insects, thrips, various beetles, mites and spiders can cause quarantine problems for export crops.



**Table 2. Common diseases of proteas.**

Common name	Cause	Symptoms	Common hosts
Phytophthora root and collar rot***	<i>Phytophthora cinnamomi</i> , <i>P. parasitica</i> , <i>P. crypto-</i> <i>gea</i>	Poor growth; yellowing of foliage; plants wilt or decline quickly; feeder roots and/or base of stem rotten.	Most species
Anthracnose***	<i>Colletotrichum gloeospor-</i> <i>ioides</i>	Dark lesions on stems and leaves; shoot dieback, especially on new soft growth.	<i>Protea</i> spp., <i>Serruria florida</i>
Scab**	<i>Elsinoë</i>	Twisting of stems, especially on new growth; pale to brown lesions on leaves and stems, with affected stems often becoming reddish. These develop into large, raised, cracked areas ('scabs') on stems.	<i>Leucospermum</i> and <i>Leucadendron</i> spp., <i>Serruria florida</i>
Grey mould or botrytis blight**	<i>Botrytis cinerea</i>	Leaves, flowers and buds have brown spots which expand to kill affected parts. In wet conditions, masses of grey or brown spores can be seen on infected parts. This fungus also causes postharvest flower rots.	<i>Leucadendron</i> and <i>Leucospermum</i> spp., <i>Serruria florida</i>
Cutting rot and damping off**	e.g. <i>Rhizoctonia</i> , <i>Pythi-</i> <i>um</i> , <i>Phytophthora</i> , <i>Colletotrichum</i> , <i>Cylindro-</i> <i>cladium</i> , <i>Cylindrocarpon</i>	Basal stem rot of cuttings; seedlings fail to emerge or rot at ground level; root rot of young plants.	Most species
Armillaria root rot*	<i>Armillaria luteobubalina</i>	Plant decline and death; root and collar rot; mats of fan-shaped white fungal growth visible just under the bark.	<i>Protea</i> , <i>Leucadendron</i> and <i>Leucospermum</i> spp.
Drechslera blight*	<i>Drechslera biseptata</i>	Round to irregular grey or brown leaf spots, sometimes with purplish margins. These expand to affect and kill entire leaves, shoot tips and flower heads.	<i>Leucospermum</i> spp.
Leaf spots and blotches*	Assorted fungi, e.g. <i>Coleroa</i> spp.	Symptoms vary from small specks to blotches, to large areas of dead tissue. Spots may be superficial, raised or sunken, and vary in colour from pale, grey, reddish or purplish to black.	Most species
Bacterial leaf spot*	<i>Pseudomonas syringae</i> pv. <i>syringae</i>	Water-soaked dark green spots on leaves enlarging to become blackish-brown and sunken. Crimson halo often surrounds these spots.	<i>P. cynaroides</i> ; probably associated with frost injury

\*minor pathogen; \*\*moderate pathogen; \*\*\*major pathogen

Note: A number of fungi recorded as pathogens of native Proteaceae, e.g. *Mycosphaerella* and *Vizella* spp., are potential pathogens of exotic Proteaceae.

For more information on protea diseases see:

- Forsberg L. 1993. Protea diseases and their control. QDPI, Brisbane.
- California Protea Management website: [www.californiaproteamgmt.com](http://www.californiaproteamgmt.com). There are sections with close-up photos of diseases of proteas, leucadendron and leucospermum (not all of which occur in Australia)—see [www.californiaproteamgmt.com](http://www.californiaproteamgmt.com).

## Harvest and postharvest handling

Leucadendrons may be harvested approximately 3 years after planting. Most *Protea* spp. are

not harvested until at least the fourth year, when flower numbers and stem length makes harvesting economic. These times are a guide only and may be influenced by species and age of the initial planting material.

Comprehensive information about harvesting, postharvest care and handling can be found in Chapter 14 and in *Postharvest Handling of Australian Flowers from Australian Native Plants And Related Species* (2010)—see Chapter 15.

For a number of South African Proteaceae (listed in the following table), you will find detailed advice on harvest and postharvest care in the *Quality Specifications for Australian Wildflowers* (2010).

ISBN	Pub No	Publication Title	URL
978-1-74254-009-2	10/036	Berzelia	<a href="https://rirdc.infoservices.com.au/items/10-036">https://rirdc.infoservices.com.au/items/10-036</a>
978-1-74254-017-7	10/044	Leucadendron 'Jubilee Crown'	<a href="https://rirdc.infoservices.com.au/items/10-044">https://rirdc.infoservices.com.au/items/10-044</a>
978-1-74254-018-4	10/045	Safari Sunset	<a href="https://rirdc.infoservices.com.au/items/10-045">https://rirdc.infoservices.com.au/items/10-045</a>
978-1-74254-019-1	10/046	Leucadendron 'Pisa'	<a href="https://rirdc.infoservices.com.au/items/10-046">https://rirdc.infoservices.com.au/items/10-046</a>
978-1-74254-020-7	10/047	Leucospermum 'High Gold'	<a href="https://rirdc.infoservices.com.au/items/10-047">https://rirdc.infoservices.com.au/items/10-047</a>
978-1-74254-021-4	10/048	Leucospermum 'Tango'	<a href="https://rirdc.infoservices.com.au/items/10-048">https://rirdc.infoservices.com.au/items/10-048</a>
978-1-74254-023-8	10/050	King protea	<a href="https://rirdc.infoservices.com.au/items/10-050">https://rirdc.infoservices.com.au/items/10-050</a>
978-1-74254-024-5	10/051	Protea 'Pink Ice'	<a href="https://rirdc.infoservices.com.au/items/10-051">https://rirdc.infoservices.com.au/items/10-051</a>
978-1-74254-025-2	10/052	Protea 'Grandicolor' <sup>(1)</sup>	<a href="https://rirdc.infoservices.com.au/items/10-052">https://rirdc.infoservices.com.au/items/10-052</a>
978-1-74254-026-9	10/053	Honey protea	<a href="https://rirdc.infoservices.com.au/items/10-053">https://rirdc.infoservices.com.au/items/10-053</a>
978-1-74254-027-6	10/054	Blushing bride	<a href="https://rirdc.infoservices.com.au/items/10-054">https://rirdc.infoservices.com.au/items/10-054</a>



A selection of South African Proteaceae as presented for sale at Sydney Flower Market.

In general, market only those flowers that have good colour and texture, will open evenly and will have a vase life of 7–10 days. The stems should be straight or nearly so, with all stems in a bunch having similar length and thickness.

Wholesalers, florists and exporters usually specify stem length, bunch size etc. to suit individual market requirements. Some proteas are sold as individual stems (e.g. king protea), while others are bunched, usually five stems per bunch (*Leucospermum*, many *Protea*) or 10 stems per bunch (*Leucadendron*).

Store stems overnight at 2 °C before grading and packing, or pack and cool in cartons using forced-air cooling. Proteas are usually graded by stem length and marketed with the lower leaves removed.



A top-quality bunch of *Leucospermum* 'Tango'.



A poor-quality bunch of *Leucospermum* 'Tango'.

Proteas destined for export markets may require treatment with registered insecticides or fumigation before shipping.

## Leaf blackening—a specific postharvest problem

Leaf blackening following harvest can be a major problem in proteas. The severity of this physiological disorder varies between species and varieties. Blackening can occur within 3 to 5 days of harvest and reduces the visual appeal and vase life of the product. Aim to grow species and varieties which are less susceptible to this disorder.

The exact mechanism of leaf blackening is still not fully understood, but it results from the cut stem drawing on the carbohydrate reserves in the leaves to supply sugar in order to complete the development of the flower head. This leads to oxidation and thus darkening of phenols within the leaves. It occurs more quickly in warmer climates and in proteas stored at warm temperatures and under low light conditions.



Leaf blackening on *Protea repens*.

Some growers recommend that in hot weather, plants should be watered the night before picking, and that flowers be picked late in the day, after they have had time to accumulate carbohydrates.

Careful postharvest handling will help reduce or prevent leaf blackening. Picking flowers when the foliage is dry, cooling them quickly after harvest and storing them at 2–4 °C will help. Keeping cut stems under continuous bright light may also help reduce its incidence.

Leaf blackening can be reduced by postharvest glucose treatment, but not by sucrose. Follow harvest, holding and storage advice to minimise this problem. Sell flowers vulnerable to leaf blackening quickly.

## International Protea Association

The International Protea Association (IPA) was formed in the late 1970s by the late Peter Mathews of Australia, who realised that there were numerous people around the world interested in protea cultivation. Although proteas

originate from South Africa, they are now widely cultivated throughout the world wherever conditions allow. The IPA now embraces both the Australian and African genera.

The IPA's executive committee is situated in South Africa, and has the support of a board of directors, representing protea associations around the globe. The IPA gives the protea industry a status that it could not have as a series of national bodies. Growers, exporters and traders may join the IPA in their individual capacity.

The IPA publishes two journals annually. A conference is held every second year, each time in a different region. The IPA also offers research scholarships on the Australian and South African genera of the Proteaceae.

An International Protea Register is held in South Africa. The register provides for registration of cultivar names of genera of African Proteaceae, aiming to avoid duplicated names within the industry worldwide. Information entered in the register includes the cultivar name, parentage, breeder's name, date and description of the plant. For further details see [www.nda.agric.za](http://www.nda.agric.za).

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# Chapter 7. Doing a feasibility study

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## Bettina Gollnow

The market environment

Your business environment

Your legal environment

Your physical environment—site selection and climate

Your technical environment—your skills and access to ‘experts’

The critical extras—your competitive edge

Before you do anything else, you need to do a feasibility study, and review the range of environments in which you will be operating, to see how you will fit into them and in what areas you need to develop your skills. You then need to use this information to develop your business plan (Chapter 8).

## The market environment

You will need to understand the cut flower business and potential markets. Then you must fine-tune this information to define your major potential business, its markets and their requirements.

### Markets

It is fundamental that you investigate potential markets before doing any planting. Markets vary in their requirements for products and quality standards. Remember that fashion drives demand for flowers and may change without warning.

**Domestic market** outlets include local markets, florists, city markets (your own stand or more likely a wholesaler), interstate markets and auctions (see also Chapter 9). Our major **export markets** lie considerable distances away—in Japan, elsewhere in Asia, in North America and in Europe. Market research is the key to success, as each market is different (see Chapter 9 for more about exporting). In NSW, most producers sell their flowers to wholesalers or exporters based in Sydney or the larger country centres. If you plan to sell through these channels, you need to talk to wholesalers and exporters as widely as possible.

Consider making a personal visit to your proposed market, whether domestic or overseas. In NSW, nothing beats a visit to the Sydney Flower Market at Flemington, where you will see a wide range of wildflower products. With overseas markets, learn how different nationalities conduct business. Austrade can provide information on exporting.

Although it won't always be easy, try to gather details of wholesale flower prices and relate these to what you are planning to do—for



example, contact the Sydney Market Reporting Service ([www.sydprod.com.au/SMRS](http://www.sydprod.com.au/SMRS)) about their recorded flower prices at the Sydney Flower Market at Flemington (see Chapter 16 for details).

The world flower business has high standards, set by a huge trade in traditional flowers. Overseas buyers demand quality and consistency, so all growers need to pack and present product exactly as specified. Many exporters and established growers work hard to develop a market for the longer term, and you need to be prepared to support their efforts.

Successful marketing requires time and special skills, as well as a thorough knowledge of the world flower trade. Even if you plan to leave this to a specialist (wholesaler or exporter), you still need to understand what is involved.



**Wildflowers can be boxed and sent to more distant markets as single stems or bunches. The additional costs need to be considered in your business planning.**

## Market demand

While Australians today are more aware of their local flora, native Australian and South African flowers have a market share nationally of only around 10% to 15%. Our unique flora is also increasingly recognised in overseas markets, where fashion-conscious buyers are constantly looking for novel products. However, Australia's share of total world sales of Australian natives is small, and the export environment is increasingly tough.

You will need (but may find hard to come by) information on the current and likely future demand for various species and cultivars in the various markets, specifically:

- time of year required by key target market
- quantities needed

- preferred varieties and colours
- specific quality requirements such as stem length, bunch size, flower maturity and post-harvest treatments
- price range (per bunch or per stem)
- likely freight costs, as freight can be a significant cost.

However, be aware that these requirements can change rapidly.

## Product requirements— is there a million-dollar product for you?

Obviously there is no 'million-dollar' flower crop, but not all products are equally profitable, so short-list and fully research products that may be suitable for you. You must consider:

- production economics (and note that some crops take at least 3 years before yielding marketable quantities)
- assured supply (How long will the crop produce under your conditions? How does this fit with projected demand?)
- quality (pest and disease management and pre- and postharvest treatments, and the source and cost of chemicals to do this)
- labour (number of staff, cost of staff and skills to ready the crop for market)
- product presentation and grading (bunching, stem length, leaves, flowers, stems, packaging, quality control)
- cool chain, transport and storage.

Some growers prefer to spread their risk by growing a range of species or cultivars. Others combine their flower venture with another horticultural or agricultural enterprise. This allows you to spread out peak labour requirements and keep permanent employees throughout the year. You can also maximise returns from the capital you have invested in plant and equipment. It is wise to limit the lines you grow to a manageable number, as it is almost impossible to be an expert in growing 20 or more different species.

In selecting species, you must evaluate links between harvesting periods and peak labour requirements, market demand and price. There is little point in planting large areas of a single

cultivar of one species if you cannot harvest (or sell) the whole crop when it comes into flower. Choose species that flower in different seasons to spread your production year around. Remember that some varieties have to be harvested within a 2- to 3-week period.

## Your business environment

Management skills are essential for the success of any enterprise. You must base your business decisions on sound budgets and a thorough knowledge of the marketplace. A love of flowers and a green thumb alone will not ensure success. You must develop a business plan (Chapter 8) based on thorough research and detailing likely costs and problems, both initially and in the longer term. Study markets and market demand before you plant your crop. Bear in mind that it is difficult to predict marketable quantities per plant for many native flower lines, and that prices usually fall when greater quantities of a particular line reach the market.

Although there are a few published budgets for the production of various flower crops, use them as a general guide only and fine-tune the figures for your situation. Ensure that your expectations, particularly of the export market, are realistic. Plan the economics of your venture on the basis of the income per carton, per plant and per hectare, rather than on per stem (as the price per stem can often be quite misleading). Risks of export are many and include fluctuations in the Aussie dollar, which can rapidly turn a profit into a loss. Overseas, will you sell on consignment or at a fixed price? Established growers recommend marketing product through a combination of fixed price and auction sales to spread the risk.

Be realistic about your financial resources—define your assets and debts. Ensure you can provide working capital (how much capital do you have versus how much you need?), especially in the early years when you are establishing crops. Plan your ability to survive periods with no income due to natural disasters, crop failures or delays in receiving the income. What will the terms of payment be, and will cash flows be adequate to sustain your business? What

are the freight costs?

How good are you at keeping records? You will need to keep many, covering financial aspects as well as crop production, to keep track of where you are at all times.

It is sensible to define your risks and how you will manage them—everything from a new pest or disease to a major drought or an unfavourable exchange rate.

Also look at your ability to expand production if things go well. Will you have enough water, appropriate land, access to labour etc?

## Your legal environment

Commercial wildflower growers must comply with several state and federal laws. More information is given in Chapter 16.

You may need approval to clear vegetation, and you will need approval to construct dams and levees, to draw water from rivers and other watercourses, and to sink bores or wells. Your local council usually requires you to seek planning approval before building structures and dams or undertaking land clearing, drainage and retailing. In NSW, for example, the *Noxious Weeds Act 1993* requires land occupiers to control noxious weeds on their land.

Some Australian native species are protected by law in the interests of protecting rare and endangered species and of protecting species diversity and ecological sustainability. Various state and territory authorities administer legislation that restricts the commercial use of these species. A licence or permit is needed to pick, trade in and sometimes grow protected species. Fines apply for unauthorised picking.

There may be restrictions on wild harvesting on Crown Land and on harvesting of some species on private land.

In NSW, a formal state plan describes management procedures aimed at ensuring sustainable harvesting of native species. Called the *Protected and Threatened Plants in the Cut Flower Industry—Sustainable Management Plan 2008–2012*, it includes details of licensing regimes affecting growers of cultivated flowers and bush harvesters. Growers and marketers of Australian native species need to be aware of

their obligations under this plan, which is administered by the Wildlife Licensing and Management Unit of the NPWS (NSW Office of Environment and Heritage): for current details see [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au) and search for 'plant licensing FAQs'. In addition, the Australian Government, which requires that growers and exporters have permits to export certain native flower products, insists that state regulations be complied with. For more information on export permits see [www.environment.gov.au](http://www.environment.gov.au).

For all export products, you will also need phytosanitary certification and inspection for specified markets from the Australian Quarantine Inspection Service plus Australian Customs clearance. Some of these permits will cost you money. You also must understand import duties and tariffs, and customs clearance in the country of destination. Contact the Australian Department of Sustainability, Environment, Water, Population and Communities ([www.environment.gov.au](http://www.environment.gov.au)) or your exporter.

Each state has its own pesticide regulations; for example, in NSW, the *Pesticides Act 1999* regulates management and proper use of pesticides. Regulations affecting commercial users include the need to keep detailed records of all spray applications and successful completion of accredited pesticide user training. Pesticides must be registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) before they can be manufactured, supplied, sold or used.

## Your physical environment—site selection and climate

Your physical environment relates to your farm location and its suitability for growing saleable flowers. The key factors for you to consider are geographical location, climate, water, topography, soil type, aspect, access to labour and access to markets. See Chapter 10 for more details.

## Geographical location and climate

Where are you planning to set up your farm? Remember that information about specific cultivation requirements of different species is often not readily available, though you can use the local flora as a guide. Obtain local records of climate, rainfall, frost, hail, drought and floods. Most of the existing wildflower industry is located on the coast, where the climate is mild and summer rainfall predominates. Inland regions have a drier climate, with winter rainfall and often winter frost. Favourable microclimates are critical to success, and you will need to work out where you have favourable areas on your property; for example, suitable growing areas at the top of a slope versus the bottom of a hill, where the cold air will settle in winter.

For most wildflower species, the effects of climate and location on growth and flowering are poorly defined. There are differences in flowering time between locations, presumably because of variations in temperature and day length between sites. Some crops come into flower earlier, while others flower later. Research local temperature records to assess maximum and minimum temperatures through the year, as well as the frequency, severity and duration of frosts. Frost is a major limiting factor in inland flower growing—it is no accident that there are relatively few inland flower farms specialising in Australian natives and South African species which have remained in business for longer than 7 years. Certain species will not tolerate frosts more severe than  $-4^{\circ}\text{C}$ . Avoid establishing plantations in frost hollows, and be prepared to seek advice and do your own trials if you are in a frost-prone area. Frost may also damage young plants and winter-flowering species.

Your plants will be more prone to various fungal diseases such as root rot, grey mould (*Botrytis*) and powdery mildew if you are in a high-rainfall area. While you can usually manage these with fungicides, this increases your time and financial inputs. Most WA species will not thrive in the high-summer-rainfall areas along the east coast. Similarly, east coast species may be unsuitable for areas with a drier climate or predominantly winter rainfall.



A number of crops can be grown under protected cultivation (under a shade house or in a polyhouse). You need to ensure that any such investment in infrastructure will be repaid by above-average returns for your crops. Currently, flannel flowers, selected kangaroo paws and waratahs are being grown under cover by a small number of growers.

## Topography

You must have vehicular access to the plantation year-round. Extremely steep locations are not practical for the movement of tractors, spray units and harvesting aids—choose a slope of less than 10% (10 m in 100 m). Steep slopes also have a greater risk of erosion.

## Soil type

Well drained soils are essential for almost all native Australian and South African species. Many wildflower farms are located on sandy loam with a pH of 5.0 to 7.0. Clay or saline soils or those with an extremely high or low pH are not suitable. Get a soil analysis done before you start growing to check the suitability of the site for the species you plan to grow. A soil test provides information on texture, pH, salinity and nutrient levels. You should also have the soil tested for nematodes. You can successfully cultivate wildflowers on land previously used for crops or pasture or on recently cleared land, but try to avoid areas where previous crops were heavily fertilised with high-P fertilisers.

## Aspect

Aim for a north to north-east aspect in full sun for maximum warmth, sunlight and wind protection.

## Water requirements

Irrigation is essential to high yields of good-quality flowers. However, the irrigation needs of many wildflower crops are unknown, as there has been little research. Research local rainfall statistics: if records show possible dry periods in autumn or spring, you may need to irrigate over an extended period. When you are estimating water requirements, remember to include the water you will need to fill the buckets to hold

flowers before dispatch to the market. This must be of good quality. You might need to collect rainwater in a tank for this purpose. You also need good-quality water for mixing pesticide sprays.

Have your water source tested for salinity, pH, phosphate, iron and calcium. There is limited information on the response of wildflower species to saline water. Get your water source tested at the end of summer, when the water quality is likely to be poorest.

Locate your dams and storage tanks in the best sites. You may need to seek expert advice. Set up your plantation areas so runoff can be channelled to the lowest point and into a dam.

## Labour

Flower growing is a labour-intensive business, especially at harvest time. You should be prepared to commit long hours each day, 7 days a week, to your business. A weekend-only commitment will increase the risk of a major problem jeopardising your investment. Young plantations need to be checked daily to catch any problems early. Established crops require significant labour to harvest, pick, grade, bunch, treat after harvest, pack into boxes and dispatch. Depending on the size of your plantation, you may need to employ part-time or casual labour. Labour costs around \$15 an hour, so poor management of staff will erode your profits. Harvest labour represents most of the harvest cost. You should calculate how long it takes to pick, grade and pack a unit area of crop and organise the labour accordingly. In isolated areas it may be difficult to find trained workers, especially if the harvest season is short.

Even during quieter periods, there are jobs to do. You need to regularly maintain irrigation systems, prune the plants and manage pests, diseases and weeds. You can treat most pest and disease problems more easily at an early stage. Poor day-to-day management will lead to major crop disasters and severe financial problems.

## Access to markets

How are the transport logistics to and from your area? If you are selling domestically, how good

is your access to markets and reliable transport? If exporting, how far are you from an international airport? Is access available all year round? Will the roads cope with the expected traffic and vehicle type?

## **Your technical environment—your own skills and access to ‘experts’**

Success in horticulture depends on a good theoretical and practical understanding of technical information. You must be able to read and interpret technical information on pests and diseases, chemicals, fertilisers and irrigation. A working knowledge of spraying techniques and the use of equipment is essential, as is horticultural training. There are an increasing number of training providers, and some distance education courses may help. If you plan to use pesticides as a commercial producer, you must have completed an accredited training course and then attend refresher courses from time to time.

No growing manuals are available for many wildflower species. Experienced growers have often adapted information and technology from other crops or from other parts of the world. It may be wise to obtain the services of an experienced consultant, particularly if you have a limited knowledge of growing plants.

Only top-quality product should leave your farm, especially if exported, so you need a quality control system. Few growers are large enough in scale to be able to meet demand on their own, so exporters tend to pool product from several growers to fill an order. This is workable if everyone works to the same standard. *Quality Specifications for Australian Wildflowers* (2010)

have been prepared to make this easier.

Flowers are highly perishable, so to be successful you must pay close attention to the ‘chain of life’. This is the sequence of stages through which fresh product passes on its journey from the farm to the end customer. Improper storage or handling at any stage will affect quality and vase life. You need to optimise postharvest handling of your product. You will find more information on postharvest care in Chapter 14.

You will also need access to local technical support—reliable commercial suppliers of agricultural products and equipment (for irrigation, pest and disease management, fertilisers etc.) and repairers of equipment such as cool rooms. Access to a local grower network or group is also invaluable.

Experienced growers say that they never stop learning. Keep up to date with new varieties, new growing methods, new products and new markets. Maintain close contact with your marketer.

## **The critical extras—your competitive edge**

With new players continually joining the industry, those with extra skills, products, services or background will have an advantage. These advantages could be other skills or experience that you can bring to your flower growing from another business, a location allowing you to harvest a crop early or late to match a particular market window, or low costs (due to good management, economies of scale, low incidence of pests or disease, or a high level of existing infrastructure on your property).

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# Chapter 8. Business planning and the costs and economics of growing wildflowers

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**David Wood, Bettina Gollnow and Ross Worrall**

Business planning   Farm infrastructure and basic equipment needs  
Managing staff   Training and conferences  
The costs of growing wildflowers

Your flower business should be based on a solid business plan. Your planning must also address potential risks to your venture and how you will manage them. You need to define the critical points where failure will reduce your viability, and how you will manage such risks. Risks include unexpected crop or yield losses due to insect or animal damage, disease or inclement weather (frost, hail, flooding), delays in payment for product, unavailability of labour and illness. If you are planning to export flowers, you may need up-front capital for airfreight and production costs for 2 to 3 months before you receive any return. An extra risk in flower growing is that fashions can change without warning. As many native Australian and South African crops need several years to come into full production, a change in demand can undo years of work. You also need to plan to replace plants as they reach the end of their productive life, and it is preferable to maintain a trial block where you can test potential crops.

## Business planning

### Every business should have a business plan

According to the Australian Bureau of Statistics, 60% of new businesses fail within 3 years. But despite the risks, many people make the leap into their own business. Some people just leave their job, start a business straight away without stopping to think, and make a success of it. Others appear to make all the right plans and preparations and still fail. There seems to be no absolute right or wrong way of starting a business, and you cannot depend on luck alone.

Those who want to start their own business often fall into one of four categories:

- People who want what they see as a form of freedom—freedom from working set hours and from being told what to do.

- People who are made redundant, and decide to use the redundancy money to buy their own business.
- People who see the necessity to go into business to create an income or to increase their income.
- People who see an opportunity to start a business on the basis of a perceived gap in the market.

Anyone thinking of jumping into their own wildflower business is strongly advised to ask serious flower growers about their experiences. Be prepared to start your business as a part-time venture to test yourself and market demand. There are many sources of help and information; for example, your state government business website (in NSW, [www.smallbiz.nsw.gov.au](http://www.smallbiz.nsw.gov.au)) and BEC Australia ([www.beca.org.au](http://www.beca.org.au)), which list a comprehensive range of services and products as well as the locations of business advisory centres throughout Australia.

In the following list of common reasons why businesses fail, you may note a strong theme—lack of planning:

- Initial lack of adequate finances.
- Lack of credit control.
- Lack of sales.
- Lack of accurate records.
- Government legislation changes.
- Staff problems.
- Lack of good financial planning and management.

Before you start your own business, ask yourself six hard questions:

1. Do I have the capability and resources to start a business, or this kind of business?
2. Do I have the knowledge, experience, money and people around to make it happen?
3. Am I passionate enough to be able to devote a lot of my time and energy in the start-up phase?
4. Am I prepared for financial uncertainty?
5. Am I excited, or unnerved, by risk?
6. Am I really willing to put in long hours?

One of the benefits of constructing your own business plan is that by the time you are finished, many of the above questions will be answered—one way or another!

## What is a business plan?

A business plan is probably best described as a summary and evaluation of your business idea, in writing. It allows you to think through all the facets of a business: to examine strategies and their consequences. The aim of a business plan is usually to help owner/operators to focus their efforts on those issues that are vital to the success of the business.

What are the benefits of having a business plan?

- It forces you to fully examine your plans and actions and to set targets.
- It enables you to test your ideas on paper.
- It allows you to anticipate problems and decide, in advance, how to solve them.
- It indicates to others your ability and commitment.
- It shows lenders and suppliers that you understand your business.

When preparing your business plan, it usually helps to be challenged by an outsider, such as a farm or financial consultant, an accountant or an objective friend.

## How do you produce a business plan?

### 1. Collect information

Find out about potential customers, markets, products, trends, business ideas, financial details etc. that may be relevant to you. Your feasibility study following the advice in the previous chapter will have provided much of the basic information already. More background information is provided later in this chapter.

### 2. Analyse the information

The key question to ask is 'Will the costs of running the business leave enough from what you expect to make to pay a wage and reasonable profit to you as the producer?'

When Steps 1 and 2 are completed, you should have decided whether there is a market for your products, and whether it is large enough and sufficiently accessible. The answers are generally positive for the cut flower market, so you have to work out whether your proposed entry into the market is financially worthwhile.

## Decide on how it's going to work

Four parts go together to make a comprehensive business plan:

1. The introduction.
2. Market research and planning.
3. The production and operations plan.
4. The financial plan.

Alternatively, the ATO indicates that a simple business plan can just include:

- a description of your activities
- the markets to which you propose to sell
- realistic estimates of quantity and volume of sales
- income expected from the activity
- the research that you have conducted
- expected expenses and capital outlays
- how you propose to finance these expenses and capital outlays.

Your business plan can be short and simple or long and complex. How much detail you include depends on how much effort you feel is justified by your business. The financial aspects of the plan are the most important parts, so you should develop or engage financial skills to make sure this part of your plan is accurate and realistic. Business plan guides and templates can be found through your local Business Enterprise Centre and at [www.business.gov.au](http://www.business.gov.au).

## Taxation considerations

Although there are a number of full-time wildflower growers, many flower farms are still worked by people who have other jobs. Many of these people have chosen to offset farm losses against their main income. Over the last few years the ATO has introduced a series of tests to determine whether 'non-commercial business' losses can be offset against other assessable income. New rulings say that a primary production business such as flower growing must be able to show a profit within a reasonable time frame. If you already have a job and if some of the above applies to you, then you may need to discuss this with the ATO.

## What now?

Once you have finished your Business Plan,

you will need to get it checked by your accountant or business advisor. There are also other sources of help for people wanting to start or grow a business. Business Enterprise Centres provide free, confidential business counselling and practical assistance to both intending and existing businesses.

Once you are happy with your concept and the figures show it to be worthwhile, **and** you have satisfied an accountant or someone with similar expertise that it's OK, then you can get started!

## What government grants are available?

You may be eligible for assistance through a specific government grant program. GrantsLINK is a comprehensive whole-of-government website that offers direct links to existing information on Commonwealth and state government grants programs. The site also gives advice on finding the best sources of funding and on writing applications.

[www.grantslink.gov.au](http://www.grantslink.gov.au)

Phone advice: 1800 026 222

## Farm infrastructure and basic equipment needs

Minimum farm size is generally 2–4 ha, but 5–10 ha is recommended. Land can be leased or share-farmed to reduce costs.

The facilities and equipment you will need on your farm will depend on the type of operation you set up. Some items will be common to all operations, but others are more specialised. Equipment will also vary with the scale of the operation.

## Farm infrastructure

### Packing shed

This should have a concrete floor, water and power supply, lights and good vehicular access. It should be vermin proof. A concrete floor is essential for efficient cleaning and to prevent mud or dirt from contaminating the product. Toilet facilities, including a shower, are essential, especially for hired labour and for decon-

tamination after pesticide application.

The design of the packing shed will greatly affect the efficiency of your packing operations, especially material flows and handling. One design feature often overlooked is the need to keep flowers that have been disinfested separate from freshly harvested material. This is especially important for export markets.

### **Cool room**

At least one cool room is essential for a commercial wildflower farm. Two are usually desirable, especially for larger operations, so that you can store freshly harvested material in one and disinfested and packed material in the second. The cool rooms should be within or immediately adjacent to the packing shed. Position the cool rooms with material handling in mind. Cut stems need to be held at 4 to 8 °C in the short term (2–4 °C in the longer term), at a high relative humidity. A humidifier may be needed, as may forced-air cooling. This equipment can be hired for the season.

### **Machinery shed**

You will need a shed for storing farm machinery and equipment. Do not store packing materials in open sheds where they can become contaminated by insects, bird droppings, dust or oil.

### **Chemical storage shed**

This is a legal requirement if you plan to use pesticides (and most growers rely on pesticides to some extent). It should be constructed to the required legal standards (see the relevant SpraySense fact sheet at [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)). At the very least it needs to be a lockable cupboard or shed with satisfactory ventilation.

### **Fertiliser shed**

A separate fertiliser shed is a good idea to prevent contamination of packing materials and machinery. Also, many fertilisers can be corrosive, flammable or even explosive and should not be stored together with pesticides.

### **Office space and facilities**

An office area with a phone, computer (email and Internet connections) and fax is essential for any commercial operation. For convenience, the office is often attached to the packing shed, but needs to be physically separated from it.

### **Greenhouse or rain shelter**

You may decide to grow certain crops in a greenhouse or rain shelter to produce better-quality or out-of-season product. These structures are expensive to build and require maintenance. Most local councils require a development application before such structures can be built.

The design needs to be considered carefully, especially in relation to efficiency of labour, your greatest cost. Growing plants on benches or raised beds is generally a good idea for labour efficiency and disease control. The amount of headroom needed will be greater, but this has the advantage of allowing better ventilation. The floor should allow for good drainage but should also suppress weeds and disease. Gravel is often used on the floor or between beds to achieve this.

### **Separate holding area for new plants**

For quarantine purposes it is a worthwhile investment to have a holding area for new planting material which is separate from existing crops. In this area young plants in pots or tubes should be placed off the ground on wire benches. New plants can be checked for potential problems, and corrective action can be taken. This reduces the risk of introducing a major problem to your new plantation, and again later should you decide to expand your planting or replace crops.

## **Machinery**

You can greatly reduce capital costs by using contractors, especially for jobs such as initial bed preparation. Second-hand and hired machinery is also an option for many operations, but convenience, availability, reliability and overall cost also have to be taken into account. Can you afford breakdowns or non-availability of machinery and equipment at critical times, such as harvesting?

The machinery and equipment required will depend on the size of your intended farm and the production system you choose. One of the advantages of intensive production in rain shelters is the reduced need for some of the larger equipment, such as tractors, for routine production. There is also obviously a reduced requirement for transport because of the more



compact nature of the operation. However, don't forget about the equipment needed for the maintenance of the surrounding area.

The following is a list of equipment you will need to consider.

### **Tractor**

The tractor should be sized to suit your operations, especially in relation to row widths. Larger field operations will require a medium-sized tractor. However, smaller tractors—even if used as a second tractor—are very useful for towing trailers for harvest. They can also be fitted with narrower equipment for operations between narrow rows. Ensure that they have a power-take-off of sufficient capacity to power the equipment you will be using.

### **Attachments**

A vast range of equipment can be attached to tractors. Many attachments will be essential or very useful for your operation; for example, cultivation equipment (scarifier, bed former or scarifier blade, rotary hoe), mowers, slashers, sprayers and fertiliser spreaders.

### **Trailers**

Trailers attached to tractors, or some other form of transport (such as a utility), will also be needed for harvesting operations. Trailers or trolleys also allow you to streamline movement of harvested product through your packing shed. A farm bike may be useful for crop inspection and maintenance operations.

### **Pesticide application equipment**

A large range of equipment is available for pesticide application. It is important that you choose equipment that is suitable for its intended use and appropriately sized to allow you to apply sprays as efficiently as possible. Tractor-mounted equipment is usually used for field spraying. Some types can also be used to apply pesticides under rain shelters, for example, with hoses attached. For small operations, especially those under cover, battery-powered sprayers may be economical and effective. It is generally a good idea to have separate equipment—especially tanks—for chemicals.



**Trailers will be needed for harvesting operations.**



**The right spray equipment and personal protective clothing are essential to managing pests and diseases in your crop.**

### **Fertiliser application equipment**

The equipment required will depend on how you plan to apply fertilisers to your crop. Tractor-mounted spreaders are generally used for efficient application of dry fertilisers to large areas (as long as you do not have weed matting covering the beds). Fertigation using soluble fertilisers in the irrigation system can also be a very efficient means of application. This is suitable for both large and small areas, especially those under protected cultivation.

### **Irrigation equipment and water supply**

Besides the actual field distribution system, you will need to consider whether or not your water source is adequate for your needs. Review the quantity, reliability and quality of the water supply. How much automation will you need to deliver the water to your plants? Look at the type and size of pumps and filters, and consider installing equipment to protect your investment, such as equipment to disinfect the water (for example, a chlorinator). You should also consider the type and location of drainage lines.

### **Equipment for delivery to market**

If the flowers are not collected from your farm, you will need a vehicle to deliver them to a central collection point or directly to the market. For long-distance transport a refrigerated vehicle is desirable.

### **Minor equipment**

You will also need a large range of minor equipment; for example:

- Secateurs for harvesting and sharpening equipment (your blades must be sharp!).
- Various hand tools such as shovels.
- Crop supports. Some annual and biennial crops are grown on supporting wires or wire mesh to ensure straight stems. You will need the wire mesh itself plus tomato stakes placed 2 m apart to hold the wire. Depending on the crop, one or two layers of wire may be needed.
- Tables for bunching, grading and packaging. Circular rotating packing tables can be very effective. They can handle variable loads and take up less space. If something goes wrong, the product just goes round again.
- Scales for weighing chemicals and bunches.
- Containers for storing and treating flowers. Generally, large buckets are suitable and can be bought fairly cheaply second-hand.
- Rubber bands or tape for tying bunches.
- Cellophane or sleeves to wrap finished bunches, as well as boxes of various sizes if you are sending product to more distant markets. Export markets have very specific requirements about box sizes, packing and labelling.

- Other equipment such as packaging tape dispensers, bunch-tying machines, strapping machines for cartons, rollers, a pallet jack or trolley, and sleeving and conveyor systems
- Dipping tanks or fumigation facilities if you plan to export your flowers.

This list is not exhaustive and should be tailored to your operations.



A bunch-tying machine will save you time and help you to present more uniform bunches to the market. Note the scales nearby for weighing bunches.

## **Managing staff— employee and workers’ compensation issues**

Once you start employing people, you must be aware of the applicable laws and conditions. This ranges from having adequate workers’ compensation and public liability insurance to providing a safe workplace.

Your obligations under occupational health and safety legislation involve issues such as sun protection, safe handling of chemicals and lifting guidelines. You need to provide and maintain safe plant (tools, machinery and other equipment your employees will be using), as well as safe systems of work. Ensure that any equipment and materials such as fertilisers and pesticides can be and are used, handled and stored safely. You also need to make sure that you provide your workers and any contractors who visit your farm with sufficient information, training and supervision to work safely.

One specific area involves chemicals, such as pesticides, used on the farm. You must ensure that only legally available chemicals are used and that you have copies of Material Safety Data Sheets (MSDS) for all the chemicals being used. You also need to provide any personal protective equipment that may be needed.

Having basic amenities available for your workers is also necessary. These include clean toilets, clean and cool drinking water and hygienic eating areas.

When employing labour, whether casual or permanent, workers' compensation insurance is mandatory in case the worker is injured while working for you. Talk with an insurance broker to assess your level of risk and how best to insure yourself. It is worth the effort to carry out formal risk assessments of your main tasks and processes in order to identify how to eliminate or minimise potential risks. This will help you to write 'safe work statements' that you can give to any new employees. In flower growing and processing, there are many manual handling activities (lifting, carrying, sorting and packing). Up to 25% of all workplace injuries are caused by unsafe manual handling, so this is an important area for you to consider. Using trolleys to avoid the need to lift heavy bags of fertiliser or buckets of flowers and having benches at the correct height are simple and obvious ways of minimising injury.

Adequate record keeping is important, and some form of daily diary or wages book is necessary. You need to understand your responsibilities and legal requirements as an employer—your local Business Enterprise Centre is a good place to start.

## Training and conferences

Various seminars, conferences or courses are available through TAFE, other training providers and various industry associations. It pays to attend, as you will always learn something, and you will benefit from networking with others in your industry.

## The costs of growing wildflowers

The costs of running any business are made up of capital costs, direct costs of production and indirect costs of running the enterprise.

### Capital costs

The capital costs are the costs of purchasing fixed assets. The fixed assets of a cut flower business are described in the previous section and typically include the items listed below. Many need to be purchased before the business has an income. Items marked with an asterisk are not considered essential, at least not initially.

- Land.
- Buildings such as a packing shed with cool room; machinery shed.
- Office space.
- Shade houses, rain shelters, greenhouses.\*
- Machinery and vehicles such as tractors, rotary hoe, delivery van, trailers or trolleys to move buckets and flowers around the farm, bunch-tying machine\*, grading machine.\*
- Disc plough, deep ripper, bed-forming equipment.
- Irrigation system components, drainage pipes or channels, water disinfection system (e.g. chlorinator), spray equipment (including protective clothing and equipment), fertiliser spreader, fertigation unit.
- Dam or bore.
- Fencing.
- Buckets, assorted hand tools (e.g. shovels), secateurs and knives.

### Direct costs

The direct costs of your cut flower business are those relating to growing the flowers and presenting them for sale. These include the cost of plants, fertilisers and farm chemicals, flower sleeves and boxes, bunch ties and tapes, postharvest chemicals and office supplies.

Direct costs are taken into account when calculating the gross margin of a particular enter-

prise. Gross margins are used to compare the gross profitability of alternative enterprises and help determine the whole-farm enterprise mix.

There is limited published information giving the gross margins of growing specific wildflower crops (see 'Key references' at the end of this chapter). Use those that are available as a guide, but remember that the gross margin may be different if any of the conditions are changed. The costs likely to vary most from year to year and from farm to farm are those relating to pest and disease control.

## Indirect costs

These relate to the running of the farm. They include rates, advertising, delivery, insurance, consultants' fees, soil, water and plant health tests, and the selling agent's commission.

## What is a gross margin?

The gross margin of a cut flower business is its gross profit: the difference between the operating income obtained on the sale of flowers and the cost of their production. When you come to run your business you will see that the gross margin is an important figure, especially in relation to the sales figure, and it is one that you will prepare each year as part of your financial reports.

$$\text{Gross margin \%} = \text{gross profit \$} \times 100 / \text{sales \$}$$

It is important to note that the gross margin includes only the costs directly related to the cost of producing a cut flower, and not other business expenses such as rates, advertising, delivery, office expenses, insurance, basic wages etc. These costs are deducted from the gross margin to give the net profit or loss of a business. Also, it does not include capital costs such as those of structures, machinery and equipment, or liabilities such as loans.

The gross margin or profit is affected by the income from sales and the costs of production. Profitability can be improved by increasing revenue or by reducing costs.

## Increasing revenue

Revenue is determined by price and yield. Obviously, the best combination is a large number of sales at good prices.

## Price

The price obtained for a flower crop can fluctuate greatly, especially if it is a more commonly grown line and is harvested over a long period. Price is affected by supply and demand. Thus, the higher the demand and lower the supply, the higher the market price, and vice versa.

Demand for cut flowers increases for occasions such as Mother's Day and Valentine's Day. However, not all cut flowers increase in demand on these occasions. For example, flowers for Valentine's Day are traditionally roses, and most often red roses, although demand for other lines has increased. Unlike a manufacturing industry, the marketable yield from a particular flower crop is generally unknown and not easily controlled, especially if it is a field crop. Consequently, the domestic market suffers from gluts due to high domestic supply, sometimes exacerbated by imports from interstate. This also applies to overseas markets, where on any given day flowers offered for sale are sourced from local and overseas growers. Timing the arrival and marketing of Australian flowers so as to gain the premium prices growers and exporters want can require considerable market knowledge.

The market price for a flower crop can also vary on any one day according to its quality. Go to the local markets and find out what makes one bunch of flowers fetch a better price than another. Often the features include stem length (the longer the better), freedom from pests and diseases and blemishes, healthy foliage, and picking at the correct stage of opening.

Over time customers will get to know the crops that have better vase life than others and the growers that produce better flowers. Vase life is affected mainly by postharvest treatment of the flowers. Some crops can have their vase life significantly extended by the use of postharvest treatments (see Chapter 14).

Some growers produce crops in a greenhouse or rain shelter to further improve quality and reduce the risk of damage from adverse weather. While this is more common for traditional flowers, some Australian native crops are now also being produced under cover, and such crops may attract higher prices.



## Yield

Yield is affected by climatic and cultural conditions. Yield can be modified to coincide with peak periods of demand if the crop is carefully managed, for example by strategic pruning.

## Reducing costs

Conversely, profitability can be improved by managing the business costs. For example:

- Having systems and procedures in place. One of the largest costs can be that of being inefficient and making mistakes so that an operation has to be repeated or a crop is rendered unmarketable because of poor pest or disease management.
- Making sure sprayers are properly calibrated so that spray is not wasted.
- Having trained staff who know what they are doing.
- Using sprays at the recommended rates and not at a lower rate so that the crop has to be sprayed again.

## Quality

Both ways of improving profitability can be achieved by quality. Higher-quality produce may fetch better prices and is sold before lower-quality produce, thus ensuring sale of your product. Quality management ensures that procedures are followed correctly, and helps ensure the production of good-quality produce. You will find detailed advice on 32 wildflowers in the *Quality Specifications for Australian Wildflowers* (2010)—see Chapter 15.

## Comparing cut flower enterprises

When deciding whether or not commercial cut flower production is for you, and then which crop to grow, remember to not only look at the gross margins of actually growing the crop. You also need to consider the other costs of growing each crop, such as the capital input necessary. Other critical considerations are the production and marketing risks of growing that particular crop. For example, some crops are particularly susceptible to pest and disease problems and so the risk of losing an entire crop is high. You

may successfully grow your crop but find that the price of your flowers is low when they come into production.

## Cash flow

The cash flow of a business is extremely important. A business may be profitable but be 'cash hungry' and consequently may fail. On setting up a business, remember that you will be funding it until you obtain an income. This may also affect your decision as to which crop to grow. For example, some crops can be harvested in 4 months from planting, while others may not produce a marketable crop for 4 years. It is also important to remember that some flowers crop relatively continuously, whereas others flower for only a short time once a year. While the latter crop may fetch good prices, you may need other crops to give your business a more continuous cash flow.

## Key references

Reliable financial information on commercial wildflower growing is scarce. The *New Crop Industries Handbook*, published by RIRDC, includes a useful section on financial planning. There are financial models for a range of crops, and when you purchase the CD edition, you also get spreadsheets that you can use. See [www.rirdc.gov.au](http://www.rirdc.gov.au) for details.

Another useful reference, also published by RIRDC—*Improving Profit for the Flower Grower*—provides information on benchmarking. This is a useful way of comparing the profitability of different crops and varieties in order to decide which ones to concentrate on.

The book *Should I Grow Wildflowers*, published by the Queensland Department of Primary Industries in 2000, includes cash flow budgets for six wildflower crops, which you could update with today's costs.

The interactive scenarios developed by Margaret Cover at the former Centre for Native Floriculture between 2008 and 2010 will make you more aware of important considerations at the planning stage:

- I think I want to grow native flowers
- Why do good flowers go bad?
- Smart marketing – the way to success

- Developing new plants for marketing
- Pest & disease management issues in native flower plantations.

Go to [scenarios.sblinteractive.org](https://scenarios.sblinteractive.org) and type the name of the scenario of interest to you into the search box.

The Flower Association of Queensland has recently produced the 'Cut Flowers and Foliage Whole Farm Economic Decision Calculator'. Contact FAQI on 07 3824 9516, or see [www.flowersqueensland.asn.au](http://www.flowersqueensland.asn.au).



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# Chapter 9. Selling your flowers

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**Bettina Gollnow and David Wood**

Customer requirements and service standards

Selling on the domestic market

Domestic wholesalers based in NSW

Exporting cut flowers

Major overseas markets

NSW-based flower exporters

You must investigate potential markets **before** doing any planting. Markets vary in their requirements for products and quality standards. Remember that fashion drives demand and may change without warning.

You may like complete the relevant interactive guide for wildflower growers produced by the former Centre for Native Floriculture—go to [scenarios.sblinteractive.org](https://scenarios.sblinteractive.org) and type ‘Smart Marketing’ into the search box.

A good recipe for failure is to market flowers with a short vase life (due to poor preharvest management). You will quickly lose your customers. To be successful, you must pay close attention to the ‘chain of life’. This is the sequence of stages through which fresh product passes on its journey from the farm to the end customer. Improper storage or handling at any stage will affect quality and vase life (see Chapter 14 for more information).



**Good product presentation is essential to attract buyers at wholesale markets.**

## Customer requirements and service standards

Growing and selling form a long chain with many links, and everyone along that chain should be treated as a customer. If you keep aware of this vital concept, it will change your whole approach to doing business with all parts of the chain. Courtesy, respect and delivering the right quality and quantity at the right time will

build trust and, most importantly, customer loyalty. This loyalty, although sometimes fickle, can be one of your most valuable assets.

To help in this, you need to:

- identify the important links or key people
- make it your job to know and regularly communicate with them
- treat them better than they probably expect to be treated.

The golden rule applies at all points along the supply chain, whether it be the truck driver, the agent or the buyer: *Do to others as you would have them do to you*. An attitude like this, plus the right product, can mean repeat business when times get tough. The other maxim here is always *Do what you said you would do, when you said you would do it*. It's the simple things like this that are so often overlooked, and yet that often mean so much in building successful commercial relationships.

Always remember that you are dealing in a highly perishable, non-essential product with a demanding and fickle buying public who are more discerning, educated and health conscious now than ever before.

## Selling on the domestic market

### Local markets

Small or large farms can use local markets for year-round sales. These should be located within 1 hour's travelling time of your farm. Outlets include local florists, farm or roadside stalls, farmers' markets, restaurants, and motels and resorts. You will need to prepare and deliver flowers once or twice a week. It is important to keep up a regular supply and excellent service to maintain your market.

### Shipping direct to florists

To properly supply this market, you need to be able to supply flowers throughout the year. You will need a large variety of lines, or supplies from a cooperating group of growers. Flowers need to be packed in flower boxes and delivered by couriers to different parts of the state,

direct to florists. Setting up the transport network may be difficult initially. You must get to know and keep in close contact with your customers in regard to orders and payments.

## City markets

If you are close to Sydney, investigate selling through Sydney Flower Market at Flemington. The market, located at Shed F, has an annual turnover of some \$150 million and accounts for about three-quarters of the flower wholesale trade in NSW. All people who sell in the flower market are growers, and some are also wholesalers or agents for other growers. Several traders tend to specialise in native Australian and South African flowers, while others include these flowers in their product range.

You may choose to sell through a trader, who will usually charge you 25% or more of the sale price for handling your product. Alternatively, the seller may undertake to buy your product at a fixed price. For more details, go to [www.sydneyflower.com.au](http://www.sydneyflower.com.au).

The market trades Monday to Saturday. The main trading days are Monday, Wednesday and Friday. The market opens for trading at 5 am. Regular stand holders begin work between 1 and 4 am. Most of the selling is done between 5 and 8 am. The main peaks in prices occur in relation to Christmas, Easter, Anzac Day, Mother's Day and Valentine's Day.



**Large domestic wholesale markets like the Sydney Flower Market give buyers the chance to see new products and to compare quality.**

The rights to a regular stand can be purchased from a grower who wishes to sell their rights to that stand. Information on the price for this transfer is available from Sydney Markets

Limited.

The Sydney Market Reporting Service records flower prices at the Sydney Flower Market. Prices are collected on Mondays, Wednesdays and Fridays through interviews with a range of wholesalers, buyers and growers (see Chapter 16 for more details).

Major regional centres are serviced mostly by wholesalers, who sell direct to florist shops or from a warehouse.

## Interstate markets

You would usually sell your product at a fixed price direct to a flower wholesaler interstate. Major markets are the National Flower Centre at the Melbourne Markets ([www.melbournemarkets.com.au](http://www.melbournemarkets.com.au)) and flower wholesalers at the Brisbane Markets ([www.brisbanemarkets.com.au](http://www.brisbanemarkets.com.au)).

## Domestic wholesalers based in NSW

The companies listed here specialise in Australian native and South African species. Most wholesalers based at the Sydney Flower Market handle wildflowers as part of their range.

### Boydita Native Foliages and Flowers

Contact: David Ross  
PO Box 3087, Erina NSW 2250  
Phone: 0428 383 158; Fax: 02 4372 1889

### East Coast Wildflowers

Contact: Craig Scott  
PO Box 31, Sydney Markets NSW 2129  
Phone: 02 9325 6774; Fax: 02 9325 6046

### Goldenvale Nursery

Contact: Rick Eagle  
3205 Pacific Highway, Ourimbah NSW 2258  
Phone: 02 4362 3344, 0408 435 299  
Fax: 02 4362 3345

### Demasi Bros

PO Box 154, Horsley Park NSW 2164  
Phone: 02 9826 1805; Fax: 02 9826 1640

### T & G Flower Growers

Contact: Tony or Gabriella Zaia

183–191 Koala Way, Horsley Park NSW 2175  
Phone: 02 9620 2150; Fax: 02 9620 2545  
[www.tgflowergrowers.com.au](http://www.tgflowergrowers.com.au)

### The Wildflower Farm

Contact: Jeremy Smith  
20 Grants Rd, Somersby NSW 2250  
Phone: 02 4372 1393; Fax: 02 4372 1774

## Exporting cut flowers

Australia is a small player in the world flower trade. In recent years, production has shifted from centres in Europe (the Netherlands, Germany and France) and North America to countries offering more suitable climates and low production costs. These include Ecuador, Ethiopia, Kenya, Colombia, Chile, India, Israel, South Africa and Malaysia. Over 60 countries are involved in the international trade in cut flowers and foliages.

In Australia, commercial flower growers with an export focus are in the minority—most growers produce traditional flowers, and most flowers produced are sold on the domestic market.

## Australia's flower exports—untapped potential?

Australian native flowers, South African Proteaceae and foliage lines account for most Australian flower exports. The true value of the Australian export industry is not clearly defined, and published estimates are often contradictory. Its value was estimated to be just under A\$30 million a year (Foster 2009), but this will have fallen owing to the global economic downturn and adverse weather.

The top export lines include:

- waxflower (*Chamelaucium* spp.)
- kangaroo paw (*Anigozanthos* spp.)
- thryptomene (*Thryptomene* spp.)
- stirlingia (*Stirlingia* spp.)
- protea (*Protea* spp.)
- banksia (*Banksia* spp.)
- leucadendron (*Leucadendron* spp.)
- koala fern (*Caustis* spp.)
- scholtzia (*Scholtzia* spp.)

- eucalypt foliage (*Eucalyptus* spp.).
- Christmas bush (*Ceratopetalum gummiferum*).

We compete with producers in Israel, the USA (California), South Africa and South America, in some cases directly if their flowers are marketed at the same time as ours. Compared with Australia, these countries often have lower labour costs, abundant labour pools, close proximity to major markets, subsidised air freight, and preferential tariffs and other duties. To survive, Australian growers and exporters must be committed to quality and service.

To date, the Australian wildflower industry has become known in countries like Japan as a supplier of new and different products. However, inconsistent quality has been identified as a problem by overseas buyers in fastidious markets like Japan. Critical to the industry's survival will be its ability to ship top-quality flowers at competitive prices and being able to source yet more new and different products.

Australian growers export a variety of wildflowers, and many other native species have commercial potential (see also Chapters 5 and 6).

There is significant potential for exporting an even greater range of flowers and foliage, if these can be grown and shipped profitably. Our unique and diverse native flora is a rich resource of possibilities waiting to be fully developed and marketed to the world. We have also already developed improved forms of several South African species. A number of research projects around the country have selected and developed improved forms and new species (for more information see [www.rirdc.gov.au](http://www.rirdc.gov.au)). However, the cost and time needed to select, improve and market new products is substantial, and perhaps more than our industry can currently sustain.

Many wildflowers cannot be grown all year round. However, Australia's range of climatic zones means that there is the potential to extend the availability of high-demand lines. In addition, Australian growers can produce crops 'out of season' for the Northern Hemisphere.

## Export versus domestic sales

The art of successful exporting lies in using the 'windows of opportunity' in the various markets. This may be product available early, or late, in

the season, when there is less competition, or a product for specific market niches. Getting involved in exporting can be a lucrative source of income, but it is a more risky and costly exercise than catering to domestic markets. Growing for export requires careful planning based on thorough market research and an export marketing plan. Some export advisers say that before attempting to export, you need to learn how to sell flowers successfully on the domestic market.

Only top-quality product should be exported, and you should put in place a quality control system on your farm. Few growers are large enough in scale to be able to meet demand on their own. A fairly recent development has been the formation of grower co-ops that allow several smaller producers to market their product together and thereby gain more power in the marketplace.

It is vital that you grow the right species or varieties, and can match harvesting periods to demand. Always be aware of peak labour requirements and market demand. To grow successfully for export, you must produce a high-quality product in sufficient quantity and be utterly reliable. You must communicate well and show long-term commitment.

Many growers use specialist flower exporters. These specialists have developed close ties with particular markets and have a good understanding of client requirements. They can combine flowers from various growers into one shipment at a more economic freight cost. Build a good relationship with your exporter and exchange information regularly. An exporter usually has facilities, or arrangements with a freight forwarder, for pre-cooling, disinfecting and inspecting flowers before shipment.

Market research is the key to success. Some exporters will make suggestions about suitable varieties for you to grow in your area and for which they know they have a buyer. Each overseas market is different. Consider making a personal visit and learn how different nationalities conduct business.

## Overseas buyers are very demanding

Overseas buyers demand top quality and consistency, so take care to pack and present your



product exactly as your exporter (or the overseas importer) has specified. Make sure every box is the same as every other box and mark them all clearly and neatly. Many exporters work hard to develop a market for the longer term. You need to support their efforts rather than undercutting them for short-term gain, for example by promising product and then selling it on the domestic market because you think you will get a better price. The *Quality Specifications for Australian Wildflowers* (2010) provide a good basis to work from.

## Sources of export assistance

Your state government may offer advice through a dedicated small business department, such as the Small Business section of the NSW Department of Trade & Investment (see [www.smallbiz.nsw.gov.au](http://www.smallbiz.nsw.gov.au)). Such departments provide free events, information and counselling to businesses entering export markets and can guide you to things like market research, distribution options and shipping information.

Austrade (the Australian Trade Commission) also provides information on getting started as an exporter, and regularly prepares profiles on industries and countries (see [www.austrade.gov.au](http://www.austrade.gov.au)). Austrade offers advice, training and assistance such as the Export Market Development Grants scheme. The website also has useful links to other organisations that may assist you.

## Planning for export

Ensure that your expectations of the export market are realistic. Plan the economics of your venture on the basis of the income per carton, per plant and per hectare, rather than per stem: often the price per stem can be misleading.

## Legislative requirements

Permits and licenses are required under the *Protected and Threatened Plants in the Cut Flower Industry—Sustainable Management Plan 2008–2012*, which is administered by the Wildlife Licensing and Management Unit of the NPWS (NSW Office of Environment and Heritage): for current details go to [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au) and search for 'plant licensing FAQs'. The Australian Government also requires that growers and exporters

have permits to export certain native flower products. Go to [www.environment.gov.au](http://www.environment.gov.au). For all export products, you will also need phytosanitary certification and inspection for specified markets from the Australian Quarantine Inspection Service plus Australian Customs clearances. You must also understand import duties and tariffs, and customs clearance in the country of destination. For more about exporting, see [www.daff.gov.au](http://www.daff.gov.au).

## Export logistics

You need to consider your needs for freight forwarder services, domestic transport, direct flights, clearing customs, export documentation, packaging, pressure cooling, cool storage and fumigation services. How far are you from an international airport?

## Product requirements

You must consider production economics, assured supply, product selection and quality (pre- and postharvest treatments, chemicals, insect control), product presentation, grading, bunching, stem length, leaves, flowers, stems, packaging, quality control, cool chain transport and storage.

## Market requirements

Different markets and buyers have different preferences for colour, grading, stem length, bunch weights (USA/Germany), bunching, sleeving, box size and labelling. Will you sell on consignment or at a fixed price? How soon will you receive sales reports? Your exporter will tell you what is necessary for the market you are targeting. Established growers recommend marketing product through a combination of fixed-price and auction sales to spread the risk.

To check whether the destination country allows imports of your particular products, or whether import requirements have changed, go to [www.daff.gov.au](http://www.daff.gov.au).

## Financial requirements

What is your level of capitalisation? How much operating capital do you have? What will the terms of payment be and will cash flows be adequate to sustain your business? What are the freight costs? Are there any government grants you could apply for?

## Market access

Market research is critical. Consider visiting the marketplace, and perhaps send samples and trial shipments. Review your marketing approach and options, and support industry promotions. Join the appropriate industry associations. Gain some understanding of language and communication requirements in your chosen market. Again, by working with an exporter you can tap into his or her knowledge and experience.

### A typical export path—this may take 7 days from start to finish.

Flowers leave farm for freight forwarder for export ↓  
Flowers arrive at freight forwarder's cool store ↓  
Forwarder inspects product, prepares documentation ↓  
Airfreight space arranged to destination ↓  
Flowers forwarded to airline terminal cool store ↓  
Flowers loaded onto plane and flown to destination ↓  
Flowers unloaded at destination airline terminal ↓  
Plant quarantine and customs clearance; fumigation if required ↓  
Flowers transferred to importer's cool store ↓  
Flowers prepared for auction and sold ↓  
Flowers transferred to flower wholesaler's cool stores ↓  
Flowers sold to florists and transported again ↓  
Flowers finally sold to end customers, who will expect the flowers to last another 5–7 days

## Major overseas markets

Over 50% of Australia's total flower exports are destined for markets in Japan, and up to 30% sell to North America (mostly the US). Other important markets are the Netherlands (11%) and Germany (3%).

Within the next 30 years, Asia will become the largest consumer market in the world. There is potential to expand into new Asian markets, the most significant being China, where a very small rise in per capita consumption will translate into large sales. However, China is rapidly developing its own flower industry to service both domestic and export customers.

### Japan

Japan remains the largest single market for Australian-grown flowers. Most flowers are distributed through the auction system, and recent changes mean that over the half the flowers are sold before auction. As the buyer is purchasing sight-unseen, reliable brands of flowers sell in preference to others. Sales by auction also mean that the sale price is not known until after the flowers are sold. Opportunities for Australian flowers rely on high-quality products, new products and high-value products. Various Australian native flowers and South African Proteaceae offer the best prospects for growth.

### United States

The USA is a large consumer market, and imports over half of the total floricultural products sold. While the market remains dominated by traditional flowers, there is a strong demand for high-quality Australian filler flowers such as waxflower. Other products like Christmas bush are developing their own niches in the US market. Demand for foliages is also increasing. However, there is growing competition from South American producers, who are planting more native Australian and South African species to export to North America.



## European Union

The EU includes many countries with a relatively high per capita consumption of cut flowers, and is believed to consume over half of the world's flowers. There is strong demand in Germany, the Netherlands, the UK, Switzerland, Italy and France.

Europe is a very competitive and quality-conscious market. Germany is the biggest and most influential market in the EU.

The UK is currently the second largest importer of flower products, and up to half of all flower sales are made through supermarkets and chain stores. Quality is critical, with increasing pressure on suppliers to pass strict audits. Vase life guarantees are becoming more common for supermarket flowers.

## NSW-based flower exporters

### Brushtop Farm

Contact: Ben McInnes  
PO Box 3108, Robertson NSW 2577  
Phone: 0412 822585; Fax: 02 4885 1998  
Email: [ben@brushtop.com.au](mailto:ben@brushtop.com.au)  
[www.brushtop.com.au](http://www.brushtop.com.au)

### GrandiFlora Growers Pty Ltd

Contact: Paul Dalley  
Trappaud Road, Kempsey NSW 2440  
Phone: 02 6562 7450; Mobile 0432 590 496  
Email: [info@grandifloragrowers.com.au](mailto:info@grandifloragrowers.com.au)  
[www.grandifloragrowers.com.au](http://www.grandifloragrowers.com.au)

### NFG Cooperative Ltd

(Golden Gecko brand)

Contact: David Mathieson  
Phone: 0417 448 667  
Email: [dmetho@bigpond.com](mailto:dmetho@bigpond.com)  
[www.goldengecko.com.au](http://www.goldengecko.com.au)

There are a number of flower exporters based interstate, some of whom source product grown in NSW. For more details, check with Wild-Flowers Australia Ltd—go to [www.wildflowersaustralia.com.au](http://www.wildflowersaustralia.com.au). WildFlowers Australia Ltd also actively promotes Australian-grown wildflowers to overseas buyers and arranges industry representation at overseas flower expos. Contact them for more information.

Any omissions are unintentional.

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# Chapter 10. Choosing a site for your plantation

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Ross Worrall, Bettina Gollnow, David Wood and Bill Yiasoumi

The site

Climate

Water

Many people enter the cut flower industry from an urban environment by purchasing a 'lifestyle' block close to their primary employment or by moving to a desirable area. The block is often purchased primarily for lifestyle reasons, after which the owner looks for a way of making it more productive. Unfortunately, few farms are selected because growers have sought the best land, suited to the crops they wish to grow and with an assured water supply.

There are many important issues to be weighed up when you are deciding where to buy land for your flower farm, and any one of them could be an overriding factor in making the land unsuitable. Examples of such factors are lack of sufficient good-quality water, remoteness from markets or labour supply, and climatic conditions that cause plants to become stressed and more susceptible to pests and diseases. Technology and investment (money and labour) can be used to overcome many of these impediments, but the process of overcoming them can have a dramatic effect on your profitability.

Remember that **the primary reason to grow flowers commercially is to make a profit**. All other factors are secondary. Experience has shown that if you take this approach your chances of success will be greatly improved. However, if you already own a block and find it

unsuitable for the optimum growth of wildflower crops, it may be cheaper to sell and buy again in a better location.

Before clearing land and building any structures, check whether you need permission or formal approvals from your local council and your relevant state authority (for example the NSW Office of Water, [www.water.nsw.gov.au](http://www.water.nsw.gov.au)). Council requirements vary from place to place. Some councils now require a development application for proposed horticultural activities, including the construction of dams.

## The site

Well drained soils are essential for almost all native Australian and South African species. A sloping site may not necessarily mean good drainage; for example, there may be underlying rock shelves that impede drainage. Many wildflower farms are located on sandy loam with a pH close to 6.0. Clay or saline soils or those with an extremely high or low pH are not suitable. Get a soil analysis done before you start, to check the suitability of the site for the species. Ask for an interpretation of the analysis. Also have the soil tested for nematodes.

## Old land

You need to find out about the fertiliser history of the soil. For instance, soil phosphorus levels less than 25 ppm are recommended for most wildflower crops. Some old farming land, such as old citrus orchards, has high residual levels of phosphorus. Weed control can be a problem if the site is infested with major weeds such as nut grass, capeweed, wild radish and wild turnip. Insects, such as cockchafer and black beetle, may carry over from the pasture and damage the new crop. Nematodes and soil-borne diseases such as *Armillaria* may also be a problem, having built up in previous crops (vegetables and citrus, for example).

## New land

Weed problems may be less severe initially on new land. However, there may be some regeneration of native vegetation and germination of weed seeds. Native insects, such as weevils, can attack the crop, particularly if the ground is not left fallow for any length of time. Rabbits, wombats and wallabies are often a problem, as are many birds (galahs, cockatoos, corellas and crimson rosellas, for instance). Many of these animals are protected species.

## Topography

You must have year-round vehicular access to the plantation. A gentle slope (less than 10%) is also desirable, allowing for the rapid but non-erosive runoff of surface water, thus reducing the risk of soilborne diseases. Design beds to allow water to run off without ponding behind them. In high-rainfall areas, or under high irrigation rates, ponding by raised beds can result in waterlogging. Ponding can concentrate runoff to the point where serious bed and crop damage can result. Ponded water can also be a source of waterborne plant diseases. Make erosion control a priority in handling your runoff. The whole farm should be designed to minimise erosion.

Be aware that a sloping site may not necessarily mean that drainage is good. In areas with recurring frosts, choose a slope to provide cold air drainage and plant near the top of the slope only. Elevated production areas can also be used to minimise frost. Adapting sprinkler

irrigation systems for frost control is not always a cost-effective option.

Steep slopes are impractical and dangerous for the movement of farm equipment, and make day-to-day operations such as planting and harvesting difficult. Apart from being an erosion risk, a steep slope can also cause problems with irrigation uniformity. The design of the irrigation system should take into account the slope of the land. Depending on aspect, plants on a steep slope may also be more exposed to wind and the damage it can cause.

## Aspect

Aim for a north to north-east aspect in full sun.

## Climate

For most wildflower species, the effects of climate and location on growth and flowering are poorly defined. There are differences in flowering time between locations, presumably because of variations in temperature and day length between them. Some crops come into flower earlier, while others flower later. Research local temperature records to assess maximum and minimum temperatures through the year, as well as the frequency, severity and duration of frosts. Start with the Bureau of Meteorology ([www.bom.gov.au](http://www.bom.gov.au)), but be aware that the reported minimum temperatures are often screen temperatures, and the ground temperature can be up to 2.5 °C lower. You may have to conduct your own trials or seek additional advice to fine-tune what you can grow.

Many species will not tolerate frosts more severe than -4 °C. In some winters, many Christmas bush plantations can suffer major losses due to frost even if they are located close to the coast. Assess long-term temperature data for the area. Avoid establishing plantations in frost hollows, and be prepared to seek advice and do your own trials to define suitable species if you are in a frost-prone area. Frost may also damage young plants and winter-flowering species. Frost damage to some banksias and wax flowers will make them unsaleable. Frost, temperatures below -0.5 °C and strong, cold winds can cause

misshapen kangaroo paw flowers or can wilt and kill them. Some species are more susceptible to frost damage during flowering.

Your plants will be more prone to various fungal diseases such as root rot, grey mould (*Botrytis*) and powdery mildew if you are in a high-rainfall area. While you can usually manage these with fungicides, this increases your time and financial inputs. Most WA species will not thrive in the high-summer-rainfall areas along the east coast. Similarly, east coast species may be unsuitable for areas with a drier climate or predominantly winter rainfall.

Adverse climate will severely affect the development of any flower plantation. Temperature extremes, unsuitable rainfall patterns, frost, hail and strong wind can cause major problems. You can minimise some of these risks through good site selection, good design and layout, adequate water resources and shelter. The best way to avoid frost losses is to choose frost-free land to plant, because active frost protection methods are expensive and may not always work. While some people see technology such as hail netting and frost protection as the solution to adverse conditions, you should assess whether or not these will be cost effective.



**Do your homework to decide which locations on your property are most suited to wildflower growing.**

## Water

Irrigation is essential on a commercial flower farm. However, the irrigation needs of many wildflower crops are unknown, as there has been limited research. You need to investigate

local rainfall amounts and patterns. If records show possible dry periods in autumn or spring, you may need to irrigate over an extended period. More information on irrigation can be found in Chapters 12 and 13.

## Water usage and storage

Irrigation, using good-quality water, is essential to obtaining plant growth that provides high yields of good-quality flowers with good stem length and minimal defects. The water supply for the plantation can come from a dam, a river, a bore, the town water supply, a rainwater tank or even recycling. Whatever the source, it must be sufficient to deliver the required amount when needed. Future expansion and increased water needs must be taken into account when estimating your water requirements.

Total household water use (including bath, toilet, washing machine and dishwasher) for two people is estimated to be approximately 525 L/day, or about 190 000 L/year. This almost doubles for four people. A typical garden and lawn will add about 500 L/day, and when used for 250 days during an average year will add 125 000 L. This will give you an idea of how much water you need to have available just for the basics.

## Irrigation requirements

Different crops, soil types and climatic conditions will create different water usage patterns. As a rough guide to your irrigation requirements you could multiply the number of irrigation emitters by their discharge rates and the duration of watering. For example, irrigation emitters such as drippers are available with discharge rates from less than 1 L to more than 12 L per hour, and micro-sprays are available with discharge rates between 20 and 400 L per hour. Multiply this by the number of emitters you intend to have to get an idea of your potential irrigation requirements. Bear in mind that some bigger plants may require up to four emitters per plant. Flower growers with 3 to 4 ha of crop can go through 1.5 to 2 million L each summer, and that is using water-efficient drippers. Typical horticultural overhead spray irrigation could require more than twice this amount for the same area.

When you are estimating water requirements, remember to include the water you will need to

fill the buckets to hold flowers before dispatch to the market. This must be of good quality. You might need to collect rainwater in a tank or use town water for this purpose.

### Collection area and storage capacity

You will be able to collect about 1 L of water for every millimetre of rainfall per square metre of roof area. For example, if you have 100 m<sup>2</sup> of roof area and the average annual rainfall is 600 millimetres you will be able to collect about 60 000 L in an average rainfall year. However, unless you have huge roof areas and tanks to suit, this may not be a reliable way of providing secure water for anything other than household and garden use. If grey water is recycled then this will allow more security, but long droughts may still cause shortages. For a flower plantation of a half hectare and over, you'll require a separate secure source of water if you are serious about your enterprise.

The potential yield of dam catchments is variable. The amount of runoff that will end up in your dam depends on the nature of the catchment surface, the slope of the land, rainfall intensities, catchment size and the amount of rainfall that actually falls.

As a very rough first cut, you could assume that 15% of the average annual rainfall ends up as runoff. For example, we could assume that a dam with a 1-ha (10 000 m<sup>2</sup>) catchment in an area with an average annual rainfall of 600 mm would collect about 900 000 L ( $0.15 \times 10\,000 \times 600$ ) of water in an average rainfall year.

### Rivers, creeks, dams, tanks and bores

Rivers are still the most viable source of water if your land is close to a suitable one, that is if there is water to be allocated and if you can get a licence. Consult your local state water authority at an early stage about these issues.

Creeks by their nature are mostly intermittent, so just when you want the water the most, it may not be there in the quantity you need. There also may be licensing problems for anything other than domestic use.



**A recommended plantation design, showing wide mown strips beside neat raised beds giving plenty of room for machinery. The raised beds are covered with weed mat to hold the soil and keep weeds at bay (this crop is fertigated). Regular mowing ensures that there are no weeds flowering. Any runoff is captured by the dam at the lowest point of the planted area.**

Dams are generally the next best source of secure water, but only if they are appropriately located, big enough and deep enough. A 2- to 3-megalitre<sup>5</sup> dam may be big enough for a 1- to 2-ha plantation depending on its refill rate and other factors. If you are fortunate to have a large dam on your block already, this could save you a lot of problems. If you have a good dam site, be aware that its size could be limited by regulations. For instance, in NSW, your dam can contain a volume equivalent to your 'harvestable right' without the need for a licence. Over this size you will need a licence from the NSW Office of Water. Locate your dams and storage tanks where they will maximise the catchment area, take advantage of the topography and minimise costs. In many cases, you may need to seek expert advice from an engineer, surveyor or earthmover experienced in water-harvesting structures.

Town water can be a viable alternative to other water sources. Apart from the cost of town water, you should check with the supply authority whether there are any restrictions on its use for commercial flower growing and whether there are any problems with supply such as very low pressures. The use of a balancing storage such as a tank equipped with a pump is recommended if you are considering town water use. This will overcome inadequate pressure or

<sup>5</sup> One megalitre (1 million L) is about one Olympic-sized swimming pool.



flow rates direct from the mains.

When planning your growing areas, avoid channelling any runoff from production areas straight into the same dam you are using for irrigation, as disease problems may arise. Alternatively, set up facilities to disinfect water before reuse.

Neighbours may have to be consulted about any potential changes to water flows, and engineering plans may have to be prepared. Note that a special through-the-wall drainage pipe should be installed if the dam receives a constant inflow from a spring or is located on a watercourse. This pipes the constant inflows past the top of the dam, avoiding damage to the spillway. Spillways should be kept well grassed to minimise erosion during flooding.

Bores can be a useful source of secure water if you have the right aquifers beneath your land. They are costly to drill and there are no guarantees that you will find good quality water. If you strike adequate quantities of water, it may have to be cased and tested for flow rate and quality. Then it has to be fitted with a special bore pump. Electricity is the most convenient source of power, but can be the most expensive to install. Regulations apply to the sinking of bores, so remember to consult the relevant authority in your state. In NSW you will need to contact the NSW Office of Water ([www.water.nsw.gov.au](http://www.water.nsw.gov.au)).

### Legal requirements

Because of increasing environmental concerns, state governments have brought in a number of new restrictive laws governing a range of water issues. Consult the relevant department for advice (in NSW it is the NSW Office of Water, [www.water.nsw.gov.au](http://www.water.nsw.gov.au)).

### Water recycling

The type of water use, the cost of water and its natural availability generally dictate how much recycling actually happens. For field horticulture conditions, in good loamy soils, water recycling is not an issue if you are applying the correct amount of water to your crop, as there should be minimal or no runoff from irrigation. The critical issues for growers tend to be effective water use and water harvesting.

The other gross user of water is the average household, and much of our domestic water can

be recycled effectively if it is appropriately treated. While this is environmentally responsible, it will probably have little financial benefit on your enterprise.

### Rainfall pattern and climate data

Historical climate data is available from the Bureau of Meteorology ([www.bom.gov.au](http://www.bom.gov.au)). Local residents with a farming background can be another good source of anecdotal evidence. It pays to ask around, as there may be significant district variations in climate, including extremes of temperatures and rainfall patterns.

### Water quality

It is vital to have your water tested for salinity, pH and all ions likely to be a problem, such as phosphates, iron, sodium, chloride, boron, bicarbonate and calcium, before establishing any crop. The quality of bore or river water, even in high-rainfall areas, can be very variable. Some sources may not be suitable for irrigation. If you test your water only once a year, do it at the end of summer, when water quality is generally at its poorest. Guidelines are available from most water testers. Crop failure is very expensive when compared with the cost of testing the water.

Salinity in particular can have a wide range of adverse effects on plant growth. By the time visible symptoms occur it is generally too late, and growth will have already been greatly reduced. Other effects that may not be immediately apparent include a reduction in flower quality (especially vase life) and increased susceptibility to disease and insect attack. The effect of salinity will also depend on climate, soil type and management practices.

The electrical conductivity (EC) of irrigation water should be below 0.75 dS/m. Water salinity is difficult to deal with, but its effects can be minimised by using micro-irrigation systems. Salt can be removed from water by reverse osmosis, but this is expensive and yields only low volumes of usable water.

Soluble iron can be present naturally in many water sources, particularly groundwater and farm dams. High levels of iron can stain spray-irrigated crops or block pipes and sprinklers. The water can be treated by aeration.

Similarly, algae can block micro-irrigation sys-



tems and filters. Algae are stimulated to grow by sunlight and high levels of nutrients. The best way to minimise the problem is to stop nutrients from entering the water supply. Nutrient sources include septic tank seepage and runoff from fertilised beds or livestock sheds. Algae in water can be treated with algicides.

As with iron in the water, turbidity or murkiness in the water, caused by fine suspended clay particles, can stain plants and block irrigation systems. Chemical treatment can settle out the clay, making the water clear. Farm dam turbidity can be reduced by grassing the catchment areas.

Water used for irrigation from creeks or dams that collect from farming areas may be a source of disease-causing organisms such as *Pythium*, *Phytophthora*, *Fusarium* and *Rhizoctonia*, which can be a problem for many wildflower crops. This water may need to be treated to minimise disease spread. Bore water is generally considered to be free of plant pathogens but may have a high salt content. Chlorinated town water is generally suitable without further treatment, but access for horticultural production may be restricted in the future.

Detailed information about water quality and treatment can be found via your state department of agriculture or primary industries, for example in the Water and Irrigation section at [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au).

## Water testing

Water analysis can be arranged through various private and government analytical laboratories (see Chapter 16 for details). When sending off a sample for testing, make sure you are specific about your intended uses of the water.

## Water treatment

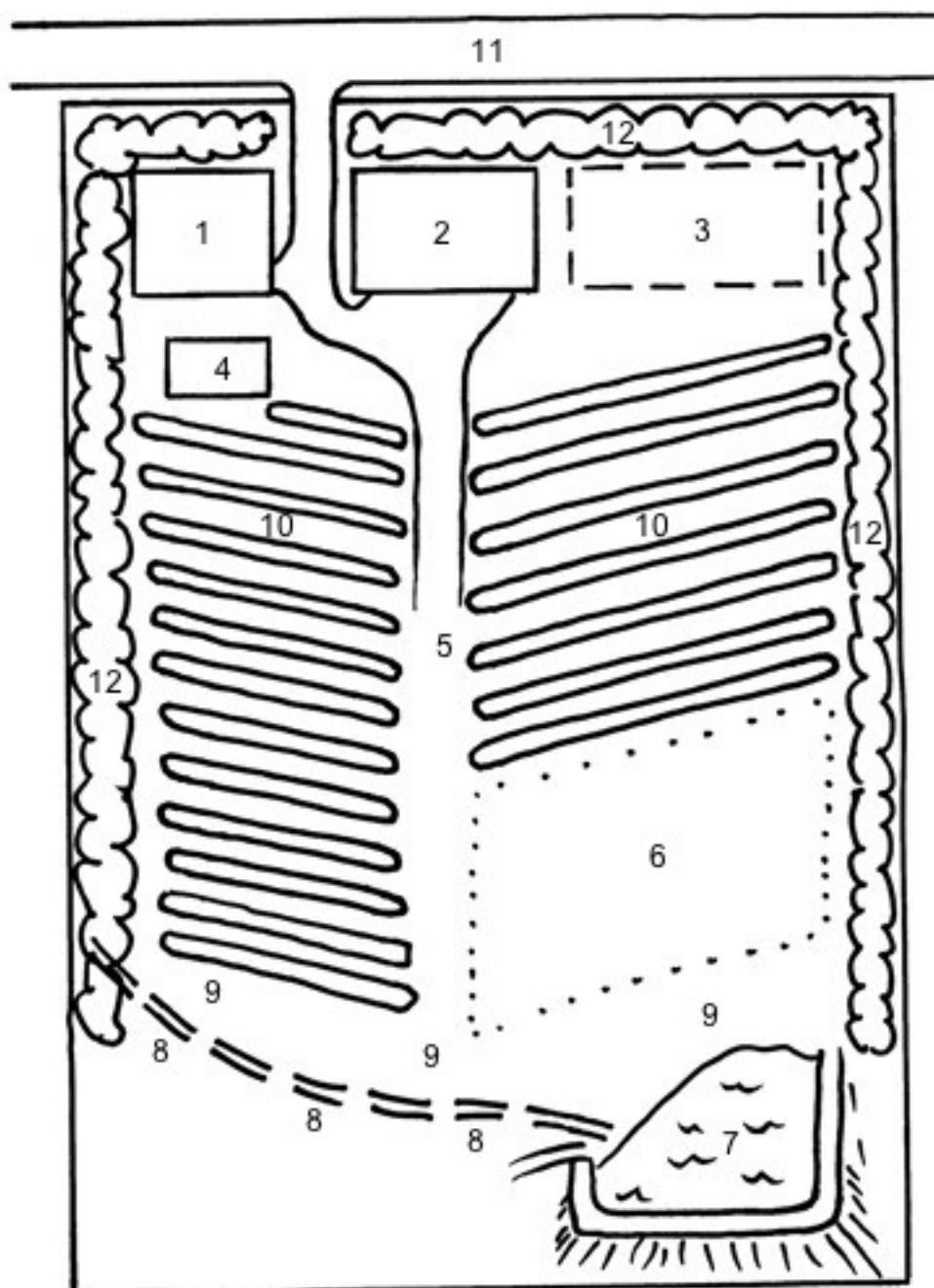
Although it is possible to treat most types of water for virtually any use, the economics are such that treatment is generally only an option for the high-value uses, such as for human consumption. Don't rely on this option for any large-scale horticultural use, unless it is a very minor and cheap intervention.

## Soil water-holding capacity

It is vital to understand the behaviour of water in the soil and the plants' moisture requirements if you are to manage this scarce resource effectively. Different soils and crops will react quite differently to water, and it is economically and environmentally sensible to know how to fine-tune your water use to your actual crop water requirements.

To learn more about soil–water relationships, check with your state department of agriculture or primary industries to see whether relevant training courses are offered (in NSW go to [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au) for information about PROfarm training).

**A simplified flower farm layout.**



**1** Owner's house

**2** Shed, processing area and cool room

**3** Trial plot area

**4** Protected growing on area

**5** Central laneway (grassed)

**6** Fallowed land or future plantings

**7** Dam at lowest point

**8** Swale\* to direct runoff into dam

**9** Grassed area to filter water

**10** Planted rows

**11** Main road

**12** Windbreaks and buffer zones

\*Swales are flat-bottomed ditches with a small bank on the downhill side to catch surface runoff water. A swale is generally formed on the contour but has a very gradual fall built in and is designed to catch and slow down water flows for use by vegetation growing in the swale or bank, or to direct water into safe dispersal areas or dams.

(Diagram reprinted from Native Flower Growers Starter Kit, Sapphire Coast Producers Association, 2002.)

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# Chapter 11. Sourcing plants and seeds

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**Bettina Gollnow**

Ordering your plants

Before you plant

Commercial suppliers of plants and seeds

Seed merchants

Many sought-after wildflower species are difficult or slow to propagate and may not be available in commercial quantities from nurseries. Where possible, buy plants grown as cuttings or grafts from superior stock plants to reduce the variability present in seed-grown plants. The cost of plants will also depend on the propagation technique. You may need to place an advance order for the next season. Allow plenty of time to source your plants. Note that you may not legally propagate from plants carrying a patent or Plant Breeders' Rights protection.

## Ordering your plants

Information on how to locate specialist propagators is given later in this chapter. Propagators may also provide cultural information and advice on suitable varieties for your area.

Start with the right planting material—high-quality plants or seed that are true to type and healthy. If possible, buy improved cultivars with proven demand in the cut flower trade. These will have mainly been propagated from cuttings. To produce good-quality plants requires skill and specialised propagation facilities—it is often

false economy to aim to do it yourself. Starting a plantation with plants of uniform age, size and quality is more likely to result in productive crops which are easier to manage and market. If possible, buy plants from an accredited nursery—these nurseries have reached the standards set by the Nursery Industry Accreditation Scheme Australia.

Most nurseries will need several months' notice to prepare a bulk order of plants. Tissue cultured plants may take longer, depending on the species. Prepare a written copy of the order and insist on a firm date for delivery.

Try to visit the nursery and look around before you buy. If possible, talk to existing customers. Buy only good-quality stock—your future success depends on it. Ask whether the nursery guarantees the plants to be free of soil disease and to be true to type.

## Before you plant

Set up a holding area for new plants. Make sure it is well drained and preferably has raised benches, since the most serious diseases are waterborne. As a matter of course, water the

plants on arrival and treat pots with an appropriate insecticide or fungicide before planting.

Aim to have your beds ready before the plants arrive. Leaving them in pots while you get organised may result in problems such as root twisting or pest or disease infestation.

When the plants arrive, check them carefully. Make sure of the following points:

- Each species is correctly labelled.
- There is no disease or sign of insects.
- Plants have healthy root development without being root bound. This is important in the long term, since root-bound plants may never be productive and could die unexpectedly some years after planting. Most nurseries supply plants in 5-cm tubes: plants left for too long in tubes can quickly become root bound.
- Major roots have not been bent or damaged during potting.
- None of the plants are sick or dying. Remove any plants that appear unhealthy and have them tested for soil disease by a diagnostic laboratory. **Do not** plant the remainder until you have eliminated the possibility of disease.

If there are any problems, ring the nursery immediately.

Even if plant material is free of disease on arrival, it can easily become contaminated. Do not leave trays or pots on the ground where people, vehicles or animals are moving about.



**Starting a plantation with plants of uniform age, size and quality is more likely to result in productive crops that are easier to manage and market.**

## Commercial suppliers of plants and seeds

Locating nurseries that can supply the commercial cut flower industry is not easy, as no specific directories are published. Contact your state Nursery and Garden Industry Association (NGIA)—details and links are provided at [www.ngia.com.au](http://www.ngia.com.au). Several state associations have a website that includes a list of members; for example, NSW ([www.ngina.com.au](http://www.ngina.com.au)) and Queensland ([www.ngiq.asn.au](http://www.ngiq.asn.au)).

The NGIA also publishes an annual trade register which lists registered nurseries Australia-wide and the species they sell.

Check your local Yellow Pages and *Flower Register Australia*, published annually by Rural Press Magazines. See also the various gardening magazines and industry publications like *Australian Horticulture*, *Australasian Flowers* and *Australian Flower Industry Magazine* for other suppliers.

The website of the Australian Native Plants Society (Australia) includes a list of plant nurseries and seed suppliers ([anpsa.org.au](http://anpsa.org.au)). Other websites may also assist in locating plant suppliers; for example, [www.plant.id.au](http://www.plant.id.au), [www.nurseriesonline.com.au](http://www.nurseriesonline.com.au), the Australian Nursery Register ([www.ausreg.com.au](http://www.ausreg.com.au)) and [www.hotfrog.com.au](http://www.hotfrog.com.au).

Some commercial suppliers of planting stock of commonly grown species are listed below. Check directly with each nursery about their current stock range, which may vary from what is listed below. (Inclusion in these lists does not imply endorsement or recommendation, and any exclusion is not intentional.)

Many nurseries will also undertake contract growing for you. This may include genera other than those listed here.

### **Ausflora Pacific**

(wide range of South African Proteaceae, *Actinotus*, *Lophomyrtus*, riceflower, thryptomene, waratahs)

PO Box 72, Gembrook Vic 3783

Phone: 03 5968 1650; Fax: 03 5968 1676

[www.ausflorapacific.com.au](http://www.ausflorapacific.com.au)

### **Ausplant Nursery**

(*Adenanthos*, *Ceratopetalum*, *Chamelaucium*, *Eriostemon*, *Eucalyptus*, *Grevillea*, *Ozothamnus*, *Ptilotus*, *Thryptomene*)

PO Box 766, Dalby Qld 4405

Phone: 07 4662 4934; Fax: 07 4662 5611

[www.ausplantnursery.com.au](http://www.ausplantnursery.com.au)

### **Australian Plant Specialists Pty Ltd**

(*Adenanthos*, *Anigozanthos*, *Backhousia*, *Banksia plagiocarpa*, *Blandfordia grandiflora*, *Buckinghamia*, *Ceratopetalum*, *Doryanthes excelsa*, *Grevillea*, *Leptospermum*, *Macropidia*, *Persoonia*, *Phebalium*, *Ricinocarpos*, *Stenanthemum*, *Stenocarpus*, *Teloepa*)

PO Box 150, Palmwoods Qld 4555

Phone: 07 5442 3045; Fax: 07 5442 3045

[www.australianplantspecialists.com.au](http://www.australianplantspecialists.com.au)

### **Brimstone Waratahs**

(waratah selections grown to order)

Email: [info@brimstonewaratahs.com.au](mailto:info@brimstonewaratahs.com.au)

[www.brimstonewaratahs.com.au](http://www.brimstonewaratahs.com.au)

### **Bushgrafts**

(grafted plants—*Darwinia*, *Eremophila*, *Hakea*, *Swainsona*, *Verticordia*)

35 Coolamon Cl, Ocean Grove Vic 3226

Phone: 03 5255 1853

### **Bywong Nursery**

(*Grevillea*, *Leptospermum*)

159 Millyn Rd, Bywong NSW 2621

Phone: 02 6236 9280; Fax: 02 6236 9429

[www.bywongnursery.com.au](http://www.bywongnursery.com.au)

### **Eastwood Nurseries Pty Ltd**

(*Eucalyptus*)

91 Pemberton's Hill Rd, Mangrove Mountain NSW 2250

Phone: 02 4374 1399; Fax: 02 4374 1699

[eastwoodnurseries.com.au](http://eastwoodnurseries.com.au)

### **Harvest Seeds and Native Plants**

(shrubs, grasses, sedges, rushes and wildflowers, especially those of Sydney and surrounds)

Lot 22, Mona Vale Rd, Terrey Hills NSW 2084

Phone: 02 9450 2699; Fax: 02 9450 2750

[www.harvestseeds-nativeplants.com.au](http://www.harvestseeds-nativeplants.com.au)

### **Larkman Nurseries Pty Ltd**

(*Acacia*, *Anigozanthos*, *Astartea*, *Baeckea*, *Banksia*, *Boronia*, *Ceratopetalum*, *Chamelaucium*, *Chrysocephalum*, *Craspedia*, *Crowea*, *Eriostemon*, *Eucalyptus*, *Grevillea*, *Helichrysum*, *Leptospermum*, *Pimelea*, *Rhodanthe*)

PO Box 567, Lilydale Vic 3140

Phone: 03 9735 3831; Fax: 03 9739 6370

[www.larkmannurseries.com.au](http://www.larkmannurseries.com.au)

### **Mountain Nursery**

Trappaud Road, Kempsey NSW 2440

Phone: 02 6562 7450; Fax: 02 6563 1389

[www.mountainnursery.com.au](http://www.mountainnursery.com.au)

### **Martindale Proteas**

(wide range of South African Proteaceae, *Banksia*, *Teloepa*)

65 South Bank Rd, Bunyip Vic 3815

Phone: 03 5629 5339; Fax: 03 5629 5771

### **Primary Plants**

(*Anigozanthos*, *Backhousia*, *Ceratopetalum*, *Grevillea*, *Leptospermum*)

PO Box 4133, Loganholme MDC Qld 4129

Phone: 07 3287 6139; Fax: 07 3287 6646

[www.primaryplants.com](http://www.primaryplants.com)

### **Proteafloa Nursery Pty Ltd**

(wide range of South African Proteaceae, *Banksia*, *Dryandra*, *Teloepa*)

PO Box 252, Monbulk Vic 3793

Phone: 03 9756 7233; Fax: 03 9756 6948

[www.protea.com.au](http://www.protea.com.au)

### **Ramm Botanicals Pty Ltd**

(*Anigozanthos*)

30 Pacific Highway, Tuggerah NSW 2259

Phone: 02 4351 2099; Fax: 02 4353 1875

[www.ramm.com.au](http://www.ramm.com.au)

### **Redlands Nursery Pty Ltd**

(*Bracteantha*, grafted *Chamelaucium*, *Leptospermum*)

905–907 German Church Rd, Redland Bay Qld 4165

Phone: 07 3206 7611; Fax: 07 3206 7502

[www.redlandsnursery.com.au](http://www.redlandsnursery.com.au)

### **Tarrawood Native Nursery**

(a wide range of Australian natives suitable for cut flowers, including superior selections and specialising in grafted plants: contact nursery for a current stock list)

PO Box 683, Bega NSW 2550

Phone: 02 6494 1850; Fax: 02 6494 5663

[www.tarrawood.com.au](http://www.tarrawood.com.au)

### **The Australian Botanic Garden Mount Annan Nursery**

(*Actinotus* 'Starbright')

Mt Annan Drive, Mount Annan NSW 2567

Phone: 02 4634 7917; Fax: 02 4647 6035

### **Vaughan's Australian Plants**

(grafted *Boronia*, *Chamelaucium*, *Geleznowia*, *Verticordia* and other usual species grafts)

1060 Portarlington Rd, Curlewis Vic 3222

Phone/fax: 03 5250 5592

### **VitroFlora Pty Ltd**

(plant tissue culture, contract deflasking, contract propagation)

PO Box 150, Palmwoods Qld 4555

Phone: 07 5442 3046; Fax: 07 5442 3191

[www.vitroflora.com.au](http://www.vitroflora.com.au)

### **Western Flora**

(*Boronia*, *Chamelaucium*, *Darwinia*, *Grevillea*, *Hemiandra*, *Hypocalymma*, *Thryptomene*)

PO Box 88, Coorow WA 6515

Phone: 08 9952 5040; Fax: 08 9952 5053

### **Wildtech Nursery Pty Ltd**

(*Acacia*, *Actinotus*, *Adenanthos*, *Agonis*, *Anigozanthos*, *Astartea*, *Baeckea*, *Banksia*, *Beaufortia*, *Boronia*, *Ceratopetalum*, *Chamelaucium*, *Conospermum*, *Conostylis*, *Crowea*, *Diplolaena*, *Doryanthes*, *Dryandra*, *Eremophila*, *Eriostemon*, *Grevillea*, *Guichenotia*, *Hypocalymma*, *Isopogon*, *Ixodia*, *Kunzea*, *Leptospermum*, *Macropidia*, *Ozothamnus*, *Petrophile*, *Phebalium*, *Philotheca*, *Pimelea*, *Ptilotus*, *Regelia*, *Scholtzia*, *Stenanthemum*, *Telopea*, *Thryptomene*, *Verticordia*)

Licola Rd, Glenmaggie Vic 3858

Phone: 03 5148 0317; Fax: 03 5148 0277

[www.wildtechnursery.com.au](http://www.wildtechnursery.com.au)

### **Wholesale Ornamental Nurserymen**

(*Grevillea*)

Phone: 07 3823 1881; Fax: 07 3823 1801

[www.wons.com.au](http://www.wons.com.au)

### **WildGems Native Plants**

(*Banksia*, *Boronia*, *Telopea*)

PO Box 5089, Cobargo NSW 2550

Phone/fax: 02 6493 7398; Mobile 0427 937 398

## **Seed merchants**

### **AustraHort Pty Ltd**

PO Box 595, Cleveland Qld 4163

Phone: 07 3821 0745; Fax: 07 3821 0746

[www.austrahort.com.au](http://www.austrahort.com.au)

### **Australian Wildflower Seeds Pty Ltd**

PO Box 3139, Carlisle South WA 6101

Phone: 08 9470 6996; Fax: 08 9470 6999

### **Harvest Seeds and Native Plants**

Lot 22, Mona Vale Rd, Terrey Hills NSW 2084

Phone: 02 9450 2699; Fax: 02 9450 2750

[www.harvestseeds-nativeplants.com.au](http://www.harvestseeds-nativeplants.com.au)

### **H.G. Kershaw Australian Native Seeds**

39/1–5 Thew Pde, Dee Why NSW 2099

Phone: 02 9984 7226; Fax: 02 9984 7575

### **Merrywood Seeds and Plants**

PO Box 3022, North Nowra NSW 2541

Phone/fax: 02 4421 0731

[www.goozeffseeds.com](http://www.goozeffseeds.com)

### **Royston Petrie Seeds Pty Ltd**

PO Box 1152, Mudgee NSW 2840

Phone: 02 6372 7800; Fax: 02 6372 7077

[www.roystonpetrieseeds.com.au](http://www.roystonpetrieseeds.com.au)

## **WA wildflower seed companies**

### **Nindethana Seed Service Pty Ltd**

PO Box 2121, Albany WA 6331

Phone: 08 9844 3533; Fax: 08 9844 3573

[www.nindethana.net.au](http://www.nindethana.net.au)

### **Vaughan's Wildflower Seeds**

RMB 642, Donnybrook WA 6239

Phone: 08 97321152; Fax: 08 9732197

### **WA Wildflower Seed Company**

PO Box 804, Canning Bridge WA 6153

Phone: 08 9313 3090; Fax: 08 9313 3091



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# Chapter 12. Setting up your plantation

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Ross Worrall, David Wood, Bettina Gollnow and Bill Yiasoumi

Ground preparation

Bed layout   Preparing the beds

Irrigation   Before you plant   Planting out

Establishment phase   Growing on

Light   Screening, windbreaks and plant support

Weed management   Trial area

## Ground preparation

### Weed control

Aim to remove all existing weeds before planting, usually through a combination of cultivation and herbicides. Cultivate the soil and leave it fallow for a time, allowing any remaining weed seeds to germinate, then remove these. You will find a wide range of information on weed management via your local department of agriculture or primary industries (for example, NSW DPI: [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)).

### Green manure

Plant a green manure crop (e.g. field peas, lupin, clover, oats) one season before preparing your plantation. Plough it in before it sets seed and it will improve soil structure by adding organic matter and help to reduce soil erosion.

### Weed matting

For perennial crops, covering the beds with

weed mat or mulch before planting may be the answer for long-term weed control, and it protects against soil erosion in the meantime.

### Fumigation

You could disinfest your soil by fumigation before you plant, especially if a preliminary soil test reveals nematodes, if the soil has been cropped previously, or if you have particularly persistent weeds. This is usually expensive, requiring licensed operators and hazardous chemicals.

### Control soil erosion

You will avoid excessive soil disturbance and movement by not cultivating between the rows. At planting, cultivate or use herbicides in strips, rather than exposing the soil over the whole area. Alternatively, plant into weed mat or mulch so that the soil next to plants is covered. Sowing an annual crop, such as oats mixed with field peas or clover (for winter) or millet (for summer) between the rows, will bind the soil. It also provides short-term wind protection for young

plants. Take care, as some annual crops attract birds that may damage your plants. Avoid planting on steep slopes.

## Ripping and mounding

A well drained soil is essential for good root growth and to minimise the potential for the development of root diseases, which are a common cause of death in wildflower crops. As a general principle, deep ripping to aerate the soil and break up any compaction is useful before making beds and planting. Contractors with bulldozers that have a ripping and mounding implement can do this in one pass. If the soil is hard and cloddy, then it will need some form of ploughing or rotary hoeing to prepare it properly for planting out. Restrict any disturbance to the ground to be used for the beds. This is always difficult with bulldozers, as every time they turn, the tracks disturb up a large area of topsoil.



Deep ripping before forming beds aerates the soil and breaks up any compacted areas.

## Bed layout

### Bed dimensions

Hilling or mounding may not be necessary in deep, porous soils where the drainage of the topsoil is rapid, and is not recommended in very light soils. In general, however, beds are raised to help with drainage and to give relief from periods of extended heavy rain or high water tables. Higher mounds often give better growth because of improved aeration in the root zone, but these tend to dry out more. If you can get a bulldozer with the right attachment, this may all be done in one pass with minimum compaction. If a tractor is doing the job, make sure it does

not drive over and compact the bed area as it does each pass.

The height and width of the mound or bed will vary with the crop. For example, for Christmas bush, beds are usually formed 1 m wide at the base and raised 20 to 70 cm at the centre.

### Row layout

Row layout is affected by the shape of the land, the slope, boundaries and access. Often rows are best oriented somewhere between the contour and downhill. Doing this prevents water from being trapped on the high side, but rows should not be so steep as to cause erosion. Rows are best broken by crossroads every 50 m or so to allow better access. Where possible, leave grassed headlands and undisturbed grassed strips between beds.



Raised beds ready for planting—note the space left between beds to allow later crop maintenance and harvest operations.

### Row spacing

The space between rows should allow for vehicle access for pruning, spraying, mowing and harvesting, keeping the final size of the plants in mind. For perennial crops like waratahs and Christmas bush, the rows are generally spaced 3.5 to 4 m apart, with plants within the row every 2 m. It may be preferable to determine the space between rows to suit the size of any existing equipment, rather than purchasing new, expensive machinery to fit a particular layout. As a guide, a 4-wheel motorbike will need 1.5 m between the rows, while a tractor may need 2.0 to 2.4 m.

Leave enough room for turning with trailers at the end of each row, and **do not** mound across

gullies or natural waterways. While the bulldozer is on site, establish cut-off drains above the beds to prevent off-site runoff into the beds.

## Preparing the beds

Mulching is not a substitute for soil preparation. The soil for your beds should be free of rocks, sticks and hard clods.

The beds can then be formed. Beds are generally formed to ensure better drainage, unless you are planting into light sandy soils. For other soil types, you can use a bed former and then firm down or compact the tops of the beds to prevent slumping after planting. Alternatively, you can use a disc or mouldboard plough (running in opposite directions) to make the beds, and then firm down the top with a roller.

Ensure that the beds are wide enough to accommodate the root zone of the crop when the plants are mature—avoid very narrow beds, which are hard to maintain and which tend to expose the root zone to greater temperature fluctuations and disturbance.

## Plant spacing

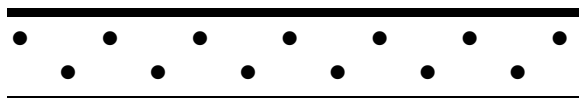
The spacing of the plants within the rows is generally based on:

- the size of the fully grown plant
- the amount of airflow required
- access for picking.

Most species are spaced centrally along the rows:



If space is at a premium, the plants can be staggered:



Some indicative spacings to consider:

Acacias	2–3 m
Boronias	700–750 mm
<i>Eremophila</i>	750–800 mm
Hakeas	1–1.5 m
<i>Ixodia</i>	400 mm

*Micromyrtus* 400 mm

Waratahs 2–3 m apart

Plants such as kangaroo paws are suitable for staggered growing, giving a higher ratio of production to aisle space and therefore higher returns per hectare. Smaller plants should be spaced about 30 to 60 cm apart in rows 30 to 60 cm apart. This spacing gives good mutual support against wind damage. Double spacing (every 1 m) for a larger plant such as waratah or Christmas bush may give higher returns early in the life of the plantation but introduces later problems, such as:

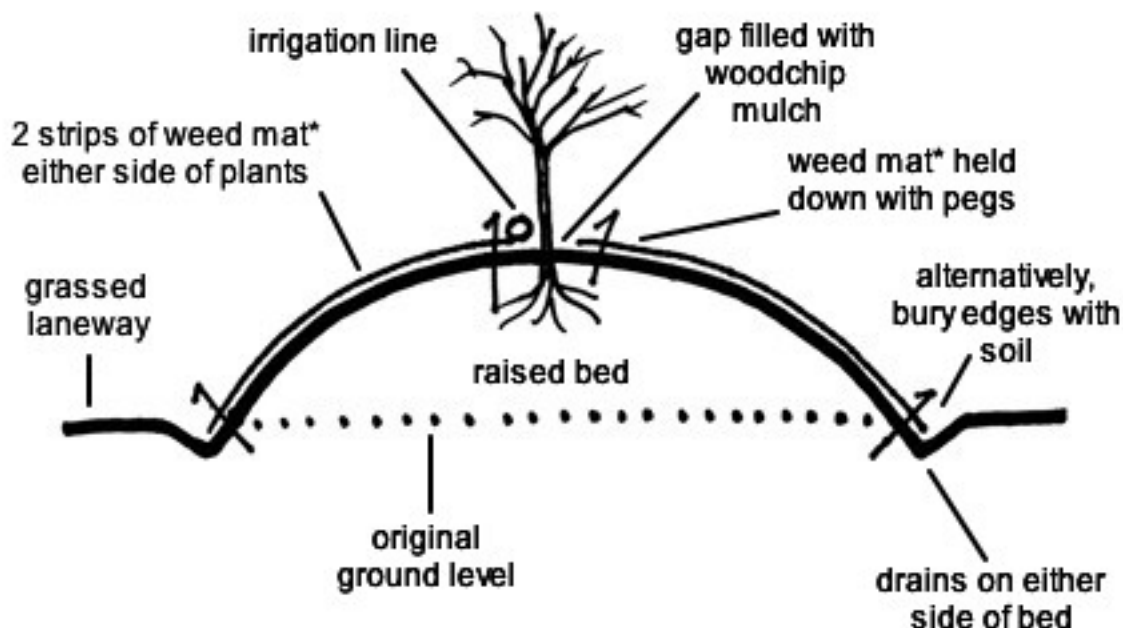
- shading, which can reduce flower quality and overall yield per plant
- practical difficulties with maintenance (spray penetration, pruning, weed control)
- difficulty at harvesting—a worker will have a problem reaching more than 60 cm into a crop to cut and remove the stems without causing damage; the greater the distance that workers must stretch, the less efficient their efforts and the more costly the labour
- increased root contact, giving greater competition for water and nutrients as well as increased risk of disease transfer.

However, closer planting along a row can be used to maximise returns in the first 5 or 6 years while plants are still small, and then every second plant can be removed when shading becomes a problem. Initial double spacing will require allowance for the extra irrigation outlets.



Young kangaroo paw plants have been planted in a zigzag pattern.

### Cross-section of a raised bed set up as described.



\* There are advantages and disadvantages to using weed mat—see page 105.

## Fencing

A 2-barbed-, 3-plain-wire fence with 105-cm rabbit netting is the standard minimum fence for a plantation. If you can get a contractor who drives in the posts rather than digs and sets them, and you don't stint on the size of the round posts, you will probably get a better job. The netting can be trenched or folded to stop rabbits from digging under it. Folding is easier, but the netting must be pegged down to stop rabbits pushing their way under. Eventually the grass will grow through it and anchor it. This is a costly fence to construct, and gates are extra.

This type of fence will keep out cattle, sheep and rabbits, but kangaroos and goats will go over the top and wombats will go through it. Electrified wires placed at strategic heights on outriggers may help, but there can be a high maintenance cost.

Ideally a fence should not cross a watercourse of any type, and any fence needs to be accessible from both sides for slashing, maintenance and fire protection. If you are in a fire-prone area, consider the use of heavy-gauge wire instead of the cheaper and lighter high-tensile product.

Contact your local Livestock Health and Pest Authorities (formerly the Rural Lands Protection Board) for further advice ([www.lhpa.org.au](http://www.lhpa.org.au)). Look for more information on fencing on your state department of agriculture or primary industries website; e.g. [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au) (search for PROfarm courses) or [www.tocal.nsw.edu.au/publications](http://www.tocal.nsw.edu.au/publications).

## Irrigation

Growing any cut flower crop requires a reliable supply of good-quality water. Irrigation is essential for good plant growth and high yields of good-quality flowers, as well as ensuring good stem length, and minimising defects such as grow-through and flower burn.

No matter how technically advanced or expensive your irrigation system is, it is important to regularly check that it is working properly. Good maintenance is essential.

If the ground is irrigated during planting, new crops can be sown or planted directly into the wetted soil. However, be aware that plant losses can occur if young plants are too far from the dripper to receive adequate water.





**The aim of your irrigation system is to ensure that enough water is delivered efficiently to the root zone to keep your plants growing steadily.**

Ensure that your irrigation system is designed to meet both present and future requirements. In your initial planning, allow for future expansion of the plantation or a change of crop. Allow for the irrigation of plants at full maturity, with the flexibility to handle crops of differing water requirements. For example, drip irrigation or micro-sprays offering part-circle spread are preferred for Christmas bush, mainly to avoid wetting the foliage, but overhead sprinklers may be needed where hot drying winds are a problem between flowering and harvest or to control frost in frost-prone areas.

The soil type will affect the irrigation volume and frequency. For example, water soaks through sandy soils faster than through clay, so more frequent, lighter watering is needed on sandy soils. Similarly, if water soaks into the soil more slowly than the rate at which it is applied, it may pond or run off the soil surface. Pondered water is a potential source of plant disease, and runoff can cause drainage or erosion problems.

The system should be able to deliver enough water under the most extreme conditions. This is especially important when your plants are

flowering. One day of hot dry winds can result in complete flower loss in Christmas bush, for example.

## Water quality

Test irrigation water regularly to monitor its suitability. For example, water from creeks or dams may be a source of disease organisms such as *Phytophthora*. This water may need to be treated to minimise disease spread. Bore water is generally considered to be free of plant pathogens but, like creek or dam supplies, may have other water quality problems such as high salt or iron content. Chlorinated town water is generally suitable without further treatment.

Some crops are very sensitive to salt in the irrigation water. Christmas bush is sensitive to even low levels of sodium (60 ppm) and chloride (90 ppm) in the water—concentrations considered safe for many other crops. Water salinity is difficult to deal with, but its effects can be minimised by using micro-irrigation systems, which do not wet the foliage.

Soluble iron and manganese can be present naturally in many water sources, particularly ground water and farm dams. High levels of iron can stain spray-irrigated crops or block pipes and sprinklers. In addition, manganese, at levels as low as 0.5 mg/L, can cause toxicity in some crops. Iron and manganese problems can be overcome by oxidising the water. Low concentrations can be effectively resolved by simply aerating the water.

Similarly, algae can block micro-irrigation systems and filters. Algae are stimulated to grow by sunlight and high levels of nutrients. The best way to minimise the problem is to stop nutrients from entering the water supply. Nutrient sources include septic tank seepage and runoff from fertilised beds or livestock sheds. Algae can be treated chemically. Once they are under control, aerating the water will help minimise future blooms.

As with iron in the water, turbidity or murkiness in the water, caused by fine suspended clay particles, can stain plants and block irrigation systems. Chemical treatment can settle out the clay, making the water clear. Farm dam turbidity can be reduced by grassing the catchment areas and sealing roadways and paths with concrete or compacted road base.

An excellent publication called *Farm water quality and treatment* (Agfact AC.2) can be found on [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au) (search under 'water and irrigation').

## The irrigation system

Non-pressurised irrigation systems, such as furrow irrigation, rely on gravity to supply, apply and remove the water. These systems are generally not suited to flower growing. A pressurised system, such as micro-irrigation, relies on a pump or a head of water, such as an elevated tank, to supply the water. These systems are more suited to flower growing.

Every irrigation system needs the following components:

### Water source

A reliable water supply is vital. Water from a dam, river, bore, town supply or recycling can be used. Town water may be expensive, but in some areas bores or dams may be too salty or unreliable for flower production. Don't assume that you will be able to use town water supplies to irrigate your crops: check your options. Recycled water, either from previous irrigations or from effluent (such as treated sewage), will require some form of chemical and physical treatment before use, either to kill plant diseases or to control algae and bacteria.

### Pump

The pump is the 'heart' of your irrigation system, so it is wise to get expert advice about its selection, operation and maintenance. The water source, topography and volumes required will usually dictate the type of pump required. Protection and control equipment is recommended. Each site is different, so speak with your irrigation supplier. As flower enterprises often have a wide range of pump requirements, a variable-speed pump is worth the small additional cost.

### Filtration

Filtration is needed to protect the emitters from becoming blocked. Filters can be screen, disk or gravel types. There are many sizes, designs, brands and grades available. The type, size and number of filters you will need depends on the quality of water to be treated and the emitter size. For water sources with a high sediment or

organic load, a filter immediately after the pump will be required. Also consider a disk or screen filter at each irrigation block. If irrigation water is to be collected and recycled, it should also be pre-filtered before UV and chlorination treatment.

The degree of filtration will depend on the level of sediment and organic matter in the water supply and the type of irrigation used. Test your water before selecting the filtration system, and discuss your requirements with your irrigation designer.

Regular filter maintenance is required to help prevent blockages, and automatic back-flushing of main filters is recommended. For small-bore emitters, regular flushing and cleaning (generally with chlorine-based chemicals) are also required to reduce the build-up of clogging hazards such as bacteria.

### Main line

This is the pipe that delivers water to the irrigation area. It can be made of plastic or metal. PVC and polythene are widely favoured owing to their ease of installation and cost advantage, but copper or galvanised steel are also used. Each has features and benefits that should be considered before purchase.

### Submain

This is the pipe that leads from the mainline to the laterals. It is usually made of polythene or PVC, and is pressurised only after the control valve is opened.

### Laterals

The laterals branch off the submain and carry the emitters. In some cases they have in-built emitters. They are usually made of polythene in micro-irrigation systems and PVC or polythene in sprinkler systems.

### Control valves

There are various types of valves, such as gate, ball or butterfly, that govern the irrigation system. They can operate, manually or automatically, with the aid of solenoids, which turn the water off and on. Other valves frequently used alleviate air pressure build up, regulate pressure and control flushing of laterals.



## Emitters

These finally deliver the water to the plant. They can be drippers, sprinklers or other types of emitters such as nozzles or stakes.

Most flower growers use individual drippers. There are many variations, such as inline drippers, where the emitters are formed into the irrigation lines, and many types that are fixed externally. You need to get your situation properly assessed to determine which will be best for your needs.

The system has to be designed to give an even distribution of the correct amount of water over the whole plantation. If possible, install pressure-compensating and non-drain emitters: these will give you the best possible control of your watering. Most irrigation suppliers will assist you in evaluating your needs, and with system design, component selection and installation. Additional help is available from commercial irrigation specialists and irrigation specialists within your state department of agriculture or primary industries.

Emitters can be pressure-regulated or non-pressure-regulated. Slopes of 3% or greater are generally not suited to non-pressure-regulated emitters: steeper slopes encourage the water to move to low spots in the system, resulting in over-watering at these areas and under-watering in the higher areas.

Micro-irrigation emitters (such as drippers, jet sprays and mini-sprinklers) are the most efficient for irrigating wildflower plantations and are the most economical users of water. They reduce foliage diseases by keeping the leaves dry and reduce weed growth by watering only the crop. Many commercial growers use drip irrigation, as it is relatively inexpensive to install, places the water where it is needed and avoids wetting the foliage. For good coverage of the root zone, several outlets per plant may be required. Very little water is wasted, and watering is not affected by wind.

However, as seen in many other crops grown in high-rainfall areas and on light soils, microjets may result in a better coverage of the root zone and greater water uptake than drip irrigation. Microjets have the advantage of not wetting the foliage but may increase the humidity in the crop under adverse conditions.

## Overhead irrigation

This should be used sparingly, as it can cause lodging of flowers (especially as they near maturity) and spotting on the flowers. It can splash soil onto the foliage and generally promote the spread of disease. It is, however, useful in the early stages of crop establishment to ensure that small plants receive water. It is also useful where hot dry winds are a problem, or as a control in frost-prone areas.

## Irrigation design, layout and basic hydraulics

Your irrigation system must be engineered properly. If it isn't, the results will be uneven application, excessive water application rates, premature system wear, higher maintenance and running costs, and ultimately poor flower yields and low profits. Central to all irrigation planning is an understanding of how to calculate total pumping heads. Calculations depend on friction loss, pump delivery data, crop water requirements, discharge rates and a way to measure vertical heights. Unless you have an understanding of all of these, it is better to get an expert to do the design. Most irrigation suppliers can help.

The idea is to plan for maximum efficiency and minimum friction losses. Large-diameter pipes impose less friction, but their lower friction losses and lower energy requirements will have to be weighed against the extra costs of the larger pipes and fittings and the possible high pressure at the emitters. If low-pressure drippers are being used, then some type of pressure reduction may be required.

Various classes of pipe (defined by wall strength) are available; your irrigation supplier will assist with selecting the appropriate class for your situation. The aim is maximum efficiency with minimum variations in pressure and output throughout the system.

The capacity of your system will dictate how many plants can be watered at any one time, and thus how many separate irrigation blocks need to be allowed for. This type of planning is fundamental to efficient irrigation and will allow you to divide the plantation into manageable blocks or zones. Crop and water management will be made a lot easier if you also try and group similar plants into the same irrigation

blocks. The irrigation timing of these blocks can be controlled:

- with manually operated valves
- by a 'watchdog' control on a diesel pump
- by a computer controller that uses solenoid valves. This controller can also turn the pump on and off.

The last method is ideal for large or complex irrigation systems. Whatever method you use, it must be planned for at an early stage and complement your management style.

## Water volumes

If you have a large plantation with several irrigation blocks or zones, watering is best managed by using low-voltage, automatic irrigation controllers. Controllers manage your watering periods by switching solenoid valves on and off according to conditions that you set. Each solenoid valve controls an irrigation block or zone. You can fine-tune the timing of the watering to allow for different species or soil types, as long as plants with similar requirements are together. This is best planned at the start, ensuring that all plants with similar water requirements are planted in one zone or block.

Water requirements can be estimated from evaporation pan data. Average, minimum and maximum values for Gosford (NSW), Kempsey (NSW) and Esk (southern Queensland) are shown in Table 1. Note how the minimum and maximum values can vary greatly between locations. A local evaporation pan is essential to get data relevant to your farm.

**Table 1. Evaporation at three sites over the past 15 years (source: Data Drill).**

Site	Average evaporation (L/m <sup>2</sup> /day)	Minimum–maximum evaporation (L/m <sup>2</sup> /day)
Gosford	2.9	0.0–8.0
Kempsey	3.4	0.2–10.8
Esk	4.5	0.6–11.4

Evapotranspiration is the total water lost from the surface of the soil (evaporation) and the crop (transpiration). To estimate evapotranspiration, a factor is applied to the recorded evaporation rate. The factor for many wildflowers is not known, but is likely to average about 0.8

over the season for a mature plant. Until better information is available, you could assume that evaporation equals evapotranspiration: hence, the daily water requirements of your flowers will approximate the daily evaporation rate.

The irrigation rate and frequency required will depend on several factors:

- The weather conditions. Evaporation varies widely with season. As a general rule, allow 2 to 3 times the rate in summer as in winter.
- Differences between the pan site and the crop site. Even siting of windbreaks can have a large effect on evapotranspiration. Mulching of the soil surface may also have a large effect.
- The stage of crop growth. Even if we assume that the plant water requirements equate with the evaporation rate, we still have to account for special circumstances such as transplants, which may require irrigation two or three times a day without the benefit of rain, and the period after harvesting, when the foliage area has been greatly reduced, thus reducing transpiration and overall water use until regrowth occurs.
- The crop factor. Different crops have varying water needs; for example, Christmas bush needs more water than banksias. The crop factor is derived by dividing the actual evapotranspiration of the crop by the pan evaporation. There are few defined crop factors for wildflower crops and they are site specific—for Christmas bush the factor has been calculated to be 0.4 to 0.8. The evapotranspiration can be less than the pan evaporation if the plants are small and widely spaced.
- Losses during application. For sprinklers assume a 10% loss for night irrigation, 20% for day application and possibly more than 40% for hot windy days. There are fewer losses in drip systems, unless excessive water is applied and it runs to waste, but you should still make an allowance of 10% loss.
- The water-holding capacity of the soil. For example, sandy soils have a low water-holding capacity, and frequent light irrigations will be required, or much of the water may run to waste.
- Rainfall. The effect of rainfall is determined by the frequency, intensity and amount of rain and the water-holding capacity of the

soil. As the drainage must be good to remove excess moisture quickly, little of the natural rainfall may be available to the plants. Even after heavy rain, irrigation may have to recommence in a day or two in summer.

## Installing your irrigation

Hopefully by this stage you have worked out where everything is going, have had your system designed properly, and have bought in most of the parts required. By now, ideally, you will have the pump, basic control valves, tanks and irrigation controller installed and ready for operation. As soon as the beds are formed you can start measuring up for the irrigation laterals. This is also the time when it is best to install all the water mains from the pump or tank and submains to the ends of each bed ready to be hooked up to the laterals. The whole irrigation system must be in place and working well, before you attempt to plant out.

The irrigation lines should be laid on the soil surface or buried 5 to 8 cm beneath it to avoid damage by rodents before the weed matting or mulch is applied. Specialised equipment is available that will lay drip tube or tape together with plastic matting in a single pass of the tractor.

Apart from overhead sprinklers used for frost protection and initial crop establishment, consider a micro-irrigation system for long-term watering. You can use:

- laterals with external drippers or micro-sprays fitted to the line or on extension tubes
- laterals with in-built emitters at fixed intervals.

With the first, you fit your drippers to suit the plants. With the second, your planting may be governed by the dripper spacing. However, you can specify the dripper spacing when ordering; speak with your supplier about the available spacing options and the costs involved. Because of the costs of running pipes and then installing individual drippers, some growers use laterals with in-built emitters.

When using the second option, some growers prefer a dripper every 250 mm to enable watering a continuous strip down the middle of the beds. This should give the best water distribution to the roots while keeping costs to a minimum. Every lateral end must be anchored and

preferably fitted with a flushing valve. A valve should be installed at the start of each lateral (or at least at each submain) so rows can be turned off for maintenance or when a crop is being replaced.

If you have long runs or a hilly site, your designer probably specified pressure-compensating drippers for your irrigation lines.

## System evaluation

System evaluation is necessary to ensure that what you think is happening in the field is actually happening. It's about how to measure actual outputs and fine-tune for maximum efficiency. You must know:

- the rate of water application to the plants
- the variation in delivery rate from outlet to outlet, i.e. the water distribution uniformity
- the pressure variation between emitters.

To evaluate your irrigation system's performance you will need buckets, measuring jugs or cylinders, catch cans, pressure gauges, plastic tubing and a watch. Run the irrigation system for a minimum of 10 minutes, catching the emitter discharges in the catch cans. Measure and record the pressures and the water volumes collected and check against the manufacturer's specifications. If you do this at a number of irrigation blocks you will get an indication of the system's variation in water distribution, application rates and pressures. Pump performance can also be evaluated. Your state department of agriculture or primary industries may run practical training courses that cover these aspects of your irrigation system. You can also get advice from your irrigation supplier.

## System scheduling and benchmarking

Scheduling is how you program your water use and irrigation intervals to minimise plant stress and maximise production, on the basis of actual crop water requirements.

Benchmarking is a process of learning from your own past performance and the performance of others in pursuit of continuous improvement. Many producers have found benefit from comparing what they do from year to year and comparing the performance of other pro-

ducers with their own. In this way crop yields or economic values can be monitored.

## Before you plant

Incorporate a basal dressing of fertiliser or chicken manure into the beds. If you are using weed matting, apply it now. It must be applied properly to get the maximum benefit. Secure the edges with soil. Never apply it when the soil is excessively wet or dry. Dry soil can settle and allow the plastic to become loose, whereas wet soil does not seal the plastic well, increasing the possibility that it will blow off the bed. It is important to have the plastic in continuous contact with the soil because:

- having space between the soil and the plastic interferes with heat transfer, preventing the soil from warming quickly and thoroughly
- if the plastic can move in the wind, it can tear
- movement against the stems of young plants can cause abrasion and thus increase the risk of disease entry.

While there are benefits of using weed mat, it can also introduce new problems, as explained later in this chapter.

## Planting out

As you are planting a 3- to 6-year (or more) investment for your income, take care when planting out. Provided that the plants are big enough to plant out and have been hardened off to suit your conditions, there are two main times to plant. Planting is best done in the spring to produce active growth, although summer planting is possible with greater care. Spring planting also reduces losses in frost-prone areas. Autumn is also a suitable time to plant, except in frost-prone areas. Autumn planting allows plants to become established before they start their growth flush in spring. However, young plants are usually more susceptible to frosts than established plants and may need protection during their first season.

Important factors include the following:

- Size of the plants. If plants are not estab-

lished by direct sowing of seed, seedlings are probably best planted out when quite small (4 to 8 cm high), before there is extensive root development in the container. Generally plants that are in 50-mm forestry tubes or bigger have sufficient roots to survive.

This allows the root system to develop in the soil, rather than becoming root bound in the pot. Root-bound plants may fail to thrive and even die as they get bigger. As the root systems are easily damaged, unnecessary disturbance needs to be avoided throughout the propagation and planting phases. The biggest problem with using larger plants is that they may need more water than if they were still in their pots. So there is a risk of the root ball drying out if there is insufficient irrigation, resulting in reduced growth rates.

- Tip pruning to establish the plant's branching framework so as to support optimum number of flowering stems. The shoot tips on the stems should be pinched out 2 weeks before planting or 2 weeks after.
- Soil moisture levels. Is it wet enough to support plant growth?
- Availability of irrigation. Is everything working, with the right amount of water being delivered to the plants?
- The weather. Hot dry windy or cold weather will only stress the plants. It's better to leave them in the pots until it's right, or you could use an anti-transpirant<sup>6</sup> on the plants before planting. You could also use water-holding gels at planting to store moisture in the root ball until the plant gets established.
- Labour availability.

Planting aids can be used for large plantings: farm forestry operations used tractor-pulled mechanical planters and hand- and foot-operated planters. There are various models available to suit different tube sizes and brands, but the standard 50-mm forestry tube is also a common size for flower tubestock. The hand planters work well, but your tubes must be suitable for the unit. They can speed up planting and reduce the bending involved once you get used to working them.

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<sup>6</sup> Anti-transpirants are chemicals that can be sprayed onto plants to temporarily cut down their moisture losses to the atmosphere.

When planting out:

- Water the beds the day before. Consider having the irrigation running as you plant.
- The hole should be larger than the pot.
- Examine the roots, and if needed, tease them out, straighten them or trim back.
- Position the plant into the hole with all the roots pointing downwards.
- If it is required, a small dose of blood and bone or 6- to 8-month slow-release fertiliser spread in the hole will kick the plant along.
- Return the soil to the hole, with some pressure to provide support to the plant, but don't compact the soil too much.
- The plant should finish up at the same height in the ground as it was in the pot.
- Water the plant thoroughly to settle the soil around the roots. Plants are especially susceptible to drying out or over-watering at this stage. This occurs because the plants have limited root systems at transplanting, especially if small tubes are used. This situation will be exacerbated if the plants are large relative to the tube size. Because water will drain from the root ball into the surrounding soil, where it is unavailable to the plant, transplants can actually require more frequent irrigation than if they remained in their original containers.
- Split or multiple applications of fertiliser allow the level of nutrients in the soil to more accurately reflect the needs of the crop. This helps to avoid the 'feast and famine' effect by ensuring a more even nutrient supply and also reduces losses through leaching.
- Depending on weather conditions, plastic sleeves or shelters may be needed. If so, keep the plastic off the ground to let air circulate freely around the base of the plant.
- Plants susceptible to wind damage and some grafted plants need staking while small. Using three 450-mm bamboo canes in a tripod arrangement can be effective and does not damage roots.

## Establishment phase

This generally lasts for about 2 to 3 weeks when

plants are actively growing. The initial irrigation frequency during this period may be as much as 2 or 3 times a day, reducing to about once a day after 2 to 3 weeks (in the absence of rain). The actual rate and frequency will vary with the weather conditions.

In the establishment phase, watering by overhead sprinklers will provide a wider distribution of water to ensure that all plants receive water. Drippers are the preferred method after establishment, as they do not wet the foliage. This means that a dual sprinkler-dripper system is desirable. The sprinkler system may have other uses, such as for frost control or for reducing excessively high foliage temperatures.

Liquid fertilisers may be applied at this time through the drip system. Do this *after* using the sprinkler system, to avoid washing the nutrients out of the soil.

It is particularly important in this phase for the soil to be freely draining so as to maintain a high air space ratio between waterings.

Keep the root ball moist during this early phase. When a soil has drained after irrigation, water movement within the soil is usually slight, but the soil surface dries very quickly. Young plants have shallow root systems, and although the surrounding soil may be moist, the root ball is often dry. Failure to supply adequate moisture to the root ball results in stressed plants that fail to establish or grow satisfactorily.

## Growing on

Monitor your newly planted crop closely, especially its water needs, which can vary greatly. Plants can use more water on mild days than on very hot days, when they become stressed and the stomata close.

With care, you can use sprinkler irrigation to cool the crop on very hot days. Sprinkler irrigation may also be used for frost control. However, excessive wetting of the foliage, especially for long periods, will promote diseases and may cause unsupported flowers to lodge (fall over) from the weight of the water.



**Recently planted bed showing the soil held in place with weed matting, with a strip of mulch along the centre where the young plants are establishing. Tree guards provide further protection for the plants until they establish, while the windbreak provides long-term protection.**

## Light

Most wildflower crops need high levels of light to develop full (and commercially desirable) colour intensity. Plants should be grown in full sun where possible. An exception may be waratahs, which suffer from bract browning and may benefit from light shading, either by being grown under 30% shade cloth or by having individual blooms protected in the lead up to harvest by covering them with a stocking.

## Screening, windbreaks and plant support

Some screening around your production areas will reduce the visual impact of production areas and farm buildings on neighbours and road users and can also catch pesticide drift. Many councils require screen plantings as part of any new horticultural development.

Adequate wind protection is essential. Plants are usually small at planting and the root system is shallow (particularly for cutting- or tissue-cultured plants). At this early stage, plastic plant guards can offer the best protection as well as reducing damage from cold, frost and animals. Avoid leaving the guards on as a support, as the trapped humidity can cause rotting of the lower leaves and may favour collar rot.

As the plants grow taller they may need support to stop the stems bending or breaking. Bent stems lower the value of the crop. Support can be provided by staking or, for certain crops, by the use of floral mesh.

Once established, flower crops need a good flow of air (but not wind) around and within them to dry the leaves and flowers and so reduce disease problems. However, hot dry winds can damage flowers in the lead up to harvest. Wind may also accentuate drought effects, break stems, or disrupt the application of sprays or irrigation. The use of natural or artificial windbreaks can help minimise this.

Windbreaks reduce the rate of water loss from the soil and the crop. Some sprinkler systems lose as much as 42% of applied water through evaporation and drift. Windbreak protection saves both water and pump fuel costs. Plants protected by windbreaks use water more efficiently and are less likely to wilt under hot conditions. Windbreaks can both protect your plantation from damage and moderate climate.





**Plastic plant guards can shelter young plants. Note the well mulched bed to reduce weeds.**

Living windbreaks may also provide a haven for beneficial species, particularly birds, which can reduce insect pest problems.

The ideal windbreak should aim to reduce wind speed by up to 50%. As a general rule:

$$\text{Protected length} = (\text{shelter height} - \text{crop height}) \times 8$$

A good windbreak deflects the wind over the crop. If the wind is blocked completely, it is forced up and over the windbreak and creates turbulence on the other side. Natural or artificial shelter can be used, but good design is critical.

Artificial shelter has a number of advantages:

- It has a defined porosity (100%), which is the optimum for windbreaks.
- It is instantaneous.
- It is more uniform, so it can be built without gaps which can cause wind tunnel effects.
- It can be incorporated with hail netting or shade cover for further crop protection.
- It does not compete with the crop for water or fertiliser.

However, you need to fully investigate the material before purchase: ascertain its stability

under sunlight and high winds, its method of erection and the cost.

Living windbreaks ideally need to be in place before you plant, as they can take several years to reach a height that is fully effective. Suitable species include the fast growing *Casuarina cunninghamiana*. Living windbreaks can also be hedged. However, death of individual plants in the windbreak can produce breaks that can lead to wind tunnel effects. Depending on the species planted, the porosity of the windbreak may decrease over time as the plants mature. Remember also that natural shelter belts compete with the crop for water and nutrients, and require labour for maintenance (pruning, fertilising and watering).

## Weed management

Weed control is a major expense in plantation management, because weeds compete with your crop for nutrients, water and sunlight. They can also harbour many pests and diseases. Weeds can cause total crop loss during the early establishment stages when plants are small, and may severely reduce yields later.

Weed mat or mulch is useful to avoid weed problems within the rows, and significantly reduces the labour needed to control weeds. It can repay its cost in as little as 2 years. It also:

- helps reduce the amount of water lost by evaporation
- helps shed water away from the root zone during periods of excessive rainfall and therefore reduces leaching of fertilizer
- prevents cultivation equipment from damaging the crop roots.

And mulch reduces soil compaction by equipment, therefore improving soil aeration and microbial activity.

## Weed mat

There are two main types of plastic weed mat available. Woven plastic generally lasts for 4 or 5 years—often more than the life of the crop. Non-woven plastic generally needs an organic mulch on top to be effective, but its efficacy depends on its quality (density).

Weed mat alone is not recommended, as it can raise the soil temperature, making it too hot for good root development. This problem is more important when the plants are small. The mat also makes the application of solid fertiliser difficult. In the longer term, the soil under a weed mat tends to become hard and compacted. Therefore, some growers use weed mat on either edge of the bed and a strip of mulch where the plants and irrigation lines run, and later replace it with mulch.

## Mulches

Mulch used in association with matting is the preferred option, as it discourages weeds and, by insulating the soil, provides a cool root run for good plant development. Organic mulches (such as straw, compost and hay), crop residues (such as tea tree mulch, cotton trash and bagasse), wood chips and sawdust also aid soil health in the long term, as they break down slowly and increase the organic matter levels in the soil. They should be properly aged and free of excess fertiliser and weed seed, and they should have a large particle size. The particle size affects both the soil aeration and the rate of microbial breakdown. If the particle size is too small the mulch will break down quickly and may cause nitrogen depletion.

Organic mulches can contribute to the control of *Phytophthora*. Keep the mulch away from the stem of the plants to avoid collar rot.

However, organic mulches:

- can introduce weed seeds
- must be regularly reapplied, as they decompose over time
- are difficult to apply to a growing crop
- require considerable labour input.

Mulch applied correctly will not blow off the beds, but at the same time will not be too difficult to remove if required.

Hardwood chips break down slowly. Phenols that leach from them may be a problem in some crops, especially small plants and crops sown from seed. Because the concentrations of phenols vary in different timbers, it may be a good idea to trial a particular hardwood mulch first for its suitability.

Mulches cannot be used on kangaroo paws if

the plants are to be slashed and burned after harvest.

## Integrated weed control

The space between the rows is generally grassed. Weed growth can be controlled by mowing or herbicides. Do not allow weeds to flower: slash or mow beforehand. Herbicide strips can be used to prevent damage by the slasher to the crop.

Most growers need to use all available control methods at some time:

- Mulching. Good weed control before planting is easier and safer than later.
- Spraying. Systemic herbicides can be transferred to the crop by contact with the roots of the weeds (especially perennial grass roots), with deadly results. Contact herbicides may be safer for the crop, but they are not as effective in weed control, and spray drift onto the crop must be avoided. Only a limited range of herbicides are registered for use in flower crops. Take extreme care in using herbicides close to the plants, as toxicities have been reported.
- Mowing, slashing and brushcutting.
- Inter-row cultivation. But if this is carried out too close to the plants, the shallow roots will be damaged.
- Hand weeding. This is very labour intensive and therefore very expensive. Crops with shallow root systems, like flannel flowers, may be more susceptible to damage from hand weeding or close cultivation.

## Trial area

It is a good idea to set aside a separate area where you can trial potential varieties and species. Trials allow you to assess the performance of varieties under **your** conditions and provide small volumes of product for test marketing. You can also compare the performance of several varieties of the one flower type and then plant the one that best suits your needs. When testing a particular plant, be prepared to plant 5 to 10 plants—just 1 or 2 won't give a good indication.

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# Chapter 13. Maintaining your crop

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**Bettina Gollnow, Ross Worrall, Len Tesoriero and Bill Yiasoumi**

Be a good manager

Fertilisers and crop nutrition   Irrigation

Weed management   Pests and diseases

Disorders   Pruning   Troubleshooting

## Be a good manager

Being a good manager is the key to achieving maximum profitability and minimising problems. Grow only what you can effectively look after, and ensure your crops are growing under optimum conditions. Know what a healthy crop looks like and investigate as soon as you notice a change. You must understand pruning, nutrition, irrigation and pest and disease control.

Like any crop, wild flowers require an adequate supply of nutrients throughout their life. This affects yield, quality, and tolerance to pests and diseases. The nutrients are supplied by applying fertiliser before the crop is planted and during its lifetime.

Good hygiene in and around your growing area is important to avoiding problems. Maintain good air movement around your plants. Ensuring spaces between plants and between rows can reduce pest and disease problems. Control weeds early, or young plants will be struggling for adequate light, air, fertiliser or water. Clean up and remove prunings often. When plants are no longer productive, pull them out—don't leave them to harbour pests and diseases.

Make sure all your equipment is well maintained, especially sprayers, safety equipment, irrigation equipment and fertiliser applicators. Regularly (at least annually) check that your irrigation water is free of pathogens and salts, especially if you are using dam water.

Make it a rule never to try a new fertiliser or pesticide without testing it on a small area of the crop first. Read the label thoroughly first.

Keep good records of everything you do to your crops. Record things like:

- when you planted and what the weather conditions were
- when you have irrigation problems or equipment failure
- when and what you spray on plants, the rate of application and what you were trying to control
- what pests and diseases you can see and when you see them
- details of fertilisers applied (when, what and how much)
- unusual weather conditions, such as extreme heat, frost or hail.



**A well managed plantation kept free of weeds means you are less likely to strike problems.**

## Fertilisers and crop nutrition

The elements known to be essential for normal plant growth fall into two groups according to their abundance in plants:

- Major or macro-nutrients: nitrogen (N), phosphorus (P), potassium (K), sulphur (S), calcium (Ca) and magnesium (Mg).
- Micro- or trace elements: iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), boron (Bo), molybdenum (Mo) and chlorine (Cl).

If any one of the essential elements is lacking, crop growth will be affected. Nutrition plays a key role in the development of the plant. Optimum nutrient levels support maximum stem numbers and stem length. The supply of nutrients will limit growth when the levels of one or more elements are too low (deficient) or too high (toxic or excessive). More information on plants and nutrition can be found in Chapter 3.

Because plants absorb most of their nutrients from the soil through their roots, fertilisers must be soluble in water. Thus, proper irrigation scheduling is important—as much to maintain the nutrient supply as to prevent water stress.

Good plant nutrition can help to minimise diseases by keeping the plants strong and healthy. The application of phosphite (also known as phosphorous acid) as a fungicide (note: **not** phosphoric acid), especially in the early stages of plant growth, may have significant benefits in improving root health and thus nutrient uptake if certain pathogens are present.

## Monitoring fertility levels

It is important to know the nutrient status of your soil so that you can decide what fertiliser is needed. There are two approaches:

- Soil testing, whereby a chemical test will show the nutrient level of your soil. This allows you to plan a fertiliser program which aims to minimise nutrient losses and prevent the build-up of excess elements.
- Plant analysis. Analysis of the plant tissue gives a reliable guide to the condition of the crop and is useful for identifying nutritional disorders. However, reliable standards have yet to be set for most wildflowers.

Fertiliser rates will vary with the situation and management techniques, and optimum rates will vary greatly with management practices. For example, if more than 10% of the required water is applied at irrigation and significant leaching occurs, higher fertiliser rates will be required. Conversely, if the soil is already high in nutrients because of previous fertiliser application, then less will be needed.

## How much fertiliser and what ratio to use?

To estimate the rate of fertiliser to use, you need first to determine the initial fertility of the soil and how much fertiliser is subsequently removed by the crop. In addition, nutrients can be leached out from, or fixed by, the soil.

### Determining the basal level of fertility in the soil

The only real way to determine the initial level of fertility of the soil is by soil analysis. In high-rainfall areas, native soils (especially the lighter ones) are generally deficient in most nutrients (especially N, P and K), and they also have a low pH—so they will require liming as well. On land that has previously been used for agriculture—particularly on lighter soils—N and K are unlikely to accumulate to any significant extent. However, P has been found at high levels in old orchard ground, in pastures and where vegetables have been grown. However, do not assume that previous addition of P means that there will be adequate **available** P present in the soil. Many types of soils can fix large amounts of P and make it unavailable to the

plant. Also, P can readily be leached from very light sandy soils by high rainfall or irrigation.

### **How much fertiliser is removed by the crop or by leaching?**

As a general rule, when applying solid fertilisers, aim for an NPK ratio of 1 : 0.44 : 0.83. This is not the same ratio that is taken up by the plant; the assumption is made that much of the P will be fixed by the soil and thus become unavailable to the plant. For soils that do not fix appreciable quantities of P (for example, light sands and most organically based potting mixes), an NPK ratio of 3 : 0.44 : 1.66 may be more appropriate, especially if fertigation is used. This is closer to the nutrient ratio in healthy leaves. In general, P, and to a lesser extent K, will accumulate in the soil if fertilisers high in K and N are used continuously.

Base your calculations of the quantity of fertiliser needed on the quantity of N required. Applying fertilisers at the correct rate can save considerable money. Once you start to harvest your crop, you are aiming to replace the nutrients you have removed in harvested material and prunings. As an example, consider Christmas bush. In its natural habitat, most nutrients are recycled in the organic matter. In contrast, in a mature planting, as much as 10 t/ha of harvested material and prunings can be removed. This contains about 150 kg N, 12 kg P and 100 kg K, all of which must be replaced. To replace the N alone you would need approximately 2.5 tonnes of dry poultry manure or 7.5 tonnes of dry sheep manure.

## **Forms of fertiliser**

### **Solid, mostly soluble form**

Chemical fertilisers are generally the lowest-cost materials to apply. Low-cost methods of application, such as fertiliser spreaders, may be used on well established crops, where the root system has spread into the rows. However, where weed matting or thick mulch is used, getting the fertiliser into the root zone may be difficult, especially with fertilisers that are only partly soluble, such as superphosphate.

The fertilisers will not become available until they are watered into, or otherwise mixed into, the root zone. It is not possible to supply all the nutrients needed for a year in one application.

Ideally, fertilisers should be applied every month or so to provide a steady supply of nutrients. Otherwise the plants will suffer from both excesses and deficiencies, and much of the fertiliser will be leached from the soil or lost to the air (especially in the case of urea).

### **Controlled release**

Controlled-release fertilisers are relatively efficient: up to 60% of the N applied is absorbed by the crop. Losses due to leaching are lower because the fertiliser is protected by a membrane. Nutrients are supplied for up to a year. The rate of release of the nutrients is affected by temperature, so the supply will vary.

Incorporate slow-release fertilisers into the soil. This may be difficult with established crops, especially if weed mat is used. The surface of the soil can become very hot (up to 60 °C), causing a very rapid release of nutrients. This can result in fertiliser toxicity in the short term, and, if the nutrients are then leached away, a deficiency in the long term. The main disadvantage of using slow-release fertilisers in field crops is the cost per unit of nutrient added, although for container-grown plants this is often very economical when you consider labour costs and the results achieved.

### **Liquid feeding (fertigation)**

Fertigation is relatively efficient: up to 88% of the N applied is absorbed by the crop. The rate of leaching is low, because the fertiliser is applied in small amounts over the life of the crop. It also has the advantage of allowing you to tailor the nutrient supply exactly to the crop's needs. The disadvantages are high capital costs (for fertiliser injection equipment), the need for a high level of technical knowledge, and the difficulty of supply during wet weather.

### **Foliar feeding**

Foliar feeding is inefficient for supplying anything other than trace elements, as you cannot provide all of the crop's requirements through the leaves without burning the plants. However, it can be used in certain conditions, for example in alkaline soils where iron is a limiting factor.

## **How to apply fertilisers**

Fertilisers need to be applied to the active root zone to be effective. In higher-rainfall areas the



root zone will be spread out. In lower-rainfall areas, however, the root zone will be concentrated around irrigation outlets. In the worst case—such as where there is a single dripper per plant growing in a light sandy soil in a low rainfall area—the root zone may be restricted to a small area around the dripper. In this instance, fertigation may be the best method of applying fertiliser.

In higher-rainfall areas, solid fertilisers can be applied directly to the soil surface if weed mat has not been used. Physical incorporation is usually not necessary if there is no significant surface erosion, but the fertiliser should be well watered in. However, take care with slow-release fertilisers such as Osmocote® and Nutricote® applied directly to the soil surface: their release rate is controlled by temperature, and the soil surface may become very hot in direct sunlight, causing rapid release. The effect is greater when the fertiliser has been freshly applied. These fertilisers need to be incorporated into the soil.

Also take care where wood-based mulches (such as wood chips) or other materials with a high C/N ratio (such as wheat straw) have been used. Fresh material can take up a lot of N when it breaks down. Additional fertiliser—especially N—may have to be applied.

Weed mat presents special problems. The only satisfactory method of fertilisation is by liquid fertiliser or fertigation. Solid, insoluble fertiliser will sit on the surface and not be available to plants. Fertiliser may be placed in a band at the edge of the weed mat, but there it will be more readily available to the inter-row grass and weeds. As a compromise, some growers use a band of mulch, which allows direct placement of solid fertiliser, with narrow weed mat strips on either side to control weeds.

## Irrigation

### Deciding when to water

Some crops use relatively large amounts of water, especially in summer, and it is important to maintain moisture levels from budding to harvest. Two- to three-year-old Christmas bush plants, for instance, commonly use around 4 L/day in summer but half this amount or less

in winter. This requirement may differ depending primarily on weather conditions such as strong winds and on crop health.

Deciding when to water is often viewed as a difficult part of flower farm management. Some growers wait until plants start to wilt, whereas others constantly over-water because they fear the plants will dry out. Both practices will adversely affect your crop. Fortunately, there are many devices available for monitoring water use, from soil moisture probes, runoff monitors and weather stations to the tried and tested 'fingers in the soil', but they must all be combined with an understanding of what to do with the information and when to do it. The optimum level of water in the soil must be determined, and then frequent, short irrigations must be applied to maintain it.



Simple soil moisture meters can help you monitor soil moisture levels in the root zone.

### Irrigation system management

Your irrigation system needs regular maintenance to keep it working as designed. This is particularly important for drip systems, where it is difficult to identify problems early.



**It is helpful to secure the irrigation line to a wire running just above the bed and clear of the mulch, to make it easy to check that all the emitters are working properly.**

All irrigation systems wear over time and their performance will deteriorate accordingly. If you devise and implement a maintenance regime then you will minimise this decline.

The most common problems with drip irrigation are clogging of emitters, filters and pipes, and deterioration of drippers. There are three main areas of drip system maintenance:

**Flushing:** Flush the system (including filters, mains, submains and laterals) before the first irrigation of the season and several times during the season. If you monitor the water quality during flushing you will be able to determine whether you are flushing enough. Make sure you flush in the order that water travels through the system, i.e. mains first, then submains, and then laterals.

**Cleaning** (using acid or chlorine): Chlorine is used to reduce blockages caused by organic matter. Acid is used to manage mineral deposits. Both must be used with caution. Wear proper protection for eyes, hands and body when using these chemicals.

**Monitoring system performance:** Regular measurement of dripper discharge and pressures will help keep your system operating correctly.

## Weed management

Broadleaf and grass weeds will use fertiliser and water at the expense of your crop and may shade young plants. You need to control them routinely, especially in young plantations. Use herbicides, weed matting, mulching, hand weeding or a combination of these. Weeds may be a problem throughout the life of crops like kangaroo paws and Christmas bells. Only a limited range of herbicides have been tested on native Australian and South African plants. Some species are very sensitive to them; for example, kangaroo paws, waratahs and grevilleas will not tolerate glyphosate drift.



**Sometimes damage becomes apparent only after the pest has long gone. Here the leaves are deformed as a result of feeding by bud mites when the leaves were still enclosed within the shoot tip.**



## Pests and diseases

Spraying with the first pesticide to hand in the shed will not always solve the problem. For a start, the symptoms you see might not be due to a pest or disease at all! And if there is a pest or a disease in your crop, you need to identify and understand the cause before you take action. Not all pesticides work in the same way.

As always, prevention is better than cure. It is important to minimise free moisture on the leaves and flowers, as this favours fungal and bacterial diseases. Schedule any overhead irrigation to allow maximum drying time of leaves. Similarly, you need to remedy boggy patches in your plantation, because wet soils favour root diseases and can cause root death. Check and improve the drainage if necessary.

You can use sticky traps to monitor flying insects like thrips and psyllids effectively. You can buy them from most farm suppliers.



**You can use sticky traps to monitor flying pests in your crop.**



**It is important to check your crops regularly.**



**You may need to look very closely to find pests.**

### Common pests of wildflower crops

The main insect pests of wildflower crops include aphids, beetles and weevils (e.g. Christmas beetles), borers, caterpillars, grasshoppers, scale, slugs and snails, termites, thrips and gall wasps. However, many different insects and mites occur on surrounding native vegetation and may be found in plantations from time to time. Not all insects you see actually cause damage; for example, some beetles and wasps may appear in large numbers but only feed on nectar or pollen. However, you may need to remove them to comply with phytosanitary requirements if exporting.

Other pests include rabbits, hares and wallabies. Use fences around your plantations to reduce such problems. Birds may also find your plantation appealing and may damage young shoots and developing flowers; for example, honeyeaters may damage flowers on Christmas bells.



Borer moth damage is evident from the sawdust-like frass in the damaged area of the stem. Some plants seem more susceptible to borers. For example, the waratah borer moth can tunnel into the flower buds or stems, making them unmarketable.

## Common diseases of wildflower crops

### *Phytophthora* root and collar rot

*Phytophthora* is a fungal-like disease that causes root and collar rots. Several other fungi cause similar problems. These diseases are the major soil diseases affecting native Australian and South African plants, many of which are highly susceptible. It is extremely difficult to eradicate *Phytophthora* from infested soil or plants, so prevention is better than cure. In eastern Australia, *Phytophthora* is endemic to many areas. To reduce losses, choose a site with well drained soil. To further improve drainage, plant in raised beds oriented at an angle to the slope. Ensure you buy disease-free plants.

*Phytophthora* requires high moisture levels in warm soil, so it tends to be a summer–autumn disease. The mycelium grows through the roots, destroying cells as it goes. The results are seen as wilting of the plant, yellowing of the foliage and finally plant death. Because many wildflowers have tough foliage, yellowing rather than wilting is most commonly seen. Symptoms of *Phytophthora* infection are most severe when affected plants are drought-stressed.

The problem is that these symptoms can be confused with those of other diseases, pests, nutrient and water stress, or other physiological disorders. So diagnosis is usually based on laboratory tests. But it's important to note that finding *Phytophthora* in a plant or soil sample is not definite proof that *Phytophthora* root rot is the main culprit. Conversely, neither is a failure to find *Phytophthora* a guarantee that the area is free of it.

Various laboratories will test soil and water samples for the presence of *Phytophthora*. If your plantation site seems to be free of *Phytophthora*, take care not to introduce it via infected soil or potting mix, contaminated equipment or later plantings. *Phytophthora* may be introduced via nursery stock and irrigation water, especially if you source your water supply from creeks, rivers or dams. You may need to disinfest the water before use, for example by chlorination.

Plants that are stressed owing to poor nutrition, weed competition or lack of water are more susceptible to diseases. Do not use plants with root systems that are pot bound.

Effective control of *Phytophthora* involves:

**Hygiene:** This has been the traditional approach to managing this disease.

- Quarantine your growing areas and make sure only clean plant material is introduced.
- Wash down vehicles and equipment to avoid carry-over on soil.
- Get training in good hygiene and disease awareness for yourself and your workers.
- Footbaths—use a solution of 1% bleach or quaternary ammonium compounds.

**Phosphite** (also known as phosphorous acid, Phos Acid, Anti-Rot, Foli-R-Fos, Fosject): This is a unique 'fungicide' (it doesn't act in the same way as most fungicides) in that it moves through the plant in both the phloem and xylem tissues (in other words, both up and down the plant). It is water soluble and easy to use, as either a trunk injection or a foliar spray. It is best sprayed as a high-volume application to runoff. Its most important effect is indirect: it stimulates the plant to initiate a range of defence responses. Its direct action on *Phytophthora* is to *contain* colonisation of roots by *P. cinnamomi* in most plant species. It does not, however, *stop* colonisation, and may not always stop sporula-

tion and zoospore release from treated but infected plants. This means that while you can use phosphite to contain *Phytophthora* in potted nursery plants, the disease may become an issue when those plants are planted out.

It is important to use this chemical at the right time—when the plant is actively growing, so that the chemical will move quickly into the roots—say late spring and early autumn when there are growth flushes. The effectiveness of phosphite as a foliar spray varies between species and environments and between seasons. Its effect lasts for 4 to 24 months.



**Checking the root system of dying plants is important in determining the cause—here *Boronia* plants are checked for root rot symptoms.**

### Diseases of seedlings and young plants

Overwatering seedlings and young plants can make them more susceptible to *Pythium* root rot. Poor drainage also favours this disease. *Rhizoctonia* (which causes wire stem rot) is a common soilborne fungus. It is often associated with diseased roots and lower stems and can affect seedlings. You can apply an appropriate fungicide as a preventive measure before planting.

### Diseases of roots and lower stem

Take care not to introduce *Phytophthora* in later plantings. It is a good practice to wash a few plants from their pots and check the roots for signs of disease. Whenever you introduce new plants to your plantation, drench them with a suitable fungicide and observe for a few days before planting out. *Fusarium* can affect some species, such as flannel flower. *Sclerotinia* may carry over from previous crops, such as vegetables.

### Diseases of foliage and flowers

Fungal leaf diseases are more common in humid coastal environments. Where possible, reduce periods of leaf wetness and, if necessary, apply protectant fungicides during peak infection months.

Botrytis or grey mould (caused by the fungus *Botrytis cinerea*) can be a serious problem near and after harvest. The fungus can lie dormant in leaves and flowers and become a problem only under conditions of free moisture. You may need to dip flowers in an appropriate fungicide before packing to lessen risk of losses due to grey mould. This is especially critical with export shipments. More information on postharvest disinfestation can be found in Chapter 14. Botrytis is also a problem in young plants and can damage leaves, stems and flowers before harvest.

Powdery mildew damages leaves of young and established plants. It is favoured by overhead watering systems. Closely planted crops are more susceptible, because air flow around each plant is restricted. In kangaroo paws, ink spot is caused by *Alternaria alternata*, and big blotch disease is caused by *A. anigozanthi*. Both diseases produce unsightly spots on the foliage. Some species and varieties of kangaroo paw are more susceptible, especially *Anigozanthos manglesii* and certain *A. flavidus* hybrids. Ink spot will affect flower quality and yield and seems to be favoured by stress. Rust disease is also a major problem in some species of kangaroo paw.

A variety of other diseases affect mainly the foliage of wildflower crops. While most of these do not cause major damage or loss, they can affect product quality.

Virus diseases can also affect wildflower crops. For example, tomato spotted wilt virus, which is transmitted between host plants by thrips, has been isolated from kangaroo paws and flannel flowers. As more native Australian and South African species are propagated vegetatively and grown intensively, increased incidence of virus diseases can be expected.





**Botrytis growth can be a serious problem after harvest. Here the fungus is growing on waxflowers (*Chamelaucium*).**

### Myrtle rust

A new disease called myrtle rust has been identified on a range of genera belonging to the Myrtaceae family. This fungal disease affects leaves, shoot tips and fruits. It has been detected in nurseries, wildflower plantations, bushland, amenity plantings and home gardens. Some hosts are affected more severely than others. Susceptible genera include several which are cultivated commercially by the wildflower industry, including some species of *Acmena* (lilly pilly), *Callistemon* (bottlebrush), *Chamelaucium* (waxflower), *Eucalyptus* (gums), *Leptospermum* (tea tree), *Melaleuca* (bottlebrush), *Syncarpia* (turpentine) and *Syzygium* (lilly pilly). The host list for myrtle rust is now compiled nationally at [www.outbreak.gov.au](http://www.outbreak.gov.au). Over 100 species are now listed.

At the time of writing, myrtle rust has been detected along the NSW coast, in Queensland and recently in parts of Victoria.

Work is being undertaken to improve our knowledge of the disease and its impacts in

Australia. It will take time to understand the long-term effects on host plants and the environment and for our knowledge of the best management approaches to develop.



**Symptoms of myrtle rust on turpentine, *Syncarpia glomulifera* (lower leaf surface). Turpentine is commonly planted as a farm windbreak.**

You should become familiar with the symptoms of myrtle rust. Monitor for it by checking any plants belonging to the Myrtaceae family on your property at least weekly. Implement adequate biosecurity and hygiene practices to minimise the risk of introducing the disease or spreading it if you detect it on your property.

Go to your state biosecurity website for the latest information (e.g. [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au) or [www.dpi.qld.gov.au](http://www.dpi.qld.gov.au)).

### Use pesticides appropriately

Because wildflower production is a relatively small industry, there may be no registered pesticides available for certain pests or diseases. Regulations on the use of pesticides are strict. A product has to be registered for a species **and** the situation in question before you may legally use it. There is also a Minor Use Permit system to cover off-label uses of pesticides (see [www.apvma.gov.au](http://www.apvma.gov.au) for details).

Whenever you use a new product for the first time, read the label carefully. Check for advice on phytotoxicity and trial the product on a small area of crop first. You are responsible for choosing the correct chemical and rate of application. Use the correct protective equipment and get training in safe use and handling of pesticides (see Chapter 8).

With flowers destined for the export market, attention to pest and disease management is essential. Many countries, particularly Japan

and the USA, have zero tolerance for pests and diseases. Postharvest disinfestation of product before shipping is necessary. This will be easier if you have competently managed pests and diseases during the growing season.

## Get training

Commercial users of farm chemicals need to complete formal training. Several courses are available—please contact the relevant agency in your state for details.

In NSW, for example, the SMARTtrain program provides up-to-date chemical training for industry and the community. It was developed by NSW DPI and TAFE NSW. A number of courses are offered at different levels for various audiences. There is a strong risk management focus. This training complies with the requirements of the National Training Framework by providing accredited training through registered training organisations that are recognised nationally. Training resources, including manuals and workbooks, have been prepared for all courses.

Courses are conducted regularly by NSW DPI at its major centres and by TAFE colleges throughout the state.

## Check your spray technique and equipment

This is easy to do with spray cards. Spray cards are strips of water- or oil-sensitive paper that you put among your crop to reveal spray coverage. Using spray cards will help you decide whether your spray equipment is placing the chemical in the right place. The cards give a visual indication of spray coverage and the size and density of the droplets produced.

## Is integrated pest management an option?

Integrated pest management (IPM) means using a combination of control options that have minimum adverse environmental, economic and social effects. These maintain pests and diseases below economically damaging levels. IPM includes crop rotation, good hygiene, regular crop monitoring, and using beneficial insects, fungi and nematodes, which behave as

parasites or predators of pest or disease organisms. This approach is already used in traditional flower growing, where greenhouse production provides a controlled environment. IPM is adaptable to wildflower growing.

As a first step, identify your pests and diseases early and accurately, and use pesticides with a narrow spectrum of activity to reduce their effect on the environment and beneficial insects.

## Plant health diagnostic services

Correct diagnosis of a problem involves several steps. If you are unsure of what has caused the problem, you will need to ask someone. A private consultant, your local supplier of farm chemicals or a plant health diagnostic service is a good place to start.

You will probably need to collect a typical sample that shows the problem. Be generous—a poor sample means diagnosis can take longer. Collect a plant, or part of it, showing all of the symptoms but with some healthy tissue remaining. This allows affected and healthy tissue to be compared.

Your sample may have to be sent to a diagnostic laboratory for an accurate identification. You must make sure it gets there in a fresh condition. Wrap plant samples in damp newspaper before mailing. Enclose insects in an unbreakable container (preferably add methylated spirits to preserve them). Post samples early in the week or use a courier service.

Be specific about what you are worried about. Some samples may show more than one problem. For example, there may be a disease, but also signs of insect damage and inadequate nutrition. Point out which one(s) you want identified to avoid time delays.

Make sure you keep good records of the diagnosis, the recommended control measures and whether they worked. This could save you time and money in the future.

Every lab varies in its methods and the variety of tests done, but there are some basic approaches. Looking under a microscope is important.

Fungi are identified in several ways, depending on the type of fungus involved. Some identification methods are quick, but others take days.

Virus diseases often cause easily recognised symptoms. Some viruses can be detected in a sap sample viewed under an electron microscope. Those not directly visible can often be diagnosed by using an assay system which detects the virus indirectly.

Insects are usually identified visually, often under a microscope. However, if only juvenile stages are present, identification may be more difficult. Sometimes only the damage caused by an insect remains. This may be very characteristic for certain insects; if not, you will need to look again for the cause of the damage.

There are commercial plant health testing laboratories located in most states, some associated with state departments of primary industries. The NSW DPI has one (see details at [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au) and Chapter 16).

## Chemical testing services

Chemical laboratories test for water quality, soil fertility, plant nutrition, chemical residues, heavy metals and contaminants. They can provide a complete plant nutrition testing service to suit your particular needs.

Symptoms of nutrient deficiency or excess can usually be confirmed with a plant tissue or soil analysis. In plant tissue analysis, major and minor nutrients present in the plant are measured and compared with standards. This reveals whether any nutrients are too low or too high, enabling fertiliser type and application to be more finely tuned to the needs of the crop.

Laboratories offering a water testing service allow farmers to determine the suitability of their water for agricultural and domestic uses. Water tests provide detailed information on pH, salinity, chloride, alkalinity, turbidity, hardness, saturation index, sodium absorption ratio and electrical conductivity. Some labs can also test for pesticide residues and blue-green algae.

## Useful contacts for the use of agricultural chemicals

Australian Pesticides and Veterinary Medicines Authority (APVMA)

PO Box 6182, Kingston ACT 2604

Phone: 02 6210 4701; [www.apvma.gov.au](http://www.apvma.gov.au)



**A well equipped diagnostic laboratory has the equipment and expertise to identify the cause of a wide range of problems and suggest solutions.**

Farm chemical suppliers usually have experienced staff who can advise on products for pest and disease control. Many also have access to services for soil and leaf tissue analysis.

## Disorders

'Disorders' cover symptoms caused by non-living agents or factors, such as an adverse response by the crop to a weather event, a pesticide spray, or a nutrient deficiency or excess. The symptoms of a range of common disorders are covered later in this chapter under 'Troubleshooting'.



## ‘Lime-induced chlorosis’



**Yellowing or chlorosis of flannel flower leaves.**

A number of wildflower crops are prone to yellowing or chlorosis of the leaves, a symptom of Fe deficiency or excessive P in the crop. It is a result of too little soluble Fe in the soil or the unavailability of Fe that has been taken up to the new growth. Fe becomes less available to plants when the pH is high (above pH 7.5), and deficiency symptoms may be seen in plants that have been over-limed. Fe chlorosis can also be seen when the plant roots stop working correctly (owing to low soil temperatures, waterlogging, root death or damage caused by disease, nematodes or physical injury, or high levels of salt or ammonia in the soil). Many plants in the Proteaceae appear less able to extract Fe from the soil than others. Ensuring that the pH of the soil is between 5.5 and 6.0 can reduce the risk of this problem.

## Pruning

Regular pruning is essential to improving yields and maximising the number of high-quality blooms per plant. Pruning also makes crop management and harvesting operations easier: for example, it improves air flow through the canopy, which reduces pest and disease problems and assists pesticide spray penetration of

the canopy. Good light penetration through the canopy as a result of pruning is also important for good flower colour development.

To get the most from your pruning, you need to understand the growth habit of each species you grow and when flower buds are initiated. Information on pruning specific to South African Proteaceae can be found in Chapter 6. For most wildflower crops there are three reasons for pruning, as described below.



**Correct pruning results in your plants producing a large number of long, strong straight flowering stems—maximising your potential. The photo shows Christmas bush ready to harvest.**

## Initial pruning

Plants may need to be pruned in the first year or two of growth to establish a multi-branched plant shape and to encourage strong stem growth. This may delay flowering, but it will greatly increase subsequent yields.

## Annual pruning

Many species produce their flowers on the current season's growth. By pruning at the right time, you will promote the growth of new and strong flower-bearing stems, which will produce your next crop. This is often best done during harvesting, or immediately afterwards. Prune off excessive or diseased growth and all weak stems. The aim is to produce strong, straight, long stems for the next flowering season. If you leave a large number of shoots on the plant, flowers will be of poor quality and have short stems. However, avoid pruning too heavily, as this will weaken the plant. Do not remove more than about one-third of the plant, unless you are rejuvenating (see next section). Take care with

your timing, as pruning too late in the season may remove the next year's flowers. Bear in mind that some species produce flowers on 1-year-old growth (e.g. waratahs), so careless pruning may remove the subsequent crop.

## Rejuvenation pruning

For certain long-lived species, after a number of years, a major prune will rejuvenate the plant. Waratahs, for example, should be severely pruned every 10 years. This reduces the overall height for easier picking and encourages longer stems. As such pruning will reduce the flower yield for the next 2 or 3 years, carry out severe pruning on a rotational basis in the plantation.



**Annual pruning has shortened strong stems and removed any weak or misshapen stems.**

Cutting-grown plants and seedlings may need to be pruned differently. Seedlings of native species may have a lignotuber just below ground level. This is a disc-shaped structure from which multiple shoots can arise. Its function in the wild is to help plants survive bush-fires, when all the above-ground part of the plant is destroyed. Therefore, for rejuvenation, seedlings can be cut back to ground level, as

the plant will regenerate from the lignotuber. Cutting-grown plants do not have lignotubers, so enough of the above-ground stem must be left for dormant buds to grow. Rejuvenation pruning is best done in late winter to early spring, timed to avoid the risk of late frosts damaging newly emerging shoots.

## Troubleshooting

### Monitor regularly and identify problems early



**Check your plants often to identify problems early.**

Successful flower growing means dealing effectively with pests, diseases, the growing environment, fertiliser needs, watering etc. You need to become skilled at scouting for problems regularly (at least once a week) and working out what caused them. Only then can you decide what will be the most appropriate action, either to solve the problem or to avoid it in the future.

Get into the habit of walking right through your crops in a set pattern. Check a specific number of plants very carefully (use a 10× hand lens to look really closely!), aiming to look hard at about 1% of your plants. The number and size of the plants will affect your scouting pattern. Develop a system to record what you see.

It's important to identify the real cause of any problem in your crop so you can quickly take the right steps to correct it. First of all, define the problem—is it plant death, leaf drop, leaf spots ...? And is this the *primary* problem or a *result* of the primary problem?

**Always** compare a 'sick' plant or plant part with



a healthy one. The two tables included below suggest paths you can follow to narrow down the options. These will either help you solve the problem for yourself (perhaps with the aid of reference books) or let you discuss it more clearly with someone who can help.

Look for patterns—a pattern of **non-uniform** damage usually indicates that a living organism is the cause. A pattern of **uniform** damage generally results from non-living factors, like weather or applications of toxic chemicals.

Learn to distinguish between symptoms and signs. A **symptom** is the modified appearance of an affected plant, such as spots or burns on leaves, distorted growth or even plant death. A **sign** is the presence of the actual organism or evidence directly related to it, such as an insect, a mass of fungal growth or insect frass. In many cases you need to look at the clues provided by both symptoms and signs to solve the problem.

In addition, you may like complete the interactive scenario for wildflower growers produced by the former Centre for Native Floriculture. Go to [scenarios.sblinteractive.org](https://scenarios.sblinteractive.org) and type 'Managing Pests' into the search box.



Frass on stems can be a sign of insect borers.

## Identifying possible causes

Table 1 Narrowing the options.

The issue	What do you look for?	Questions to ask yourself
The plant	What is it?	Common name? Botanical name? Is it a perennial crop? Or is it a shorter-lived species? How does this plant normally look and grow, and where?
The problem	Which plants are affected?	Are they all plants of the same species? Or are they plants belonging to different species?  Do you see the problem regularly? Or just occasionally or even seasonally?  For how long do you see the problem? Does it change over time?
	What part of the plant is affected?	Is the problem scattered or uniform all over the plant? Does it affect the leaves—if yes, the new leaves or the old ones? Does it affect the buds or flowers? The stem? The roots?

The issue	What do you look for?	Questions to ask yourself
The appearance	Symptoms	Are the affected plant parts an abnormal colour? Can you see spots, blotches or holes? Is the plant wilting? Can you see any distorted growth or unusual out-growths?
	Insects present	Can you see any insects on or inside the plant? What about in the root zone (soil)?
	Other signs	Can you see insect droppings, webbing or 'furry' growth? Do you see 'sawdust'? Is there any stickiness on the affected parts of the plant?
The environment	Location	Where are the plants—suburb or town? What is the history of the area where they are growing—e.g. previous crops?  What has the general weather in the area been like? Are the plants in containers or growing in the ground?
	Drainage	Are the plants in raised beds? Does water lie near the affected plants after rain?
	Soil	What do you know about its texture? pH? Electrical conductivity (EC)?
	Pollution	Could there be any atmospheric or below-ground pollution sources?
	Weather	Has there recently been rain, hail, frost or a heatwave?
	Animals	Have you noticed animals such as cats, dogs, rabbits, birds, possums or wallabies among the plants?
	Nearby plants	What species are they? Are they healthy? Could they be competing with your affected plants for water, fertiliser or light?
The cultivation system	Water	What is your water source? (town, creek, bore etc.) How often are you watering?
	Mulch	Are you using weed mat? Do you have an organic mulch? If so, what type? When was it last applied?
	Fertiliser	What type of fertiliser do you use? How often do you apply it? When did you last apply it? How did you apply it?
	Pruning, disbudding etc.	When did you last prune (time of year)? How did you prune?
	Chemical sprays	What type of chemicals have you applied recently? How did you apply them? Could there have been accidental drift of a chemical onto your plants? What does the label say about using the chemical?
	Soil preparation	Was it suitable? Was it adequate?

**Table 2 Using signs and symptoms as clues.**

Sign or symptom	Possible cause	Comments
Plant is dying	Root disease, waterlogging, burn, water stress, poor-quality planting material	Check the root system—are the feeder roots dead or missing? Is the stem or collar region rotten? Are there damaged roots? Are there any signs of insects or other pests? What chemicals or fertilisers have recently been used and at what rates? Has the watering been adequate? Are the roots twisted together?
Plant is wilting	Inadequate watering, over-watering (or waterlogged soil), root disease or damage, high temperatures, low humidity, high soil salinity	Do checks as above; check temperature records and humidity; check soil conductivity.
Leaves yellow	Nutrient deficiency or toxicity, root death or damage, virus disease, toxicity	Do checks above for root problems. Check fertiliser and chemical spray (including herbicide use) records.
Leaves with areas or spots of dead tissue	Disease (fungal or bacterial, maybe viral), burn (heat, frost, high salt levels in soil, spray), toxicity (chemical)	Are spots scattered over leaves? Are all leaves affected? Are mainly older/younger leaves affected? Are spots large or small? Do they have a halo of yellow or reddish tissue around them? Is the dead tissue near the leaf margins? Does it correlate with the veins?
Splits in the stems	Disease, damage (frost, hail), pests	Is there gumming in or around the splits? Where are the splits? What cultivation has been done recently? Are there insects or animals around or evidence of them? Has there recently been hail or extremes of temperature?
Stunted growth	Virus, soil problem (toxicity, wrong pH, shallow soil, nematodes)	Check root system and underlying soil, test pH, test for virus and nematodes.
Reduced growth rate	Adverse conditions—light, heat, cold, low humidity, phytotoxicity (pesticides), poor soil aeration and drainage, nutrient deficiency, soil pH not ideal, soil salinity Pests or diseases causing root damage, or virus	Check environmental conditions and your own records, test soil for pH and conductivity, check root system, check soil moisture, look for pests or diseases.
Distorted growth	Virus, herbicide injury, insects, mites, crown gall, nematodes, fasciation, off-type plant	Check records of herbicides used recently. Have there been insects around that could have transmitted a virus? How many plants are affected? What does a typical plant look like?
Plant tissues mashed	Mechanical damage	Check records of what has been done to the crop. Look for signs of animals. Has there been a hail storm?

Sign or symptom	Possible cause	Comments
Parts of leaves, shoots or flowers missing	Insects, slugs, snails, rabbits	Look for insects, snails, animals etc. (You may need to check by torchlight as well.)
Leaves 'rolled'	Insects, spiders, cold	Unroll the leaf and look for insects or spiders. Check temperature records.
Silvery trails within leaf	Leaf miner	Check for insect larvae within the leaf.
Leaf drop	Heat or cold stress, severe toxicity	Check climate and spray records.
Stem dieback	Pests, diseases (shoot and root), injury (e.g. heat, drought, frost)	Look for evidence of pests (e.g. borers) and diseases. Check records for possible causes.
Lots of ants	Ants attracted to sweet honeydew secretions of aphids, scale or mealy bugs	Look for aphids, mealy bugs or scale insects.
Black mould on leaves and stems	Sooty mould fungus growing on honeydew	Look for insects as above.
White, brown or silvery mottling on leaves or petals	Feeding damage from mites or thrips	Look for thrips or mites—check lower leaf surfaces and flower centres, using a hand lens if necessary. Shake flowers over piece of paper and check what falls out.
Yellowing of veins	Virus, possibly toxic reaction	Check chemical spray records. How many plants are affected?
Flower or bud drop	Temperature (heat, cold), moisture stress, low humidity, ethylene, phytotoxicity (e.g. pesticides)	Check your records.
Abnormal colour or mottling of leaves or petals	Nutritional problem (deficiency, toxicity), virus, herbicide or other toxicity	How many plants are affected? Check records for incidence of insect pests, use of herbicides, fertiliser application.

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# Chapter 14. Harvest and postharvest handling

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**Bettina Gollnow, Ross Worrall and David Wood<sup>7</sup>**

When and how to pick

Postharvest management and treatments

Postharvest problems   Transport

The aim of any cut flower business is to produce high-quality cut flowers while maximising yield per unit area. To optimise the financial return from each crop, it must be fully harvested when at its best, processed, packed and delivered all the way along the marketing chain to reach the consumer in good condition. It has been estimated that 15% to 50% of all floral crops may reach consumers in less than perfect condition owing to improper care and handling following harvest.

However, because harvest and subsequent operations may represent more than half of the total costs of growing, there will be times when it is more economical not to pick at all. Examples of such times include when prices drop owing to oversupply or when the costs of getting your flowers to market could exceed your expected returns.

If you are unable to fully harvest your crop, because of poor management (such as under-estimation of labour requirements or high cost

of labour) or circumstances outside your control (such as weather), your returns will suffer.

Similarly, a lapse in quality control somewhere along the chain can make all the difference between a high-quality product reaching the market and a box of worthless rubbish.

This chapter provides a brief overview of harvest and postharvest issues related to wildflowers. In-depth information about postharvest care can be found in *Postharvest Handling of Australian Flowers from Australian Native Plants And Related Species* (2010) (see [rirdc.infoservices.com.au](http://rirdc.infoservices.com.au)).

You may also like complete the interactive guide for wildflower growers produced by the former Centre for Native Floriculture. Go to [scenarios.sblinteractive.org](http://scenarios.sblinteractive.org) and type 'Why Do Good Flowers Go Bad' into the search box.

Detailed descriptions and guidelines for harvest and postharvest care of many commonly grown products are available in the *Quality Specifications for Australia Wildflowers* (2010).

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<sup>7</sup> The information in this chapter includes information from Neil Wade first published in the Flowers and Ornamentals section of the NSW DPI website ('Postharvest care of cut flowers').



**Quality specifications are available for these wildflowers.**

ISBN	Pub. No.	Publication title	URL
978-1-74254-001-6	10/028	Flannel flower	<a href="https://rirdc.infoservices.com.au/items/10-028">https://rirdc.infoservices.com.au/items/10-028</a>
978-1-74254-002-3	10/029	Kangaroo paw	<a href="https://rirdc.infoservices.com.au/items/10-029">https://rirdc.infoservices.com.au/items/10-029</a>
978-1-74254-003-0	10/030	Black kangaroo paw	<a href="https://rirdc.infoservices.com.au/items/10-030">https://rirdc.infoservices.com.au/items/10-030</a>
978-1-74254-004-7	10/031	Baxter's banksia	<a href="https://rirdc.infoservices.com.au/items/10-031">https://rirdc.infoservices.com.au/items/10-031</a>
978-1-74254-005-4	10/032	Scarlet banksia	<a href="https://rirdc.infoservices.com.au/items/10-032">https://rirdc.infoservices.com.au/items/10-032</a>
978-1-74254-006-1	10/033	Hooker's banksia	<a href="https://rirdc.infoservices.com.au/items/10-033">https://rirdc.infoservices.com.au/items/10-033</a>
978-1-74254-007-8	10/034	Menzies' banksia	<a href="https://rirdc.infoservices.com.au/items/10-034">https://rirdc.infoservices.com.au/items/10-034</a>
978-1-74254-008-5	10/035	Hinchinbrook banksia	<a href="https://rirdc.infoservices.com.au/items/10-035">https://rirdc.infoservices.com.au/items/10-035</a>
978-1-74254-009-2	10/036	Berzelia	<a href="https://rirdc.infoservices.com.au/items/10-036">https://rirdc.infoservices.com.au/items/10-036</a>
978-1-74254-010-8	10/037	Boronia	<a href="https://rirdc.infoservices.com.au/items/10-037">https://rirdc.infoservices.com.au/items/10-037</a>
978-1-74254-011-5	10/038	Christmas bush	<a href="https://rirdc.infoservices.com.au/items/10-038">https://rirdc.infoservices.com.au/items/10-038</a>
978-1-74254-012-2	10/039	Waxflower	<a href="https://rirdc.infoservices.com.au/items/10-039">https://rirdc.infoservices.com.au/items/10-039</a>
978-1-74254-013-9	10/040	Pearlflower	<a href="https://rirdc.infoservices.com.au/items/10-040">https://rirdc.infoservices.com.au/items/10-040</a>
978-1-74254-014-6	10/041	Eucalyptus flowers	<a href="https://rirdc.infoservices.com.au/items/10-041">https://rirdc.infoservices.com.au/items/10-041</a>
978-1-74254-015-3	10/042	Grevillea flowers	<a href="https://rirdc.infoservices.com.au/items/10-042">https://rirdc.infoservices.com.au/items/10-042</a>
978-1-74254-016-0	10/043	Leptospermum	<a href="https://rirdc.infoservices.com.au/items/10-043">https://rirdc.infoservices.com.au/items/10-043</a>
978-1-74254-017-7	10/044	Leucadendron 'Jubilee Crown'	<a href="https://rirdc.infoservices.com.au/items/10-044">https://rirdc.infoservices.com.au/items/10-044</a>
978-1-74254-018-4	10/045	Safari Sunset	<a href="https://rirdc.infoservices.com.au/items/10-045">https://rirdc.infoservices.com.au/items/10-045</a>
978-1-74254-019-1	10/046	Leucadendron 'Pisa'	<a href="https://rirdc.infoservices.com.au/items/10-046">https://rirdc.infoservices.com.au/items/10-046</a>
978-1-74254-020-7	10/047	Leucospermum 'High Gold'	<a href="https://rirdc.infoservices.com.au/items/10-047">https://rirdc.infoservices.com.au/items/10-047</a>
978-1-74254-021-4	10/048	Leucospermum 'Tango'	<a href="https://rirdc.infoservices.com.au/items/10-048">https://rirdc.infoservices.com.au/items/10-048</a>
978-1-74254-022-1	10/049	Riceflower	<a href="https://rirdc.infoservices.com.au/items/10-049">https://rirdc.infoservices.com.au/items/10-049</a>
978-1-74254-023-8	10/050	King protea	<a href="https://rirdc.infoservices.com.au/items/10-050">https://rirdc.infoservices.com.au/items/10-050</a>
978-1-74254-024-5	10/051	Protea 'Pink Ice'	<a href="https://rirdc.infoservices.com.au/items/10-051">https://rirdc.infoservices.com.au/items/10-051</a>
978-1-74254-025-2	10/052	Protea 'Grandicolor' <sup>(1)</sup>	<a href="https://rirdc.infoservices.com.au/items/10-052">https://rirdc.infoservices.com.au/items/10-052</a>
978-1-74254-026-9	10/053	Honey protea	<a href="https://rirdc.infoservices.com.au/items/10-053">https://rirdc.infoservices.com.au/items/10-053</a>
978-1-74254-027-6	10/054	Blushing bride	<a href="https://rirdc.infoservices.com.au/items/10-054">https://rirdc.infoservices.com.au/items/10-054</a>
978-1-74254-028-3	10/055	Scholtzia	<a href="https://rirdc.infoservices.com.au/items/10-055">https://rirdc.infoservices.com.au/items/10-055</a>
978-1-74254-029-0	10/056	Waratah	<a href="https://rirdc.infoservices.com.au/items/10-056">https://rirdc.infoservices.com.au/items/10-056</a>
978-1-74254-030-6	10/057	Thryptomene	<a href="https://rirdc.infoservices.com.au/items/10-057">https://rirdc.infoservices.com.au/items/10-057</a>
978-1-74254-031-3	10/058	Christmas Bells	<a href="https://rirdc.infoservices.com.au/items/10-058">https://rirdc.infoservices.com.au/items/10-058</a>
978-1-74254-032-0	10/059	Gymea lily	<a href="https://rirdc.infoservices.com.au/items/10-059">https://rirdc.infoservices.com.au/items/10-059</a>

## When and how to pick

Pick only the best-quality flowers and foliage for market. Cut flowers and foliage begin to deteriorate as the reserves of moisture and food present at harvest start to run out. Correct handling will ensure the longest possible vase life:

- Do not pick a crop that is suffering from water stress. If necessary, irrigate before picking.
- Picking in the early morning is usually the best, when it is cooler. Avoid picking during the hot times of the day.
- Place stems into buckets of clean water as soon as possible after harvest, and promptly transport flowers to a cool location, e.g. a shaded packing area, which may be cooled with an evaporative air conditioner; or place buckets in a tunnel fitted with evaporative coolers.
- Take care, as allergic reactions may result from exposure to some cut flowers (for example, kangaroo paws, flannel flowers and grevilleas). This is caused by the fine hairs on the leaves and flowers or by chemicals that are naturally present in the sap. Sensitive workers, especially those handling large quantities, should wear protective clothing, especially on the forearms and hands, and perhaps a dust mask if handling flowers with many fine hairs.

## Controlling harvesting costs

Ideally, pick only when you are confident that you can actually sell the flowers for a reasonable price. This requires up-to-date market intelligence. In reality, most growers tend to pick when the crop is ready, regardless of the market.

Keep in mind that there may be times when it is more economical not to pick rather than selling your product at below cost, especially on the export market, where extra costs can accumulate before your product is actually sold.



**Pick only the best-quality flowers and foliage for market.**



**Sleeved bunches of uniform appearance appeal to buyers and ensure that the flowers arrive in good condition. You need a well organised packing shed to achieve the required presentation.**

The first thing to do is to minimise the number of handling steps for the flowers. As a rule of thumb, it has been estimated that every time a stem is handled, an extra cost equal to the cost of growing the flowers is added. Give pickers clear instructions on how flowers are to be picked, graded, bunched and packed. Make it

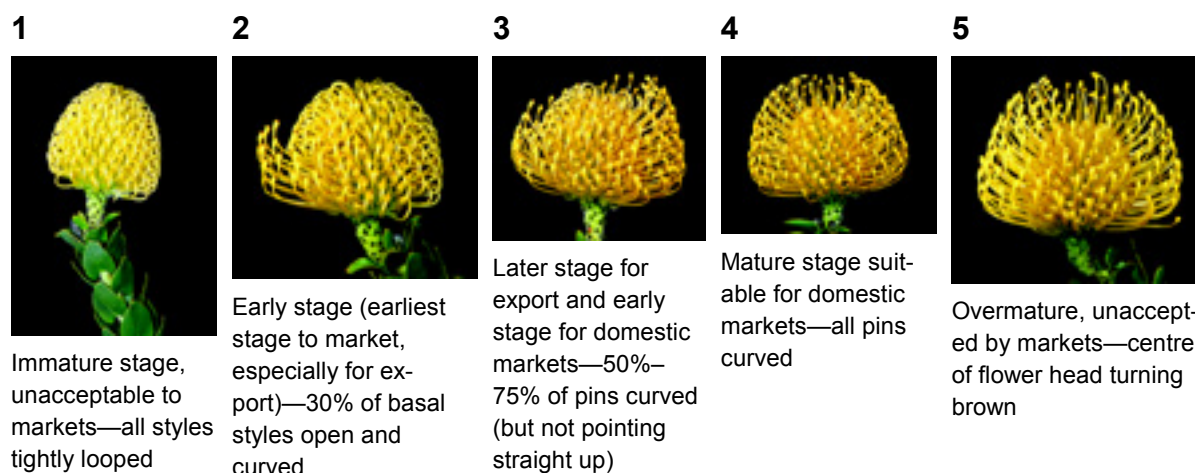
easy for pickers to put flowers into buckets or trays and on trailers. Avoid excessive bending and heavy lifting by placing buckets on a raised platform or trailer. Organise an efficient way for the flowers to be collected from the plantation and taken to the packing shed.

In the packing shed, make sure the flow of flowers is even, to avoid flowers piling up and staff either waiting or being rushed. To do this you need an efficient workflow with plenty of tables, mechanical aids if necessary, and racks or trolleys to move lots of buckets and cartons around on. Good working conditions, with proper lighting, are also needed.

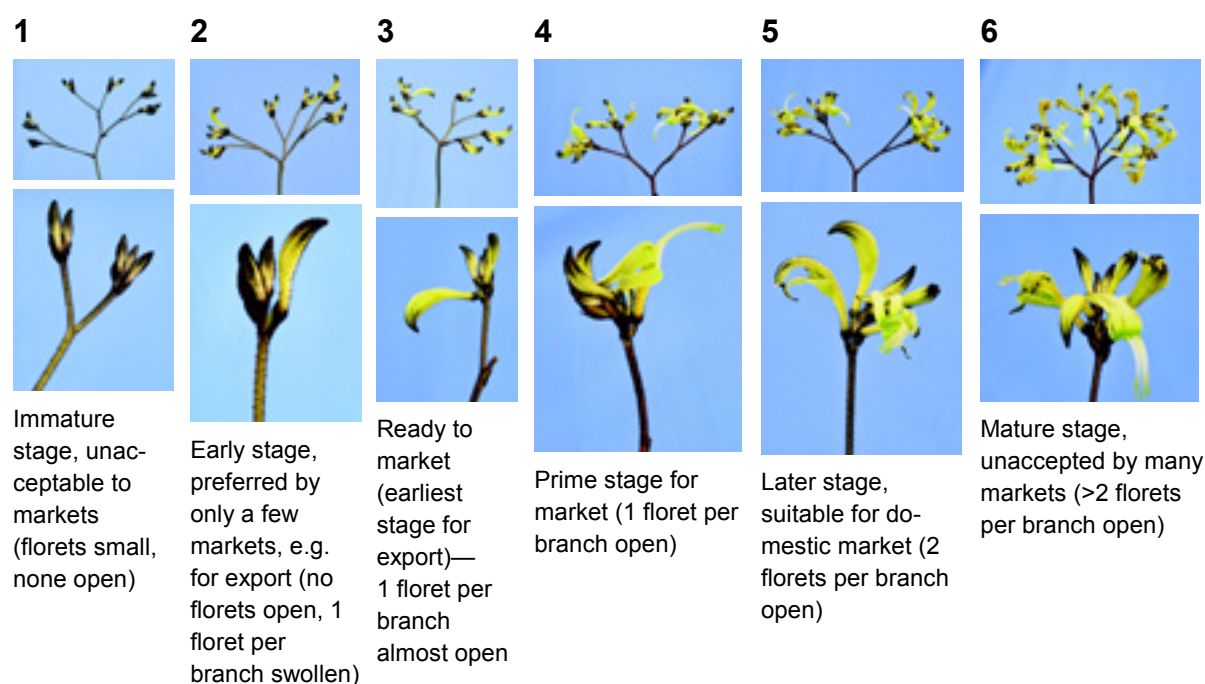
## Flower maturity

Some flowers are cut while still in bud or when partly open in order to make storage, packing and transport easier and to prolong market availability. Pay attention to the weather, time of year, and mode and duration of transport, because most flowers will continue to open during transport. You must consult with your target market to ensure that the flowers arrive at the desired stage. Consult the 'Quality Specifications for Australia Wildflowers' (2010) for guidance.

### Example 1: *Leucospermum* 'High Gold' flowers.



### Example 2: *Macropidia* flowers.



Cut the flower only at a stage after which the buds can fully open.

Flowers for the domestic market should be marketed at a more open bud stage than flowers that are destined for export.

Different markets require flowers at different stages of maturity, so check with your wholesaler or exporter for details.

## Postharvest management and treatments

### Temperature and humidity

Temperature management is as much a management tool as a technical handling aid. Temperature affects the rate of transpiration (water loss) from plants, and therefore postharvest decline. To ensure a good vase life, you need to cool flowers rapidly after picking—this is called removing the field heat. You must then hold them at low temperatures.

The holding temperature is very important. Cool rooms should be kept at high relative humidity (95% or greater), or flowers should be wrapped in a vapour barrier (for example, plastic) to avoid drying out. For most flowers, a suitable storage temperature is between 1 and 4 °C. Species that grow naturally in tropical climates need warmer storage temperatures (minimum 10 °C, maximum 12 °C) to avoid injury.

A properly operating cool room also increases management flexibility. With cooling, flowers can be picked at optimum maturity and held over for market, instead of being allowed to deteriorate on the bush.

Once the flowers are dispatched to market, you clearly have less control over the temperature. Fluctuating temperatures during transport are one reason cut flowers may reach the market in poor condition, even though they may have been in a top-quality condition when they were packed. Small temperature loggers may help to determine when the temperatures are getting too high; these are especially useful in shipments of flowers for export.

### Postharvest treatments

Most flower and foliage products are very sensitive to drying out, especially those with a large leaf area. Many native Australian and South African flower lines have woody stems, and tend to need more water. You can reduce water loss by storing at low temperatures and maintaining high humidity (95%) in the cool room or package. Under these conditions, you can hold stems either wet (in buckets of water, preferably with an added biocide or commercial postharvest solution) or dry (wrapped and packed inside boxes).

The water you put in the buckets must be clean, that is, free of bacterial contamination. Commercial postharvest solutions are available, designed to be added to your buckets. These maximise water uptake and flower freshness.

You should also regularly clean your buckets with a biocide.

### Food supply and sugar solutions

In a living plant, starch and sugars (carbohydrates) are stored in stems, leaves and flowers. These stored foods are needed to sustain the cut flower after harvest, and to allow flowers picked in bud to open. Feeding sugars to cut flowers can supplement the food reserves of the flower; this is a common practice with traditional flower crops.

Sugar solutions are not always beneficial for wildflowers, and must be used with care (for example, they should always include a registered biocide). Some flowers that do benefit from sugar are kangaroo paws and Christmas bells. You can prolong the postharvest life or flowering display of such flowers by pulsing them (giving them a 'boost of energy' with sugar) after picking. This involves putting the stems in a sugar solution (the content varies with the flower, and you may need to do trials to determine the optimum level for your flowers), usually for 12 to 16 hours.

This topic is dealt with in detail in *Postharvest Handling of Australian Flowers from Australian Native Plants and Related Species* (2010).



## Disinfestation

Managing pests and diseases effectively in your plantation will reduce the likelihood of pests and diseases remaining on harvested stems. However, flowers destined for export **must** be disinfested of any insects and treated with a fungicide solution if they are to be held for any length of time (to reduce the risk of botrytis flower rot). This is because plant material leaving Australia for most of our major overseas trading partners has to be inspected carefully when it leaves Australia and again when it reaches its destination for any living insects or diseases. If you send material with insects, some export agents may check and disinfest your shipment at your cost before it leaves Australia. Not all agents have this facility, and if something slips through and it is discovered in the destination country, their quarantine service will disinfest or destroy the entire shipment and you may get a much larger bill!

Remember that exporters usually consolidate product from several farms to maximise airfreight efficiencies, so this means that several growers' products may be in the one shipment. Exporting growers must each work to the same standard, or one person's bugs may cause the destruction of the whole shipment.

Currently, one of the most economical and effective ways to disinfest the flowers after picking, especially for export, is with a dip containing the fungicide iprodione (for example, Rovral) and the insecticide deltamethrin (e.g. Cislin). This procedure is permitted under the APVMA Minor Use Permit 12785 (expires 30 June 2016). However, dipping can leave moisture on the product, which can be a problem in some hairy-leaved species and delay packing.

### Postharvest dip for the control of quarantine pests

Australian Pesticides and Veterinary Medicines Authority Permit 12785. Current 7 April 2011 to 30 June 2016. For all states of Australia. For a copy, go to [www.apvma.gov.au](http://www.apvma.gov.au).

Products containing 10 g/L deltamethrin as the only active constituent:

Cislin® Residual Insecticide, or  
Barmac Delta Force Insecticide, or  
Insectigone® Insecticide

and

products containing 500 g/L iprodione as the only active constituent:

Rovral® Aquaflo Fungicide, or  
Farmoz Civet® Aquaflo Fungicide

Directions for use and critical comments

Rate: Mix 250 mL product containing deltamethrin per 100 L of water.

Mix 100 mL product containing iprodione per 100 L water.

Flowers must be totally immersed in the diluted solution for not less than 1 minute and left to dry naturally for 2 hours.

Withholding period: Not required if used as directed.

Unless otherwise stated, the use of these products must be in accordance with the instructions on their labels—for example, but not exclusively, 'Safety Directions'—as listed.

## Grading and packing

This is the last stage at which you can perform simple and low-cost quality checks. Cull any unsaleable stems and sort and grade the remainder according to market requirements (including stem length, diameter, flower size and maturity, bunch size, bunch ties and sleeves). Discard anything that does not come up to standard or does not meet order specifications. Check for insect and fungal damage, especially if the stems have been stored.

Specific cut flower standards or specifications have been developed for 32 commonly grown wildflowers. See the *Quality Specifications for Australia Wildflowers* (2010).

Flowers are often sold in sleeves, which protect the flowers, improve market appeal and make packing easier. This is done after dipping and drying of the stems. Select the sleeve size according to the bunch size.

There are differing requirements for the export and local markets. You can package flowers for the local market in anything that works for you. Most florists and agents don't seem to care what type of box or buckets you use, so long as the product arrives in good condition. For transport over short distances, stand your bunched and sleeved flowers in buckets of clean water.



For longer distances and for export, bunches are usually packed firmly so they will not move and be damaged. Pack even-graded bunches per box; do not include thick- and thin-stemmed bunches together. Make sure the presentation is neat and tidy and the count is correct. For some types of flowers, a carton liner of paper or plastic film that is folded over the stems will give added protection. The liner increases humidity, reducing water loss from the stems. It also reduces absorption of water vapour by the carton, thus helping to maintain the strength of the package. Avoid liners if the flowers are susceptible to botrytis rot or overheating.

For the export market, packing is more rigorous. A range of boxes rated from about 1 kg to about 16 kg (nominal weights only) are available. These boxes are strong, are easy to pack,

palletise well, display the flowers well, and have holes for forced-air cooling or fumigation. Each exporter has access to a range of boxes, often branded with the exporter's name, which are sold to growers. Or you can get your own boxes specially made.

When packing the bunches in the box, get the right balance between fitting as many flowers as possible in but avoid putting in so many that they get damaged, look terrible or overheat. You can't mix flower types, stem lengths or different qualities or grades in the one carton. Some growers use sleeves or sheets of plastic or paper to separate bunches or layers of flowers, preventing them from interlocking and getting damaged. An increasing range of 'long-life' packaging and films is becoming available to assist growers.



**Flowers need to be firmly packed in boxes so they don't move around in transit and get damaged. However, over-packing boxes can also cause damage and other problems. Here some stem ends are packed against the ends of the carton to help hold the other bunches in place, away from the ends of the box. This is called 'using stem breaks'.**

It is important to get as many flowers as possible into the transport space, because airfreight rates are usually calculated on volume rather than on actual weight, and flowers are light. For 800- to 900-mm stems of *Boronia heterophylla*, a 4.5-kg box will take about 40 to 60 stems. For 700-mm stems of *Eremophila nivea*, a 1.5-kg box will fit about 40 stems. If you are packing short-stemmed varieties, often it pays to put the flower heads at either end of the box, with the stems in the middle.

Cool flowers as soon as possible after packing them. A forced-air cooling system can reduce the time to cool a box of flowers packed at 20 to 25 °C down to 2 °C from as long as 72 hours to a mere 20 minutes.

## Postharvest problems

### Air embolisms

Air embolisms result when small air bubbles are drawn into the stem at cutting or during dry storage. They effectively block later flow of water up the stem, and the flower wilts. You can remove embolisms by cutting off, at an angle, the lower 3 cm of the stem while the stem remains under water. The water must be replaced frequently. Dirty water causes stem blockage and reverses the benefit of cutting under water. Placing stems into acidic water and using warm water (40 °C) also help reduce the occurrence of air embolisms.

## Physiological and bacterial plugging

When plant cells are wounded by cutting, the plant naturally produces substances to seal the wound. These substances can block water flow. This blockage is called physiological plugging.

Woody stems are more prone to bacterial plugging. Bacteria and other microbes that plug stems may be present even in tap water, but are most abundant in vase, bucket and recutting water that is not replaced regularly, or in water that has been put into dirty containers.

## Ethylene

Ethylene gas is released by ripening fruit, leaf and stem trimmings, burning wood and cigarettes, and is present in motor vehicle exhausts. Several Australian native flowers are known to be sensitive to ethylene, which damages them or reduces their vase life. These include waxflower, *Verticordia* and *Grevillea*. Some varieties or species of a listed genus are less sensitive, or even insensitive, to ethylene; for example, some waxes. Not all wildflowers have been tested.



**Most varieties of waxflower are ethylene-sensitive. Postharvest treatment with a commercial anti-ethylene product will protect the flowers from damage.**

Where sensitivity of flowers to ethylene is a problem, commercial products can protect the flowers from accidental exposure during handling. You will find more information in *Postharvest Handling of Australian Flowers from Australian Native Plants and Related Species* (2010) and the *Quality Specifications for Australian Wildflowers* (2010).

## Mechanical damage

Product quality is reduced when bruised and broken flowers, leaves and stems are present. Wounding can cause ethylene to be released and give disease organisms access.

## Pests and diseases

Export product in particular may need to be fumigated or dipped to meet phytosanitary requirements. Pests and diseases present in an export shipment of cut flowers may result in the shipment being condemned, or re-fumigated at the grower's expense.

Many flowers are susceptible to grey mould fungus (*Botrytis cinerea*). This disease may be latent, and develop only during shipping. Grey mould is favoured by free moisture on the flowers and foliage. Wildflowers that produce lots of nectar may be more susceptible. You may need to dip the cut flowers in an appropriate fungicide before shipping.



**Effective preharvest management of pests like scale insects is important. Aim to avoid marketing flower stems with insects present, especially those destined for export markets.**

## Transport

Ideally flowers should always travel in refrigerated transport, but this is not always achieved. You should pre-cool the flowers before the truck's arrival. Once the flowers leave your hands, they are out of your control, so it is important to know that your flowers are being handled by capable people. It is also important to ensure that the flowers are transported quickly, kept cool, handled gently and not exposed to heat or ethylene (e.g. from gas forklifts or ripe fruit). After transporting to their destination, flowers may need to be re-cooled and re-cut and placed into fresh, clean water.

Several transport firms will deliver from regional areas to a major international airport such as Sydney or direct to export agents or freight forwarders. Not all have refrigerated trucks, and

with some there may be several transshipments required to get to the airport. It is unlikely that you will find a transport company with a daily service that you can rely on, so you have to plan your harvesting around their schedules. In addition, export agents have their own schedules based on airfreight movements and overseas auction times, so getting the coordination right can be a juggling act.

To monitor your product's transport, you can pack compact dataloggers with the freight to track temperature variations for the duration of the trip. These can provide very valuable data to pinpoint supply chain problems, but retrieving them for downloading can be problematic. However, if your products are arriving at their destination in less than perfect condition, they may be an ideal way of finding out where problems are occurring.

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# Chapter 15.

## Recommended reading and sources of information

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**Bettina Gollnow**

General references on wildflower growing

Individual species

Potting mixes, soils, plant nutrition, mulches

Plant propagation   Water quality and irrigation

Managing pests, diseases and weeds

Harvest and postharvest care

Farm business management   Industry magazines

Specialist bookshops   Library services

Other information sources   The Internet

An ever expanding range of information dealing with Australian native and South African flower and foliage crops is available. Look on the Internet, and consult specialist magazines and information centres, general booksellers and specialist horticultural bookshops. As a commercial flower grower you need to keep up to date with developments in the production and postharvest care of the crops you grow and of potential crops. You should also be reading about business and marketing skills.

The list below is intended as a guide only, and any omissions are unintentional. Many titles cover traditional flower crops or traditional

flowers plus some wildflower species. Contact specialist booksellers for help in locating specific books or topics.

An excellent source of information is the Rural Industries Research and Development Corporation (RIRDC). It publishes a range of information on the wildflower industry, including short and detailed reports on research projects it funds. See [www.rirdc.gov.au](http://www.rirdc.gov.au) for details.

## General references on wildflower growing

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Proceedings of the 7th Australian Native Flower Conference, Brisbane, 26–27 May 2005. Flower Association of Queensland, PO Box 327, Cleveland Qld 4163. [www.flowersqueensland.asn.au](http://www.flowersqueensland.asn.au).

The Australian wildflower industry—a review, 1997, 2nd ed. Report by Karingal Consultants for RIRDC.

Carson C et al. 2000. Should I grow wildflowers? Agrilink Horticulture Series QAL 0001. DPI, Brisbane. Contact Agrilink Manager, PO Box 5269 SCMC, Nambour Qld 4560.

Coates, B. 1987. Flower arranging Australian natives and how to grow them. Kangaroo Press, Sydney.

Cover, M. 2008–2010. Interactive scenarios developed by the former Centre for Native Floriculture, University of Queensland, Gatton. Go to [scenarios.sblinteractive.org](http://scenarios.sblinteractive.org) and type the name of the scenario into the search box:

- 'I think I want to grow native flowers'
- 'Why do good flowers go bad?'
- 'Smart marketing – the way to success'
- 'Developing new plants for marketing'
- 'Pest & disease management issues in native flower plantations'

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Johnson K, Burchett M, eds. 1996. Australian plants—their horticulture and uses. UNSW Press, Sydney.

Matthews L. 1993. The Protea growers handbook including leucadendrons, banksias and grevilleas. Simon & Schuster, Sydney.

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Salvin S, Bourke M, Byrne T, eds. 2004. The New Crop Industries Handbook. Pub 04/125. RIRDC. [rirdc.infoservices.com.au](http://rirdc.infoservices.com.au) (includes chapters on banksias and other Proteaceae, *Blandfordia*, *Boronia*, *Eucalyptus*, flannel flower, kangaroo paw, NSW Christmas bush, smokebush, *Thryptomene*, tropical rainforest foliages and wax flower; and costs of production).

Wrigley J, Fagg M. 1993. Bottlebrushes, paperbark and tea trees. Harper Collins.

Wrigley J, Fagg M. 1998. Australian native plants—a manual for their propagation, cultivation and use in landscaping, 3rd ed. Collins Angus & Robertson, Sydney.

## Individual species

### *Acacia*

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Maslin B. 2001. Acacias of Australia. CSIRO Publishing / ABRS. CD-ROM. PO Box 1139, Collingwood Vic 3066.

Sedgley M, Horlock F. 1998, 'Acacias, cut flowers and foliage', in The new rural industries—a handbook for farmers and investors, RIRDC, Canberra.

### *Baeckea*

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## ***Banksia***

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Sedgley M. 1998. 'Banksias', in The new rural industries—a handbook for farmers and investors. RIRDC, Canberra.

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WA Dept Agriculture and Food. 2007. The *Banksia* production manual. 3 Baron-Hay Court, South Perth WA 6151.

## ***Blandfordia***

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## ***Boronia***

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- 'Proteas in perspective—pruning'. How to prune proteas, leucadendrons and leucospermums from an early stage right through to the mature bush.
- 'AFPGA exporting workshop'. How to prepare your product for the export market.
- 'AFPGA production workshop'.
- 'AFPGA nutrition workshop'. Learn about soils and the necessary nutrients to be added to the soil on *your* property.
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## Industry magazines

### **Australian Flower Industry Magazine (quarterly)**

PO Box 327, Cleveland Qld 4163  
Phone: 07 3824 9516; Fax: 07 3826 3094  
[www.australianflowerindustry.com.au](http://www.australianflowerindustry.com.au)

### **Australian Horticulture (monthly)**

Rural Press Magazines  
PO Box 254, Moonee Ponds Vic 3039  
Phone: 03 9287 0900; Fax: 03 9370 8300

### **FloraCulture International (bi-monthly)**

P O Box 1081, 1430 BB Aalsmeer  
The Netherlands  
[www.floracultureinternational.com](http://www.floracultureinternational.com)

## Specialist bookshops

There are several specialist horticultural booksellers. Several offer a mail order service or a customised list of titles within your areas of interest. Those in the Sydney region include:

### **Florilegium Press**

65 Derwent Street, Glebe NSW 2037  
Tel: 02 9571 8222

### **Johima Books**

PO Box 226, Menai Central NSW 2234  
Tel: 02 9541 4791; Fax: 02 9543 1710

### **The Gardens Shop**

Royal Botanic Gardens, Mrs Macquaries Road  
Sydney NSW 2000  
Tel: 02 9231 8125

## Library services

The State Library and your local library can access literature and computer databases worldwide. For a fee, you can have a search done to list publications in your area of interest. Your library will also arrange book loans from other libraries.

## Other information sources

*Flower Register Australia* is a directory of flower growers, wholesalers, products and services. It is published annually by Rural Press, PO Box 160, Port Melbourne Vic 3207.

## The Internet

Many organisations and service providers have Internet sites which provide a wealth of information. Search on 'Australian flower industry'.

See also industry association websites listed in Chapter 16.

### **Australian National Botanic Gardens, Canberra**

[www.anbg.gov.au](http://www.anbg.gov.au)

### **Australian Native Plants Society (Australia)**

The society (formerly known as the Association of Societies for Growing Australian Plants, ASGAP) caters to people interested in the cultivation, propagation, conservation and appreciation of Australia's native flora.

[anpsa.org.au](http://anpsa.org.au)

### **Chain of Life**

The Chain of Life Network is a comprehensive assembly of information that can be used by growers, wholesalers, florists, supermarkets, brokers, breeders, importers, educators, bouquet manufacturers, associations, students and floral supply companies to improve the performance of cut flowers and greens; cuttings and plugs; and foliage, flowering and bedding plants. Floral marketing and consumer information is also included. Over 448 floral crops are listed with specific postharvest care, handling, botanical and historical information. A picture of each plant or flower is provided.

[www.chainoflife.com](http://www.chainoflife.com)

### **Market Fresh—Melbourne Market Authority**

The flower section contains a lot of useful information.

[www.marketfresh.com.au](http://www.marketfresh.com.au)

### **Nursery and Garden Industry Association of Australia**

The NGIA is the peak industry body for the Australian nursery industry. Their website includes a list of useful related websites.

[www.ngia.com.au](http://www.ngia.com.au)

### **Rural Industries Research and Development Corporation (RIRDC)**

RIRDC manages R&D investments on behalf of the Australian Government and industry. The site contains information on RIRDC research programs and publications.

[www.rirdc.gov.au](http://www.rirdc.gov.au)

## State government departments

### **NSW Department of Primary Industries**

The home page contains a searchable collection of online Primefacts and other publications. The horticulture section contains a subsection on flowers and ornamentals. Many publications produced by the former NSW Agriculture have moved across to this website. To locate specific publications, like the Agfacts and Agnotes listed in this chapter, try searching for the title using the 'search' function, or check the general category (for example 'water and irrigation' to find information on water quality and irrigation).

[www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)

### **Northern Territory Department of Primary Industries, Fisheries and Mines**

[www.primaryindustry.nt.gov.au](http://www.primaryindustry.nt.gov.au)

### **Queensland Department of Primary Industries**

[www.deedi.qld.gov.au](http://www.deedi.qld.gov.au)

### **Primary Industries and Resources, South Australia**

[www.pir.sa.gov.au](http://www.pir.sa.gov.au)

### **Department of Agriculture and Food, Western Australia**

[www.agric.wa.gov.au](http://www.agric.wa.gov.au)

### **Department of Primary Industries Victoria**

[www.dpi.vic.gov.au](http://www.dpi.vic.gov.au)

### **Tasmania Department of Primary Industries, Water and Environment**

[dpiw.tas.gov.au](http://dpiw.tas.gov.au)



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# Chapter 16. Government and industry contacts, consultants and other sources of assistance

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**Bettina Gollnow**

State government agencies   Federal government agencies

National allied industry organisations

National wildflower industry organisations

Other information sources

Consultants   Market prices

Agricultural chemical, fertiliser and associated product resellers

Manufacturers of agricultural chemicals   Suppliers of fertilisers

Commercial suppliers of beneficial insects

Soil and plant testing laboratories

## State government agencies

A fast way to get information about the various state government departments and their services is to go to your relevant state government website; for example, for NSW go to [www.nsw.gov.au](http://www.nsw.gov.au), then select 'Quick links'—'A–Z NSW govt agencies'.

This section refers to NSW agencies, but it illustrates the broad range of services likely to be available in your state. Be aware that in all

states there are likely to be changes from time to time, with agencies being renamed or moved into other departments.

## Department of Education and Training (DET)

DET administers training through TAFE NSW and also has training and industry programs, including small business programs (see [www.det.nsw.edu.au](http://www.det.nsw.edu.au) for details).

## Office of Environment and Heritage

The NSW OEH oversees environmental regulation, sustainability, biodiversity and native vegetation, coastal protection and Aboriginal cultural heritage.

[www.environment.nsw.gov.au](http://www.environment.nsw.gov.au)

OEH includes several agencies of interest to the wildflower industry:

- The Environment Protection Authority (EPA), which regulates air emissions, contaminated sites, dangerous goods and hazardous materials, noise, pesticides, forestry activities, waste and water quality.
- The Wildlife Licensing and Management Unit of the NPWS, which administers the 'Protected and Threatened Plants in the Cut Flower Industry—Sustainable Management Plan 2008–2012'. This plan describes management procedures, including licensing, aimed at ensuring sustainable harvesting of native species. Growers and marketers of Australian native species need to be aware of their obligations under this plan.  
Go to [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au) and search for 'plant licensing FAQs'.
- The Botanic Gardens Trust:  
[www.rbgsyd.nsw.gov.au](http://www.rbgsyd.nsw.gov.au).

## Local Government (local councils)

The NSW Division of Local Government provides links to your local council. Contact your local council for information on zoning, development applications, and dam and other building approvals. Information about local government acts and regulations can be obtained at [www.dlg.nsw.gov.au](http://www.dlg.nsw.gov.au).

## Primary Industries (DPI)

This includes a number of agencies, covering agriculture, forests, minerals and petroleum, and the Office of Water. Agriculture includes the services listed below.

[www.industry.nsw.gov.au](http://www.industry.nsw.gov.au)

## Diagnostic services

Diagnostic laboratories provide plant pathogen and insect identification. Specialist plant pathologists and entomologists have the backing of the Agricultural Scientific Collections Unit, which houses Australia's largest collection of agriculturally significant insects, fungi and plant bacteria.

The chemistry laboratories test for water quality, soil fertility, plant nutrition, chemical residues, heavy metals and contaminants.

## Biosecurity

Under the NSW Biosecurity Strategy, NSW DPI and other partners—such as the Department of Environment and Climate Change, the NSW Food Authority, NSW Health, Livestock Health and Pest Authorities, primary producers and the general public—work together to manage biosecurity threats and problems across the State. Biological threats and problems include both land-based and aquatic plant and animal diseases, pest animals, and insects and weeds.

## PROfarm courses

PROfarm is a training program developed to meet the needs of farmers, primary industries, agribusiness and the community. Courses are delivered locally. Many of the courses are subsidised to reflect the public benefits provided by the adoption of more sustainable farming practices.

## Irrigation officers

Irrigation officers are located around the State to help irrigators increase farm water use efficiency, maintain and enhance irrigated productivity, minimise environmental impacts of irrigation, and further enhance the sustainability of the NSW irrigated agricultural sector.

## NSW Office of Water

The NSW Office of Water is responsible for the management of the State's surface water and groundwater resources. It provides information on water policy, water sharing plans, water availability and allocations, monitoring, modelling, environmental flows, ecology and water quality, water licensing, approvals and trading, metropolitan water and country town water.

[www.water.nsw.gov.au](http://www.water.nsw.gov.au)

## Department of Trade & Investment

This is the first point of contact within government for companies wishing to do business in Sydney and regional NSW. This agency also hosts a small business website, which posts information relevant to flower growers.

[www.business.nsw.gov.au](http://www.business.nsw.gov.au)

## Rural Assistance Authority

The NSW Rural Assistance Authority provides assistance to rural producers and small business in regional NSW through programs that encourage self-reliance and adaptation to change. It administers a wide range of assistance measures to the rural sector, both Commonwealth and state funded. Although the core client is the rural sector, the Authority is also responsible for small businesses that have suffered loss or damage due to natural disaster.

Phone: 1800 678 593 or 02 6391 3000.

[www.raa.nsw.gov.au](http://www.raa.nsw.gov.au)

## WorkCover Authority

WorkCover promotes workplace health and safety, and provides a worker's compensation system for employers and workers. It administers and enforces compliance with occupational health and safety, injury management and worker's compensation legislation, and manages the worker's compensation system.

[www.workcover.nsw.gov.au](http://www.workcover.nsw.gov.au)

## Federal Government agencies

### Department of Agriculture, Fisheries and Forestry (DAFF)

Areas of activity include natural resource management, water property rights, climate change, rural policy and innovation, industry development, market access and biosecurity, product integrity, plant health, and quarantine and export services (see AQIS below).

[www.daff.gov.au](http://www.daff.gov.au)

### Australian Quarantine and Inspection Service (AQIS)

Within DAFF, AQIS provides quarantine inspection for the arrival of international passengers, cargo, mail, animals and plants or their products into Australia, and inspection and certification for a range of animal and plant products exported from Australia. AQIS has regional offices throughout Australia.

Free call from within Australia: 1800 020 504.

[www.daff.gov.au/aqis](http://www.daff.gov.au/aqis).

### Austrade (Australian Trade Commission)

Austrade helps Australian companies win overseas business for their products and services by reducing the time, cost and risk involved in selecting, entering and developing international markets.

Austrade is represented in over 50 countries and has an extensive network throughout Australia. It offers practical advice, market intelligence and ongoing support (including financial) to Australian businesses looking to develop international markets.

[www.austrade.gov.au](http://www.austrade.gov.au)

### Export Market Development Grants

The EMDG scheme is a financial assistance program for aspiring and current exporters. Administered by Austrade, the scheme aims to encourage small and medium-sized Australian businesses to develop export markets. EMDG reimburses up to 50% of expenses incurred on eligible export promotion activities (see [www.austrade.gov.au](http://www.austrade.gov.au)), above a \$10 000 threshold, provided that total expenses are at least \$20 000.

### Australian Bureau of Statistics

The ABS is Australia's official statistics organisation. It assists and encourages informed decision-making, research and discussion within government and the community by providing a high-quality, objective and responsive national statistical service.

Because of the complexity and range of data available from the ABS, your questions can

often best be answered over the phone. ABS's National Information and Referral Service, staffed by trained consultants, can be called from anywhere in Australia on 1300 135 070.

## **Australian Customs and Border Protection Service**

Customs manages the security and integrity of Australia's borders. It works closely with other government and international agencies, in particular the Australian Federal Police, AQIS, the Department of Immigration and Multicultural and Indigenous Affairs and the Department of Defence, to detect and deter unlawful movement of goods and people across the border.

GPO Box 858, Canberra ACT 2601

Phone: 1300 363 263

[www.customs.gov.au](http://www.customs.gov.au)

## **Australian Pesticides and Veterinary Medicines Authority (APVMA)**

APVMA is the Australian Government authority responsible for the assessment and registration of pesticides and veterinary medicines and for their regulation up to and including the point of retail sale.

APVMA administers the National Registration Scheme for Agricultural and Veterinary Chemicals in partnership with the states and territories and with the active involvement of other Australian government agencies.

Its role is to independently evaluate the safety and performance of chemical products intended for sale, making sure that the health and safety of people, animals and the environment are protected. Only products that meet these high standards are allowed to be supplied. APVMA does not register products if their use is likely to jeopardise trade or if they don't work.

To ensure that only products that meet APVMA requirements are actually supplied, APVMA constantly monitors the market for compliance. It also reviews older chemicals to make that they continue to meet current high standards.

[www.apvma.gov.au](http://www.apvma.gov.au)

## **Department of Sustainability, Environment, Water, Population and Communities**

The DSEWPC administers the *Environment Protection and Biodiversity Conservation Act 1999*. This legislation provides a national framework for environment protection through a focus on protecting matters of national environmental significance and on the conservation of Australia's biodiversity.

The Australian Government requires that growers and exporters have permits to export certain native flower products, and insists that state regulations be complied with. For more on export permits go to [www.environment.gov.au](http://www.environment.gov.au) and look under 'import and export of wildlife'.

## **Horticulture Australia Ltd**

HAL is a national R&D and marketing organisation. It works in partnership with individual horticultural industries on strategic planning and on developing and managing programs that address the needs of the industry, now and into the future. Through HAL, horticultural industries are able to access matching Commonwealth Government funding for all R&D activities.

[www.horticulture.com.au](http://www.horticulture.com.au)

## **Rural Industries Research and Development Corporation (RIRDC)**

RIRDC works closely with Australian rural industries on the organisation and funding of their R&D needs. RIRDC supports several programs related to the cut flower industry, including the Wildflowers and Native Plants Program, where its objective is to improve the profitability, productivity and sustainability of the Australian wildflower and native plant industry.

For the Wildflowers and Native Plants Program, the RIRDC website includes full and short reports on completed projects, a list of currently funded projects and industry objectives, and details of publications available for purchase.

[www.rirdc.gov.au](http://www.rirdc.gov.au)

## National allied industry organisations

### AgSafe Ltd

Agsafe Ltd is an independent subsidiary of [CropLife Australia](http://www.croplifeaustralia.org.au) (the national body for the plant science industry). Agsafe implements three industry stewardship programs: the Agsafe Accreditation and Training Program, drumMUSTER and ChemClear.

[www.agsafe.com.au](http://www.agsafe.com.au)

drumMUSTER is the national program for the collection and recycling of empty, cleaned, non-returnable containers for crop protection and animal health chemicals.

[www.drummuster.com.au](http://www.drummuster.com.au)

ChemClear is the industry-funded national program for the collection and disposal of unwanted, registered chemicals. The objective of the program is to minimise the accumulation of unwanted rural chemicals on farm, which may pose risks to the environment, public health and trade. The program features a web-based booking system and free-call number.

[www.chemclear.com.au](http://www.chemclear.com.au)

### CropLife Australia

CropLife Australia represents the developers, registrants, manufacturers and formulators of plant science solutions for use in agriculture and the management of pests in other settings.

[www.croplifeaustralia.org.au](http://www.croplifeaustralia.org.au)

## National wildflower industry organisations

### WildFlowers Australia Ltd (WFA)

This is a company formed by a leading group from the wildflower industry, with representation from all states of Australia. One of its main objectives is to enhance the profitability and viability of the Australian wildflower industry.

WFA aims to help growers, flower wholesalers, exporters and importers, buyers such as florists, and allied industry members such as plant

growers, by supplying information on services and to create a forum for meetings, conferences and discussion about the challenges facing the industry.

[www.wildflowersaustralia.com.au](http://www.wildflowersaustralia.com.au)

## Flower and wildflower industry organisations and networks

### NSW

#### Australian Native Flower Growers and Promoters

PO Box 4327, East Gosford NSW 2250

#### Blandfordia Research & Extension Group

Contact: Lyn Johnson

Email: [myallausflowers@bigpond.com](mailto:myallausflowers@bigpond.com)

#### Flower Growers Group of NSW

Contact: Denis Secco

Email: [denis@secco.com.au](mailto:denis@secco.com.au)

[www.australianflowercouncil.org.au](http://www.australianflowercouncil.org.au)

#### GrandiFlora Growers Pty Ltd

A group of NSW and interstate growers who support the GrandiFlora brand.

[www.grandifloragrowers.com.au](http://www.grandifloragrowers.com.au)

#### Native Flower Grower's Association Inc. (Mid North Coast)

[www.australiannativeflowers.com.au](http://www.australiannativeflowers.com.au)

#### NFG Co-op

[www.goldengecko.com.au](http://www.goldengecko.com.au)

#### Wildflower Industry Network NSW Inc.

Contact: Frank Allatt

Email: [fallatt@bigpond.net.au](mailto:fallatt@bigpond.net.au)

### Western Australia

#### Wildflower Growers of WA

08 9651 4147

#### WA Protea Growers Association

08 9755 1147

### Victoria

#### Flowers Victoria

03 9207 5552

[www.flowersvic.com.au](http://www.flowersvic.com.au)



## Queensland

### Flower Association of Queensland

All flowers

07 3824 9516

[www.flowersqueensland.asn.au](http://www.flowersqueensland.asn.au)

### Cairns Regional Flower and Foliage Group

07 4093 7048

## South Australia

SA Flower Growers Association

c/o SA Farmers Federation

08 8232 5555

## Northern Territory

North Australian Cut Flower Group—mainly tropical flowers

08 8988 1771

[www.cutflowers.net.au](http://www.cutflowers.net.au)

## Other information sources

### Australian National Botanic Gardens

GPO Box 1777, Canberra ACT 2601

Tel: 02 6250 9450; Fax: 02 6250 9599

[www.anbg.gov.au](http://www.anbg.gov.au)

### Australian Native Plants Society (Australia)

ANPSA (formerly the Association of Societies for Growing Australian Plants, ASGAP) caters to people interested in the cultivation, propagation, conservation and appreciation of Australia's native flora. They host state and regional events. Their online magazine, *Australian Plants Online*, features several hundred articles reproduced from the society's newsletters. These cover all aspects of propagating and growing Australian native plants.

ANPSA consists of seven affiliated regional societies, one in each of the six states and the seventh in the ACT. Each regional group is independent and is responsible for managing the affairs of ANPSA within its geographical area. Each publishes a quarterly newsletter for

its members, and there are regular regional meetings featuring expert speakers on a range of topics related to Australian flora.

More information is available at [anpsa.org.au](http://anpsa.org.au).

## Nursery & Garden Industry Australia

This is the peak industry body for the Australian nursery and garden industry. It is responsible for overseeing the national development of this diverse and essential industry. You will find links to the various state associations on its website: [www.ngia.com.au](http://www.ngia.com.au).

## Related industry associations in NSW

(Look for similar organisations in your state.)

### NSW Farmers' Association

The NSW Farmers' Association is a voluntary industry body representative of the whole farming community in NSW.

[www.nswfarmers.com.au](http://www.nswfarmers.com.au)

### Livestock Health and Pest Authorities

(formerly the Rural Lands Protection Board)

[www.lhpa.org.au](http://www.lhpa.org.au)

### Professional Florists Association of NSW

PO Box 231, Sydney Markets 2129

## Consultants

The Yellow Pages, industry magazines and *HortGuide* include lists of agricultural consultants (see 'Farm & agricultural advisory services' and 'Horticultural consultants').

Further information can be obtained by searching the Internet for 'Australian agricultural consultants'. One organisation is the Australian Accredited Agricultural Consultants (AAAC). This is the national organisation which represents the interests of professional agricultural consultants in Australia.

AAAC-accredited consultants and advisers in agri-industry and allied natural resource areas are professionals who provide a high standard of advice and abide by a code of ethics. The

Consultants' Section of the Australian Institute of Agricultural Science and Technology (AIAST) assesses the capabilities of aspiring consultants and recommends those that meet the standards for entry into the Consultant's Register. AAAC members must maintain membership of the AIAST. Go to [www.aiast.com.au](http://www.aiast.com.au) to locate a consultant near you.

The people listed below have experience in the wildflower industry.

**Paul Dalley**

Mountain Nursery  
Trappaud Road, Kempsey NSW 2440  
Phone: 02 6562 7450; mobile: 0432 590 496  
Email: [paul@mountain-nursery.com.au](mailto:paul@mountain-nursery.com.au)

**Audrey Gerber**

Qbloom Pty Ltd  
Email: [audrey@gerbermail.com.au](mailto:audrey@gerbermail.com.au)

## Market prices

The Sydney Market Reporting Service provides details of flower prices at the Sydney Flower Market, Flemington. Call them for an application form for daily, weekly or monthly data and to discuss your specific information requirements.

**Chris Cope**

Phone: 02 9746 3437 or 0416 108 639  
Fax 02 9746 1075  
Email: [chris@sydprod.com.au](mailto:chris@sydprod.com.au)  
[www.sydprod.com.au](http://www.sydprod.com.au)

## Agricultural chemical, fertiliser and associated product resellers

These companies may also advise on crop diseases and pests and on soil and tissue tests. Check the Yellow Pages for resellers.

## Manufacturers of agricultural chemicals

Many companies market a wide range of agricultural chemicals. They provide advice on technical aspects like Material Safety Data Sheets (MSDS), chemical formulations and spray mix compatibilities. MSDS contain details about precautions for use (including re-entry times), safe handling, manufacturers' contacts, health effects and first aid.

**Barmac Industries Pty Ltd**

[www.barmac.com.au](http://www.barmac.com.au)

**Bayer CropScience Pty Ltd**

[www.bayercropscience.com](http://www.bayercropscience.com)

**Colin Campbell (Chemicals) Pty Ltd**

[www.campbellchemicals.com.au](http://www.campbellchemicals.com.au)

**Cropcare Australasia Pty Ltd**

[www.cropcare.com.au](http://www.cropcare.com.au)

**Farmoz Pty Ltd**

[www.farmoz.com.au](http://www.farmoz.com.au)

**Nufarm Australia Ltd**

[www.nufarm.com.au](http://www.nufarm.com.au)

**Organic Crop Protectants Pty Ltd**

[www.ocp.com.au](http://www.ocp.com.au)

**Scotts Australia Pty Ltd**

[www.scottsaustralia.com.au](http://www.scottsaustralia.com.au)

**Syngenta Crop Protection Ltd**

[www.syngenta.com.au](http://www.syngenta.com.au)

## Suppliers of fertilisers

**Barmac Industries Pty Ltd**

[www.barmac.com.au](http://www.barmac.com.au)

**Colin Campbell (Chemicals) Pty Ltd**

[www.campbellchemicals.com.au](http://www.campbellchemicals.com.au)

**Incitec Pivot Ltd**

[www.incitec.com.au](http://www.incitec.com.au)

**NutriTechSolutions (NTS)**

[www.nutri-tech.com.au](http://www.nutri-tech.com.au)

**Paton Fertilizers Pty Ltd**

[www.paton.com.au](http://www.paton.com.au)

**Scotts Australia Pty Ltd**

[www.scottsaustralia.com.au](http://www.scottsaustralia.com.au)

## Commercial suppliers of beneficial insects

Contact Australasian Biological Control Inc. for general information on integrated pest management, commercial biological control agents, and commercial suppliers and consultants.

Phone: 1800 000 160

[www.goodbugs.org.au](http://www.goodbugs.org.au)

## Soil and plant testing laboratories

A number of government and commercial laboratories provide plant health diagnostic services or conduct soil and leaf analyses. Correct identification of pests, diseases and nutritional problems in your crop is critical to allowing you to choose the most appropriate management.

Regular soil and tissue tests are important management tools to help ensure you don't use too much or too little fertiliser. Get these tests done at least once a year. When choosing a laboratory to do these tests for you, select one that includes an **interpretation** with the results.

Be aware that there are no published nutritional standards for most wildflower crops for a lab to compare your results with.

To find an accredited soil and plant tissue laboratory near you, go to the website of the Australasian Soil and Plant Analysis Council ([www.aspac-australia.com](http://www.aspac-australia.com)). ASPAC is an independent international organisation consisting of individuals, laboratories, and research and commercial organisations involved in soil and plant analysis. It promotes the adoption of:

- appropriate field sampling protocols
- uniform and reliable soil and plant analytical methods
- sound interpretation guidelines
- the most reliable and appropriate advice to clients.

Most state departments of agriculture or primary industries offer plant health testing as well as soil and plant tissue analytical services. Check the relevant website for information on current services, sample submission forms and charges.

Tests and services available in NSW include:

- plant health diagnosis
- specialist plant disease, insect and mite identification
- chemical analysis of irrigation water and hydroponic solutions
- water analysis for plant pathogens
- nutrient analysis of plants and soil
- analysis of chemical residues in plants, soil and water.

Plant health diagnostic services may also be available through your state botanical garden—for example, in NSW, the Royal Botanic Gardens have a plant pathology laboratory, which offers plant disease diagnosis, fungal isolation, pest identification, molecular identification of pathogens, on-site plant consultancies, advice and treatment recommendations.

Mrs Macquaries Road, Sydney NSW 2000  
[www.rbgsyd.nsw.gov.au](http://www.rbgsyd.nsw.gov.au) (see 'laboratories')

Phone: 02 9231 8189; Fax: 02 9241 1135

## Getting Started in Wildflower Growing

By Bettina Gollnow

Pub. No. 12/O90

This guide provides advice aimed at assisting potential wildflower growers to make a realistic assessment of their capacity to enter the industry and be successful. It also provides information on all aspects of setting up a plantation and then the growing, harvesting and postharvest handling of wildflowers (flowers and foliage from native Australian and South African species).

This 'how to' guide has been produced for potential and new members of the Australian wildflower industry who plan to grow and market wildflowers commercially.

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RIRDC books can also be purchased by phoning 1300 634 313 for a local call fee.



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