Acacia Cut Flower & Foliage Production Manual

This manual is based on a report for the Rural Industries Research and Development Corporation by Francha Horlock and John Faragher Institute for Horticultural Development, Knoxfield, Agriculture Victoria and Rod Jones National Flower Centre, Melbourne Markets

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Foreword

Market research, optimal plant propagation, and development of special postharvest handling techniques to increase vase life, have resulted in successful test marketing in Japan of Acacias as an export cut flower crop.

Although there are approximately 700 species of Acacia endemic to Australia, very little is grown here as cut flowers or foliage. Ironically, Acacia has proved successful in Europe, grown in southern France and Italy, and sold as a cut flower under the name of Mimosa.

Its success as a cut flower in Europe indicates the huge potential of this genus as a commercial crop in Australia, particularly when it is considered that the European industry is based on only two or three species, grown under adverse conditions on grafted rootstock.

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Peter Core
Managing Director
Rural Industries Research and Development Corporation
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Executive Summary

Although there are approximately 700 species of *Acacia* endemic to Australia, very little is grown here as cut flowers or foliage. Ironically, *Acacia* has proved successful in Europe, grown in southern France and Italy, and sold as a cut flower under the name of Mimosa.

Its success as a cut flower in Europe indicates the huge potential of this genus as a commercial crop in Australia, particularly when it is considered that the European industry is based on only two or three species, grown under adverse conditions on grafted rootstock.

Market research, optimal plant propagation, and development of special postharvest handling techniques to increase vase life, have resulted in successful test marketing in Japan of *Acacias* as an export cut flower crop.

The most promising *Acacia* species tested included *A. buxifolia*, *A. pravissima*, *A. retinodes*, *A. baileyana*, *A. cultriformis*. It was established that flowers were best picked in bud, with five per cent and 20 per cent of inflorescences/buds open. For best results during transport, the flowers were wrapped in perforated sleeves or polyethylene box liners, with the stem ends placed in moistened floral foam. Then the flowers were packed in fibreboard boxes. After transport, to optimise flower life, stems should be recut and placed in a standard commercial preservative solution.

The Japanese market appears eager and ready to buy good quality, Australian–grown *Acacia* flowers which have a total life span of more than seven days in Japan.

For Australian–grown *Acacia* to be successful on the international market, the flower industry must adopt the recommended postharvest treatments and select clones with long flower life.

The researchers plan to assist exporters with further trial shipments and believe also that good quality *Acacia* should be promoted on local flower markets in Australia.
1. Introduction

1.1. The genus *Acacia*

The *Acacia* (Mimosaceae) genus contains over 1200 species with world wide distribution in South America, India, Africa and Australia. Australia, with over 700 endemic species possesses the greatest amount of species diversity for the genus. A small number of species are also found in parts of Indonesia, and on some of the islands of the Pacific and the Indian oceans. Throughout the world *Acacia* mainly occur in subtropical and arid regions where they grow in savanna or open woodland communities. In Australia *Acacia* are widespread, inhabiting all communities except alpine and most rainforest areas.

1.2. A history of its uses

Indigenous Australians have used *Acacia* plants for tool making, as a food source and for medicinal purposes. Foods derived from *Acacia* species have included the gum, the roots which are cooked and flours which are made from ground seeds, which have been pre-soaked and roasted. Early settlers and aboriginals have used the bark of *A. pycnantha* and *A. decurrens* and the gums of other species for medicinal purposes. Bark has also been used for tanning leather. The foliage of some *Acacia* species has also been utilised as a fodder for livestock during times of drought when regular food sources are in shortage. These do however cause impaction when they are the only source of food.

1.3. Commercial uses today

Today, products from a number of *Acacia* species are utilised commercially in Australia and throughout the world. The timber of species such as *A. melanoxylon* is highly valued for building and furniture making, and lower quality timbers from other species have been used for fence construction. Plantations of fast growing Australian *Acacia* species are being planted in developing countries as a source of firewood, where population growth has led to the depletion of the native tree species which were the traditional fuel source. The seeds of some species are being collected from the bush and from plantation grown plants for the Australian bush food industry. A number of species are grown for their ornamental value as landscape plants, for the cut flower and foliage industry and research is being conducted into the suitability of some species as flowering potted plants.

Australian *Acacia* species (mainly *A. retinodes* and *A. dealbata*) marketed as 'Mimosa' have been grown as a commercial cut flower and perfume crop in France and Italy since 1918, and interest in the production of *Acacia* as a cut flower and foliage crop is growing in Australia. *A. baileyana purpurea* is grown in Israel for its cut foliage, and *Acacia* is also grown in the USA as a cut flower.
2. Plant and Flower Structure

2.1. Plant form

Species within the genus *Acacia* occur as short or long lived woody perennials, taking the form of small shrubs, climbers and tall trees. The majority of *Acacia* species however are short lived, having a life expectancy of 7 to 25 years. Desert species, which develop more slowly, are often longer lived, many reaching 50 years or more, and some tree species, such as *A. melanoxylon* have a long life span of 100 years or more.

Seedlings of *Acacia* produce divided leaves. The leaves of mature *Acacia* either persist as divided leaves or at plant maturity seedling leaves of many species develop into phyllodes, which are entire flattened leaf structures.

2.2. Flower arrangement

*Acacia* flowers are arranged into inflorescences, that are spherical (ball shaped) or cylindrical (rod shaped), are located at axillary or terminal positions on branches, and inflorescences are arranged either into spikes or racemes. The flower consists of the outer whorl, the calyx (either separate or fused sepals) and an inner whorl, the corolla (composed of separate or united petals). The stamens are enclosed within the corolla, and enclosed inside the stamen is the ovary. The flowers are usually cream, yellow or orange in colour, although there are some species which have purple or pink flowers (*A. purpureapetala*). Flower colour is provided by the stamens, which are the most distinctive feature of the floral display. Most Australian *Acacia* produce flowers in winter (June) and spring (October), but rain often induces arid zone species to come into flower at other times. *Acacia* flowers are pollinated by insects, such as wasps and beetles and sometimes by birds and mammals, and the European honey bee seems to be a major pollinator of *Acacia* flowers since it's introduction to Australia.

2.3. Fruit and seed development

After pollination, the ovary develops into a legume fruit, which contains a number of seeds, the seed coats of which are hard and resistant to water penetration. For germination to take place, the seed coat requires scarification, to allow water to enter the seed and germination to proceed. Scarification of the seed is usually achieved by exposure to high temperatures (ie fire or boiling water treatment) or surface abrasion of the seed coat either manually or by machine.
3. Floral Development

Temperature, water availability and light intensity impact on floral development in *Acacia*. The following information is summarised from Sedgley (1989) and Parletta and Sedgley (1996).

3.1. Temperature

Research has shown that cool temperatures are required for flowers of some species to develop. At day temperatures of 25°C and night temperatures of 20°C, the flower buds of *Acacia pycnantha* and *A. drummondii elegans* are still produced, but further development of flowers at these temperatures is inhibited and the buds are shed. For these buds to come into flower, night temperatures of 15°C or lower must be achieved. The floral development of other winter-spring flowering *Acacia* species may also be temperature dependant and so in regions which do not experience night temperatures below 15°C, floral development may not proceed.

3.2. Light intensity

Low light intensity can also inhibit flower development. The floral development in *Acacia pycnantha* was greatly reduced in plants grown under 30% light conditions. So growers should be aware of this and ensure that light levels are maintained at acceptable levels for flowering. So avoid planting crops in the shade of other trees.

3.3. Water

Some *Acacia* species, especially those which occur in the arid zones of Australia, will come into flower after it has rained, regardless of the time of year. *Acacia aneura* is an example of this. It has been found that well watered plants of *A. pycnantha*, in cultivation have the ability to produce flower buds or flower all year round. However, the dominance of seasonal flowering in most *Acacia* species, despite variability in rainfall, indicates that flowering is more closely tied to temperature and photoperiod.
4. How is Acacia Utilised in Horticulture?

4.1. Landscape plants

Acacia have long been used in ornamental horticulture as landscape plants, this can be attributed to their fast growth rates, diversity of leaf forms and growth habits and the attractive display of bright flowers they produce, often in winter, a time when there is little else in flower. Due to their rapid growth rates Acacia are often used as screen plants or in wind breaks, in the landscape situation. Unfortunately, many Acacia which have fast growth rates are also short lived, 10 to 20 years. This problem can sometimes be overcome by maintaining a pruning regime from a young age, so that plants remain dense and do not become woody and over mature. Low growing species such as A. acinacea and A. drummondii, or prostate forms of usually upright growing species such as A. baileyana, are grown in gardens for their ornamental value. Species possessing pungent phyllodes (A. verticillata) or spinescent stipules (A. paradoxa) are excellent bird habitat plants. There may be potential for some species to be used as flowering pot plants and research has been conducted on this by Parletta and Sedgley (1995, 1996).

4.2. Cut flower and foliage production

The European industry

Australian Acacia species grown and marketed in Australia show great potential as a new cut wildflower crop and foliage line. Acacia, with their bright fluffy flowers and attractive foliage are established in Europe as a cut flower. In Europe they are marketed as 'Mimosa', and are a popular flower during the European autumn and winter. The European mimosa industry distributes the majority of flowers within Europe, but has sent small numbers to Japan. The Japanese have shown interest in mimosa, but are generally unhappy with the European product, as it often arrives in poor condition (dried out or crushed) due to the long freight period. Australia has a number of advantages over European producers in the Japanese market. The air travel time from Australia to Japan is around 12 hours, compared to 24 hours from Europe. With over 700 species of Acacia indigenous to Australia, we possess a vast genetic resource for the selection of clones with naturally long life, and the opportunity to select species which are new and unusual to maintain market interest in mimosa.

The European mimosa industry has been in operation in France and Italy since 1918. Today it is centred in the hills behind Cannes, on the French Riviera, and the growers have formed a co-operative, European Mimosa Pty. Ltd., which handles the distribution and marketing of mimosa. There are currently about 300 ha in cultivation and approximately 500 tonnes of mimosa was sold in Europe in 1988/89 with a total value of approximately A$800,000. There are 35 growers in European Mimosa, who supply product from mid September until early March. Production ranges from 1.5 tonnes per day early in the season to a peak of 9t/day in February. Plants have become naturalised in this region over the years and the locals consider them to be a native flower. Cultivars of superior forms have been selected for local production, and the majority of production is in A. dealbata 'Mirandole' and 'Gaulois', and 'Floribunda', which is a selection of A. retinodes. Growers pick branches in yellow bud, then force branches into full flower, and deliver to European Mimosa, where branches are stored for one to four days, depending on demand. These are then sent to markets throughout Europe, and a little to the USA. Very little product is sent to Japan, as transit time is in excess of 24 hours, and the mimosa often arrives dry and unattractive. It is also interesting to note that in 1992 New Zealand started to export small quantities of mimosa to Japan.
A developing industry in Australia

The introduction of a new range of *Acacia* species would greatly enhance the Australian cut flower export industry. Australian cut flower exports have risen dramatically in the past 13 years, from approximately $1.2 million (1983) to $30 million in 1995/96. It is necessary, however, to introduce new cut flower products to ensure the growth in sales continues. *Acacia* would likely be used as a filler in floral bouquets, and therefore has a similar market potential to Geraldton Wax, the most popular flower exported from Australia at the moment. The introduction of several *Acacia* species as new cut flower crops exported to Japan, U.S.A and Europe (off season) could, therefore, potentially add $3 to $4 million in export earnings pa., equivalent in value to Geraldton Wax.
5. Market Research and Species Selection

5.1 Market research

Market research was conducted by the Institute for Horticultural Development and exporter Austwinds as part of the RIRDC funded project "Developing Native Acacia Species as an export cut flower crop" (Horlock, Faragher, Franz and Jones 1997). This market research was conducted for the Japanese market, Australia's largest and most demanding export market. It was assumed that the Australian market would initially be small but could grow as quality flowers become more available. Japanese importers and consumers were presented with a series of high quality colour photos and asked to select the flower colours and morphologies of flowers and leaves they most preferred.

Japanese importers and florists prefer:
- Round, 'ball-shape' flowers to the longer, 'brush-shape'.
- No preference was given on leaf shape, but long, thin, strappy leaves, such as those of A. retinodes are very popular as they are ideal for Japanese floral arrangements.
- The heavy scent common in many Acacia species is not wanted.
- Importers expressed a clear preference for pale, lemon-coloured flowers from July until early November. They would also take good quality pale coloured Acacia flowers from late January onwards, and A. retinodes fits this category.
- Darker yellow-orange flowers are in demand from mid December until the end of December.

The Japanese market is currently supplied by:
- Acacia (sold as Mimosa) is currently exported to Japan from Europe, as well as grown locally in the Chiba area (between Narita airport and Tokyo).
- Local growers supply the market from January until April, particularly with A. baileyana.
- Europeans supply the market from mid-December until May.
- A good opportunity exists for Australian Acacia in the Japanese Autumn period from September until mid-December, where good quality Acacia with total flower life of more than 10 days, ie a vase life of more than seven days, can compete with local grown and European grown product.

There may also be markets in USA and Europe. However, there needs to be market research to see whether these markets want Acacia outside their normal season and to determine whether the likely prices would make export profitable.

There appears to be an opportunity to increase sales on the Australian markets. If flowers are given the best postharvest pulse solutions and handling they can have an acceptable vase life and florists and consumers could take advantage of the brilliant golden flowers. Wattle Day could be revived and used to promote Acacia as a cut flower (Norton and Saunders, 1997). The idea that wattles inside bring bad luck apparently dates back to English settlers who didn't want Australian bush flowers inside!
5.2 Which species are suitable?

Based on the market survey of Japanese importers, a number of *Acacia* species have been selected and assessed for suitability for cut flower production. Selection criteria included species possessing globular flowers, with the required flower colour, that flower in the period of June to December, are not heavily scented, and are readily propagated and cultivated. If Australian product is of high quality and arrives in Japan in top condition, it could compete well with European mimosa, and there are *Acacia* species which do flower from December until May, e.g., *A. retinodes*.

Importantly, all species and clones which show promise need to be assessed for postharvest longevity. Only species or clones with a total postharvest flower life of 7 days (for local markets) and 10 days or more for export markets (after treatment with a postharvest solution consisting of a non-ionic detergent, a germicide and sugar) should be considered as being suitable as cut flowers.

There is great variability in the vase life of stems cut from different trees of the same species. Some of this may be due to genetic factors. Therefore it is important that plants with flowers of long life are selected and propagated.

The following species have been identified for cut flower production in south-eastern Australian conditions, for local and export markets; *A. baileyana* and *A. baileyana* ‘Purpurea’, *A. buxifolia*, *A. cultriformis*, *A. pravissima*, *A. merinthophora* and *A. retinodes*. These species grow well in the south east and flower readily.

There may be many other species which possess the desired characteristics, that have not been tested, because they are not available to us here in south-eastern Australia or because they will not grow here. As a potential grower of *Acacia* you should keep your eyes open in your local area, looking for *Acacia* species which meet some or all of the selection criteria. It is also a good idea to talk to your local nursery supplier and see which species they have in stock or can get hold of. Ask if they have any suggestions on species which may be suitable.

When it does come to planting do it on a trial basis in the beginning. Trial a small number of few different species and test the same species on different parts of your property, i.e., on different soil types, flat land, sloping land, frost protected and frost prone areas, to work out which species are best suited to your area and in which parts of your farm they will perform the best.

You should also do vase life trials on the flower stems when they are produced to see whether the flowers are suitable as a cut flower. Harvest the flowers as described in section 10, Postharvest care of cut flowers and foliage, and then ask yourself:

- Do the flowers have a strong scent? If so they may not be suitable as cut flowers.
- Are the stems of marketable length (60 cm or longer)?
- Do the flowers produce an attractive display and are there enough flowers per stem?
- Do the flower buds continue to open after harvest?
- Do the flowering stems have a flower life of 10 days or more?
- Do the leaves remain attractive and fresh looking?
- If the flowers are for export to Japan, are they ball shaped and what colour are they?
6. Promising Species

6.1 A. baileyana and A. baileyana 'Purpurea'
- The Cootamundra wattle

*A. baileyana* is a widely cultivated plant, which is fast growing and can easily escape into surrounding areas. It's natural distribution is the Cootamundra district of NSW, but it has become naturalised on the central coast and tablelands of NSW, and in parts of Victoria, SA and Queensland. It forms a small to medium sized tree of up to 10 metres. Its leaves are divided, and are feathery and fern-like in texture, and are blue grey in colour. The new season's growth of *A. baileyana* 'Purpurea' is purplish in colour, which makes it attractive as a cut flower or foliage. Adaptable to most well drained soils, *A. baileyana* will tolerate short periods of waterlogging and will also tolerate moderate coastal exposure. The flowers are bright yellow and ball shaped and produce a massive display of colour in mid winter. The flowers are produced all the way along the stems, terminally and in the leaf axils.

The standard form of *A. baileyana* is grown in Japan for the cut flower trade and so is not seen as a novelty product. The purple form of *A. baileyana* which is less common may have more appeal. When trying to access plants of *A. baileyana* 'Purpurea', it would be wise to obtain plants that have been grown from stem cuttings or those that have been grafted using material from a parent plant which is purple, as seedlings are not all true to type and a large proportion of these plants may not be purple when they grow to maturity.

*A. baileyana* does not have as long a vase life as some of the other species, often because the large leaves look unattractive when they dry out.

6.2 A. buxifolia - Box-leaf wattle

*A. buxifolia* is a highly ornamental species, with attractive flowers and foliage. *A. buxifolia* has a wide distribution, spreading from southern Queensland along the western slopes and northern and southern tablelands of NSW and into north eastern Victoria as far as Omeo. It forms an open, rounded, medium shrub of 2 to 4 metres, but can be kept down with pruning. Branches can be yellow-brown or red in colour and are often covered in a grey coating, which looks attractive. Phyllodes are blue-grey, 10-35 mm long and can be small and narrow or wider and rounded in shape. The new growth on some plants can be purplish in colour. A profusion of fluffy, golden yellow ball shaped flowers are produced in spring. The flowers are presented in the leaf axils along the majority of the stem and contrast well with the foliage and stems.

*A. buxifolia* can be readily propagated from seed, but has also been successfully propagated from stem cuttings taken from soft tip growth after flowering and fruiting have been completed. *A. buxifolia* is variable in form, and types with the shorter, more rounded phylloide shape are better suited to cut flower production, as the phyllodes are more attractive and the flowers on this type seem to be larger and more fluffy. To ensure that plants have good stem and phylloide colour and intensity of flowering, plants should be propagated from stem cuttings.

Plants require a moist, well drained soil but can tolerate short periods of waterlogging or dryness, and are frost tolerant. Prolonged waterlogging will lead to leaf drop and possibly to plant death.
A. *buxifolia* has a good vase life, the leaves remain attractive and even when the flowers wilt the inflorescence still looks attractive.

### 6.3 A. *cultriformis* - Knife-leaf wattle

*A. cultriformis* is distributed along the western slopes of NSW, spreading from near the Victorian border and northward to Queensland. *A. cultriformis* is a medium to tall shrub of 2 to 4 metres, of open habit, producing long straight or pendulous branches. The phyllodes are triangular in shape, blue green in colour, and thick and leathery in texture. The flowers are golden yellow, short, rounded spikes which appear globular. These are produced in the leaf axils at the ends of the flowering stems in spring.

*A. cultriformis* is readily propagated from seed, and cutting propagation is possible but can be difficult. For growing, plants require a well drained soil and are very drought and frost tolerant. With it's attractive blue green foliage stems of *A. cultriformis* could be used for their foliage as well as for cut flower production. In postharvest trials flowers hold up well and because of the relatively large size, the flowers still look good a few days after the stamens have started to dry out.

*A. cultriformis* has a good vase life, the leaves remain attractive and even when the flowers wilt the inflorescence still looks attractive.

### 6.4 A. *pravissima* - Ovens wattle

*A. pravissima* can be found in scattered populations on the south coast and southern tablelands of NSW and the eastern highlands of Victoria, in the Bright and Mitta Mitta regions. It forms a tall shrub to small tree of up to 7 metres, of dense habit. The branches can be upright or pendulous and the bark is often red in colour. The phyllodes which are blue green in colour, are densely packed on the branches, and are triangular in shape. Masses of globular, bright yellow flowers are produced at the leaf axils at the ends of the flowering stems from early to late spring.

New plants are easily propagated from seed or from cuttings taken from soft tip growth in the summer. A popular landscape plant, *A. pravissima* will grow in a range of soil types and climatic conditions, is frost tolerant and will survive periods of drought. With it's attractive foliage and floral display *A. pravissima* could be used for cut flower or foliage production.

*A. pravissima* has a good vase life, the leaves remain attractive and even when the flowers wilt the inflorescence still looks attractive.

### 6.5 A. *merinthophora* - sometimes known as zig-zag wattle

*A. merinthophora* is a highly ornamental species, native to WA. A medium shrub of 3 to 4 metres in height, the branches are zig-zagged in shape from node to node and are pendulous. The dark green phyllodes are fine and terete to 300 mm long and 1 mm wide, with a curved point. The golden yellow flowers are short and rod shaped up to 150 mm in length and are borne directly on the flowering stem at the leaf axils in winter to spring.

*A. merinthophora* is readily propagated from seed and is mainly grown for it's cut foliage, with or without it's flowers. The flowers will dry and remain yellow. A well drained soil is required, of light to medium structure. Plants will withstand extended dry periods but they are frost tender, particularly when young. Once established they may tolerate light frosts.

### 6.6 A. *retinodes* - Wirilda, Swamp wattle, Silver wattle
A. retinodes is found throughout most of Victoria, except the north-east and north-west, and also grows in SA, and on the islands of the Bass Strait. It forms a large shrub to small tree, up to 8 metres tall, of medium density, which opens up with age, as the branches become woody. The phyllodes are long and narrow in shape, usually around 30 to 200 mm long and 3 to 15 mm wide and dark green or dark blue-green in colour. The flowers are pale to brighter lemon yellow in colour and are produced in the leaf axils along the flowering stem. The main flowering periods are in summer and autumn, but flowers can be produced throughout the year.

A. retinodes can be propagated from seed or can be vegetatively propagated by grafting the desired clone onto an A. retinodes seedling rootstock. It may be possible to propagate from stem cuttings.

A. retinodes will grow in most soil types, will tolerate short periods of waterlogging and slightly saline soils. It is very tolerant of coastal conditions and will tolerate moderate frosts. Psyllids are persistent pests, sucking on the new leaf and stem growth and these need consistent control once observed.

A. retinodes has a good vase life, the leaves remain attractive and even when the flowers wilt the inflorescences remain attractive.

6.7 Other species

A. lanigera, the woolly wattle, with it's medium sized, bright, yellow-orange, ball shaped flowers also shows potential as a cut flower. Initial simulated transport trials with A. lanigera have produced good vase life results, and stems remain attractive after the stamens have dried out.

A podalyriifolia which possesses attractive grey foliage also shows potential as a cut foliage line, but there are problems with leaf damage caused by leaf miners.

A. floribunda, a species with yellow rods, or brushes, is reported to have a good vase life, probably because it remains attractive even when the stamens have wilted.

Table 1. Cut Flower Acacia species

<table>
<thead>
<tr>
<th>Species</th>
<th>Flower colour type and flowering time</th>
<th>Leaf type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. baileyana</td>
<td>Balls, golden yellow. Early July to mid August.</td>
<td>Divided</td>
<td>Not such a long life. Already grown in Japan.</td>
</tr>
<tr>
<td>A. baileyana puapurea</td>
<td>Balls, golden yellow. Early July to mid August.</td>
<td>Divided</td>
<td>Main use foliage.</td>
</tr>
<tr>
<td>A. cultriformis</td>
<td>Shortrods, like balls, yellow-orange. September..</td>
<td>Simple</td>
<td>Mass display of flowers; good vase life. Flowers or foliage.</td>
</tr>
<tr>
<td>A. erectophora</td>
<td>Shortrods, golden yellow. June to August.</td>
<td>Simple</td>
<td>Main use foliage.</td>
</tr>
<tr>
<td>A. pruvissima</td>
<td>Balls, lemon yellow. Early August to late September.</td>
<td>Simple</td>
<td>Mass display, good life, flowers or foliage.</td>
</tr>
<tr>
<td>A. retinodes</td>
<td>Balls, lemon yellow. Main period December to February, but sometimes September to October.</td>
<td>Simple</td>
<td>Good vase life, foliage is attractive in some markets.</td>
</tr>
</tbody>
</table>
7. Seed Propagation and Germination

7.1 Germination and propagation

Conventionally *Acacia* are propagated from seed, as many species are propagated readily and reasonably quickly by this method. *Acacia* seed is often dormant, as it does not germinate when exposed to conditions that are generally conducive to germination (adequate levels of temperature, light and moisture). This dormancy is due to the hard seed coat, which is impermeable to water. For dormancy to be broken and germination to take place, the seed coat must be physically damaged, thus allowing water to enter the seed, and begin the germination process. A number of techniques are used to pre-treat seeds for germination.

*Treatment with hot or boiling water*

The water temperature and the duration of exposure to the heated water varies from species to species. While optimum treatments will enhance germination rates, excessive temperature or treatment times can actually damage seed and reduce seed viability and germination. In some species an increase in susceptibility to fungal attack has been noted after hot water treatment.

*Manual or machine scarification*

This is where part of the seed coat is removed by cutting or rubbing and care must be taken not to damage the embryo or cotyledons inside. Manual scarification is slow, labour intensive and cannot be carried out on a commercial scale, and machine scarification requires machinery that is expensive and may not be specifically designed for the treatment of *Acacia* seed.

Table 2. has been adapted from Cavanagh 1987 as well as containing some information on seed germination collected from work performed at IHD, Knoxfield. It lists seed pre-treatments and cultural conditions utilised in the germination of some *Acacia* species.

It should also be noted that there are some *Acacia* species which do not require seed pre-treatment for germination to take place, these include, *A. peuce*, *A. harpophylla*, *A. argyrodendron* and *A. cambagei*.

After the method of pre-treatment has been identified, the seed should be sown in a seed raising mix of 1 part sand, 1 part perlite and 1 part peat. Some species require germination in the dark and others will germinate under light conditions. A dark environment can be created by spreading a fine covering of the seed raising media (which can be sieved) over the seeds. A light environment can be achieved by surface sowing the seed over the media, and leaving the seed uncovered. Once the seed is sown it should be watered in and a fungicide applied to prevent the onset of fungal diseases such as phythium and phytophthora which can cause seedling death.

7.2. Seed Suppliers

Seed merchants, some plant nurseries and revegetation specialists are some of the main seed supply sources. If the local nursery or seed merchant doesn't have the seed of the species required, and you know where it may be growing, then perhaps you can collect the seed yourself. However, to do so a flora or plant material collecting permit is required. This can be obtained from your state Conservation or Flora and Fauna Department. If the plant is an endangered or rare species, then seed collection may not be allowed.
Table 2. Pre-treatment methods required for seed germination in some *Acacia* species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Germination treatment</th>
<th>Incubation</th>
<th>% Germination</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>A. aneura</em></td>
<td>Boiling water; soaked</td>
<td>In light, 25°C</td>
<td>84</td>
</tr>
<tr>
<td><em>A. baileyana</em></td>
<td>Machine scarified (heavy) Boiling water; soaked</td>
<td>In soil in nursery</td>
<td>97, 14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>84-90</td>
</tr>
<tr>
<td><em>A. brachybotrya</em></td>
<td>1 min in water that has just been boiled</td>
<td>In dark, 25°C</td>
<td>30</td>
</tr>
<tr>
<td><em>A. buxifolia</em></td>
<td>Placed in water that has just been boiled and then soaked for 24 h</td>
<td>In dark, 25°C</td>
<td>79</td>
</tr>
<tr>
<td><em>A. cyclops</em></td>
<td>Nicked</td>
<td>Moist sand room temperature</td>
<td>72, 92</td>
</tr>
<tr>
<td></td>
<td>3 min in water that has just been boiled</td>
<td>Moist sand room temperature</td>
<td>16, 84</td>
</tr>
<tr>
<td><em>A. dealbata</em></td>
<td>Placed in water that has just been boiled and then soaked for 24 h</td>
<td>In dark, 25°C</td>
<td>89-97</td>
</tr>
<tr>
<td><em>A. decora</em></td>
<td>Placed in water that has just been boiled and then soaked for 24 h</td>
<td>In dark, 25°C</td>
<td>62</td>
</tr>
<tr>
<td><em>A. decurrens</em></td>
<td>Boiled for 15-600 sec</td>
<td>In dark, 25°C</td>
<td>89-97</td>
</tr>
<tr>
<td><em>A. elongata</em></td>
<td>1 min in water that has just been boiled</td>
<td>In dark, 25°C</td>
<td>62</td>
</tr>
<tr>
<td><em>A. gladiformis</em></td>
<td>Nicked</td>
<td>In dark, 25°C</td>
<td>30</td>
</tr>
<tr>
<td><em>A. iteaphylla</em></td>
<td>1 min in water that has just been boiled</td>
<td>In dark, 25°C</td>
<td>26</td>
</tr>
<tr>
<td><em>A. mearnsii</em></td>
<td>Nicked</td>
<td>29°C</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Placed in water that's been heated to 80°C, then soaked for 12 h</td>
<td>29°C</td>
<td>90</td>
</tr>
<tr>
<td><em>A. meisneri</em></td>
<td>1 min in water that has just been boiled</td>
<td>In dark, 25°C</td>
<td>42</td>
</tr>
<tr>
<td><em>A. melanoxylon</em></td>
<td>Placed in water that has just been boiled and then soaked for 24 h</td>
<td>In light, 25°C</td>
<td>25-79</td>
</tr>
<tr>
<td><em>A. merinthophora</em></td>
<td>Placed in water that has just been boiled and then soaked for 24 h</td>
<td>In dark, 25°C</td>
<td>92</td>
</tr>
<tr>
<td><em>A. myrtilloides</em></td>
<td>Placed in water that has just been boiled and then soaked for 24 h</td>
<td>In light, room temperature</td>
<td>85</td>
</tr>
<tr>
<td><em>A. podalyriifolia</em></td>
<td>Boiled for 15-600 sec</td>
<td>In dark, 25°C</td>
<td>44-60</td>
</tr>
<tr>
<td><em>A. pravissima</em></td>
<td>1 min in water that has just been boiled</td>
<td>In dark, 25°C</td>
<td>55</td>
</tr>
<tr>
<td><em>A. pyriformis</em></td>
<td>Boiled for 1-7 min in water</td>
<td>Boiled water, 1 min</td>
<td>100</td>
</tr>
<tr>
<td><em>A. rubida</em></td>
<td>1 min in water that has just been boiled</td>
<td>Boiled water, 1 min</td>
<td>90</td>
</tr>
<tr>
<td><em>A. saliciformis</em></td>
<td>Nicked</td>
<td>In dark, 25°C</td>
<td>42</td>
</tr>
<tr>
<td><em>A. saligna</em></td>
<td>Boiled for 5 min in water</td>
<td>In dark, 15, 20°C</td>
<td>95</td>
</tr>
<tr>
<td><em>A. silvestris</em></td>
<td>1 min in water that has just been boiled</td>
<td>In dark, 25°C</td>
<td>32</td>
</tr>
<tr>
<td><em>A. stricta</em></td>
<td>1 min in water that has just been boiled</td>
<td>In dark, 25°C</td>
<td>17</td>
</tr>
<tr>
<td><em>A. uncinata</em></td>
<td>Nicked</td>
<td>In dark, 25°C</td>
<td>28</td>
</tr>
</tbody>
</table>
Source: adapted from Cavanagh, 1987.
Some seed suppliers are listed below and there are other suppliers listed under seed merchants in the telephone book.

- Vaughan's Wildflower Seeds, PMB 2, Gingin, WA, 6503, ph 08 9575 7551 fax 08 9575 7595
- Nindethana Seed Service Pty. Ltd., PO Box 2121, Albany, WA, 6330, ph 08 9844 3533 fax 08 9844 3573
- Goldfields Revegetation Pty. Ltd, Dysons Rd, Mandurang, Victoria, 3551, ph 03 54 39 5384.
- Kershaw Pty Ltd, PO Box 84, Terry Hills, NSW, 2084, ph 02 9973 2210
- Goozeff Seeds, PO Box 3022, North Nowra, NSW, 2541, ph 044 21 0731 fax 044 21 0731
8. Vegetative Propagation

Vegetative propagation of *Acacia* species has not been practised widely in the ornamental industry, although interest in its effectiveness is growing as researchers and growers in the cut flower, flowering pot plant and nursery industries look to clone superior forms and achieve a more uniform product, reducing genetic variability. As vegetative propagation bypasses the juvenility stage experienced in seedlings, vegetatively produced plants will begin flowering at an earlier age.

The European mimosa industry have been selecting superior forms of *Acacia* for cut flower production since the 1950's. These forms are clonally propagated by grafting or budding the desired scion material onto a rootstock which is also tolerant of the calcareous soils in which they will be grown. Species which are not tolerant of calcareous (high pH) soils are grafted onto seedling rootstocks of *A. retinodes* and species which are not tolerant of acidic soils are grafted onto *A. dealbata*.

More recently in Australia, Glocke and Sedgley (1995) have been looking at methods to improve stem cutting propagation in ornamental *Acacia* species. Investigations have included the use of the plant growth regulating chemical, indole butyric acid (IBA), etiolation, girdling and plant juvenility. Species studied include, *A. baileyana*, *A. imbricata*, *A. glaucoptera*, *A. podalyriifolia*, *A. polybotrya* and *A. vestita*.

8.1. Method developed for stem cutting propagation of *Acacia*

The technique below is that devised by Glocke and Sedgley (1995) and can be used as a guide for cutting propagation of *Acacia* species.

Rooting was observed in 20% to 90% of cuttings, in species tested. At IHD, using the above technique, 40% to 95% rooting was achieved in *A. pravissima*, *A. acinacea*, *A. buxifolia*, *A. boormanii* and *A. stricta*, and best results were achieved when soft or juvenile stock plant material was used to take the softwood cuttings.

IBA at 10,000 ppm positively influences root development of *Acacia* species, but its effect varied with the time of the year, the pre-treatments and the genotype. Etiolation or girdling of stock plants before taking cuttings did not significantly affect rooting, however juvenility did increase rooting.
## Steps for Stem Cutting Propagation of *Acacia*

1. Cuttings can be taken from summer through to autumn when new season's vegetative growth is being produced, after plants have finished flowering and fruiting. It is best however not to take cuttings on hot days as they desiccate more rapidly.

2. Best results are achieved from softwood or semi-hardwood cuttings.

3. Cuttings should be approximately 12 cm in length.

4. Two thirds of the leaf area should be removed from the lower part of the cutting.

5. Each of the remaining leaves or phyllodes should be cut in half.

6. After cuttings have been prepared to size, the base of each cutting should be dipped in a 1.25% solution of supermarket bleach and then rinsed in clean water.

7. Next the cutting base is dipped in 10,000 parts per million (ppm) IBA for five seconds and allowed to air dry for 30 seconds.

8. The cuttings are then placed into a propagating mix of one part coarse river sand, one part peat and one part perlite.

9. Cuttings are best placed into communal trays or pots, as the crowding of cuttings may increase the humidity around each individual and so reduce water stress through transpiration.

10. The cutting trays are placed into a mist bed propagator which produces five seconds of mist every 60 minutes, with bottom heating at 25°C.

11. The glasshouse temperatures should range between 25 to 28°C during the day and 12 to 15°C during the night.

12. Cuttings are harvested after eight weeks or once roots have developed.
8.2. Grafting and budding of Acacia clones

Listed below are the grafting and budding techniques utilised by the European mimosa industry for cloning their superior selections of Acacia.

Note: If the source of the cutting or grafting material is a naturally occurring one, growing on a road side, on crown land or in a state forest, you will need to apply for a collecting permit from your state's Conservation or Wildlife Department.

**Steps for Approach Grafting**

1. Approach grafting is undertaken in the summer, when the plants sap flow is fast.
2. The potted rootstock is placed in the field beside the bud wood tree prior to grafting. Seedling rootstocks of A. retinodes are used for tolerance of calcareous soils. A. dealbata rootstocks are used for tolerance to acid soils.
3. A branch of new seasons growth from the scion giving plant is brought towards the rootstock.
4. A section of the branch which is sufficiently long, straight and smooth barked is chosen from both plants for the grafting union.
5. A section of bark is removed from both plants. The bark and a tiny piece of wood 7 to 10 cm in length is removed.
6. The two cut sections are joined together so as to get the best possible fit of these sections between the two plants.
7. The graft union is then bound together with a piece of newspaper and then with moistened raffia to hold this in place. Plastic grafting tape could also be tried.
8. The grafts generally take between one to two months to unite, and when this occurs the grafting tape is removed.
9. Grafted plants will come into flower after two years.
### Steps for T-budding

1. Potted seedling rootstocks of *A. retinodes* or *A. dealbata* are used.
2. The T-bud technique is undertaken during spring, a time when the bark is well detached from the wood.
3. A smooth section of bark, underneath a branch is chosen on the rootstock, as the site for the bud section.
4. An incision, the shape of a T, is cut into the bark of the rootstock.
5. A well formed bud is removed from the variety to be cloned. This is done by making a clean cut, so as not to remove too much wood from a bud wood stem. There should not be any wood behind this budding material.
6. The bud is placed inside the T incision of the rootstock, underneath the bark, so that the bud is well aligned with the wood of the rootstock.
7. The T-bud union is then bound with raffia which has been soaked in water. Alternatively plastic grafting tape could be tried.
8. Buds generally take between one to two months to unite, and when this occurs the tape is removed.
9. Cultivation

9.1. Windbreaks

The following is summarised from Washbourne (1996)

Do you have a problem with prevailing winds? Plants will require protection from the wind from the time of planting and they will benefit from this protection. Wind damage can cause stunted growth and loss of production through total loss of crop and plants.

So when planning for a windbreak the following questions must be answered:
1. Where does the windbreak need to be planted?
2. What type of plants should be used in the windbreak?
3. How dense should the windbreak plants be?
4. How far apart should the windbreak plants be and to what height should they grow?

Where does the windbreak need to be planted?

This should be reasonably easy to answer as it is only a matter of the direction of the prevailing winds and planting windbreaks as near as possible at right angles to the wind direction.

What type of plants should be used in the windbreak?

This is more difficult to answer and the list of trees suitable for windbreaks provided in appendix 1 provides some guidance. Your selection of trees should take into consideration the final height and width of the windbreak planting. Consideration when planting should be given to the crop being grown, powerlines, drainage lines and irrigation lines. In some instances it may be better to erect an artificial windbreak. Artificial windbreaks have several advantages over live windbreaks.

• Very low maintenance costs once installed.
• They will take up very little room so allowing more room for the crop.
• They will not interfere with the crop.
• They are a known height and permeability so the distance between windbreaks can be easily calculated.

How dense should the windbreak plants be?

Windbreaks should only stop about 40-50% of the wind as any more than this is likely to cause wind damage on the lee side of the windbreak more than if there was no wind protection at all. Windbreaks should be designed to give an even protection over the full height. If tall trees are used, it may be necessary to plant several stories or layers in the windbreak.

How far apart should the windbreak plants be and to what height should they grow?

The question of height and distance are inter-related. When designing windbreaks it is very important to know the final height as it is only at this stage that the distance between them can be determined. Windbreaks will give total protection to the crop over a horizontal distance for up to five times the actual height and partial protection for a further ten times it's actual height. So from this it can be seen that windbreaks should be planted no further apart than fifteen times the final height. A method to calculate the height of established windbreaks is provided in appendix 2.
Once you have decided to plant a windbreak and the plants it will contain, consideration should be given to planting the windbreak and looking after it in such a fashion that it will grow as quickly as possible to perform the task for which they were intended. Maintain windbreaks in a sound horticultural fashion, control the weeds, irrigate and fertilise all plants so as to obtain the maximum height in as short a time as possible. Windbreak protection is particularly important in the formative years of the crop. If it is possible, plant the windbreak several years prior to planting the crop.

9.2. Planting time

*Acacia* plants can be planted at any time of the year but care should be taken not to plant in extremely cold or hot times of the year. The best time of the year for planting is autumn when temperatures are still warm enough for the plants to establish themselves for the coming winter. Young plants such as those of *A. merinthophora* are often more susceptible to frost and may need frost protection during the first season.

9.3. Planting densities

Plant spacings along rows will vary with the size and spread of the *Acacia* plant and the growing conditions. Small to medium sized shrubby species such as *A. acinacea* and *A. boormanii* should be planted around 1.5 to 2 metres apart. Large shrub (*A. pravissima*) and small tree species (*A. retinodes* or *A. baileyana*) should be planted at spacings of 2 to 6 metres. Spacings between the rows should equal the width of the machinery which will move along the rows plus the final width of the *Acacia* plants.

The more dense the planting the more costly it is to establish, but dense plantings give quicker returns, as greater numbers of stems per hectare are produced at an earlier date.

9.4. Soil preparation

Most *Acacia* species prefer to be grown in a well drained soil, however, due to the great species diversity and the diversity of habitats in which they are found this may not always be the case. This also means that you may be able to find species which are better suited to your local soil conditions. Heavy soils can be improved in structure and made to be more free draining with the applications of coarse sand and organic matter.

The soil pHs which best suit many *Acacia* species are not known. To gain an idea of the soil conditions which may suit a particular *Acacia* species, it would be useful to look at the growing conditions in which that species naturally occurs and use this information ie., soil pH and drainage when preparing the soil for planting at your property.

In Europe *Acacia* species which are not tolerant of calcareous soils (soils of high pH) are grafted onto seedling rootstocks of *A. retinodes* which are tolerant of high pH soils. Species which are not tolerant of acidic soils (those soils with a low pH) are grafted onto rootstocks of *A. dealbata*. An indication that the soil pH is too high for a particular species is the occurrence of chlorosis (yellowing of the leaf surface in between the leaf veins of the younger leaves) on the plants leaves. Iron chelates should be used to lower the soil pH and combat iron chlorosis. The application rate for flowers is 24 g of iron chelates dissolved 10 litres of water, and this treats an area of soil 10m$^2$. Preferably, these changes to soil pH should be made prior to planting.
In Europe, fertiliser regimes have been devised for *Acacia* crops and these are reported by Sedgley (1996). Before planting, ripped soil is fertilised at the rate of:

- 500-1000 kg superphosphate,
- 150-200 kg potassium sulphate,
- 150-200 kg ammonium sulphate,
- 1000 to 2000 kg vegetable waste
- and 40-60 tonnes manure per hectare.

Each year after this, potassium sulphate is applied throughout the year after each prune. The fertiliser program for mature plants is:

- 0.6 kg superphosphate,
- 0.2 kg potassium sulphate
- and 0.4 kg ammonium sulphate per tree.

**9.5. Pruning methods**

The following is summarised from Sedgley (1996)

Pruning of the *Acacia* plants to develop a sturdy, multi-stemmed and high yielding plant shape should be carried out once the plants have become established, which is usually 6 months to 1 year after planting. This practice should be repeated annually, until the plants have reached production maturity, after which time pruning will be replaced by harvesting. It should be noted that some additional tidying up may be required at the end of the harvesting season.

In Europe pruning methods are also used to delay the flowering time of summer flowering species such as *A. retinodes* to winter, to cater for the more lucrative European Christmas market. However, the standard pruning techniques of heading back and cleaning up plants, at the end of the flowering season are performed on winter flowering species such as *A. dealbata*.

Pruning can also extend the life of *Acacia* plants by maintaining plants in a vegetative condition. However, plants must also be supplied with adequate water and nutrition, especially after harvesting has finished and the plants are pruned back.

**The European pruning technique for the traditionally summer flowering species A. retinodes**

- Trees are first pruned just prior to the spring flush of growth and two year old wood is reduced back to four or five buds.
- The new growth produced from these buds is 30-40 cm in length when it is cut back again to 20-25 cm to promote branching.
- In summer, the time when *A. retinodes* naturally flowers, the trees are prevented from flowering, by the removal of the flower buds, when a further 10 cm is cut from the main branches. This prune will delay flowering until winter.
9.6. Irrigation

The following is summarised from Slater (1996).

It is important that a regular supply of water is provided for the newly planted Acacias to enable them to become established. After the flower stems have been harvested and the plants headed back, plants should also be irrigated, to encourage the development of the new vegetative growth required for the next seasons crop. Over summer and the drier periods of the year, as well as directly after harvest has finished, supplementary watering should be supplied to ensure that the plants produce strong, healthy growth and good quality flowers.

However, care should be taken not to supply too much water to plants just prior to the flowering season as this may lead to the production of soft tip growth beyond the flowers which subsequently reduces the quality of the flowering stems.

The best methods of irrigation for Acacia are those which direct the water at the plant roots, keeping it away from the flowers, which can be easily damaged by water.

9.7. Nutrition

The following is summarised from Slater (1996).

Currently there is little information about the optimum levels of fertiliser for field grown Acacia plants. It is known that some species of Acacia (ie, A. amblygona) are damaged by high levels of phosphorous in the soil. Plants suffering from too much phosphorous show severe leaf scorch and leaf drop and even plant death. Boron deficiency is also known to be a problem in some species, especially where plants are growing in waterlogged soils. Symptoms appear as dieback of the plant shoots.

Nitrogen and iron deficiencies often cause problems in other wildflower crops and so may effect the growth of Acacia. Nitrogen deficiency symptoms are shown by the older leaves of plants yellowing and dying off, while the plant becomes stunted. Nitrogen deficiency can be corrected by the application of any nitrogen containing fertiliser. Acacia are nitrogen fixing plants and so actually add nitrogen to the soil.

Iron deficiency appears as the yellowing of young foliage, especially when plants are grown in alkaline or the wrong soils to which they are adapted. As the deficiency becomes more severe, the entire top of the plant becomes yellow or bleached, while the old leaves remain their normal green colour. Iron deficiency can be corrected by the application of quick acting soluble iron chelates at the rate of 24 g dissolved in 10 litres of water. This will treat a 10 m² area of soil.

Generally the application of fertilisers for wildflowers currently includes:

- With the exception of Proteaceous species, a complete slow release, low phosphorous fertiliser.
- Nitrogen and potassium are applied to boost growth, while phosphorous has been applied with caution because of the general knowledge that the plants may be prone to phosphorous toxicity.
- Plants on low fertility soils may display yellow leaves; a characteristic symptom of nutrient deficiency. These plants are often sprayed with a general micronutrient solution.
- Iron chelates are also applied to plants in iron-deficient soils, at the rate given above.
It is a good idea as part of an on-going management strategy to have a periodic soil analysis conducted to determine the nutrient status of the crop. These analyses can be done by: State Chemical Laboratories, Cnr Sneydes Rd and South Rd Werribee 3030. Ph: (03) 9742 8755. Fax: (03) 9742 8700

9.8. Cultivation and postharvest life

There is great variability in postharvest life of flowers from different trees of the same species and some of this is probably due to the growing environment. Longer life appears to be correlated with strong, young growth rather than with old wood. Therefore it will probably be worth ensuring that plants are growing well and strongly. On the other hand, if branches have soft tip growth when they are cut the tips wilt quickly and look unattractive. The solution to this problem is probably to grow species which do not have flowers and soft tip growth at the same time. Alternatively water and nutrients can be limited to limit tip growth and it might be worth experimenting with growth retardants.

9.9 Allergies

There is a risk that some *Acacia* growers could become allergic to the pollen. In one study in northern Italy 31% of 106 commercial *Acacia* (*dealbata*) growers had respiratory allergies like hayfever.
10. Pests and Diseases

10.1. Insect pests

Insect pests cause damage to wildflowers as a result of feeding and egg laying. It is critical in flowers being grown for export that they are kept pest free, as the discovery of insects in consignments of exported flowers will increase the export costs and impact badly on the quality of the flowers.

This means the adoption of a pest monitoring and management program in the field and of a disinfestation program at harvest. The main insect pests of Acacia include gall making insects, psyllids, scales, caterpillars, leaf eating beetles, leafminers and wood boring insects.

The main insect pests of Acacia in Australia

- Wood boring insects are one of the most serious insect pests of Acacia. The larvae beetles of the family Cerambycidae, the longicorn group, or of the family Curculionidae, the weevils, are most commonly responsible for damage. Wood borers should be detected early and treated by the injection of alcohol or a pesticide into the hole.

- Psyllid insects are particularly a pest to A. retinodes. They lay their eggs on the stems and foliage and the larvae eat the new tip growth and leaves making the flowering stems unattractive and unsaleable. They are present for most of the year and are at their worst from spring through to autumn. Affected plants must be sprayed regularly ie, every 9 to 14 days.

- Larvae of leaf miners, such as those of the family Gracillaridae, also cause problems in some Acacia species. The larvae tunnel into the leaves of plants, such as those of A. podalyriifolia. These tunnels turn silver-brown in colour and make the stems look unattractive and unsaleable.

Samples of the insects should be identified by the grower or submitted for identification by a diagnostics laboratory for correct diagnosis and recommended control measures.

These diagnoses can be done by:

Crop Health Services, Institute for Horticultural Development. Private Bag 15, South Eastern Mail Centre 3176. Ph: (03) 9210 9222, Fax: (03) 9887 3501

10.2. Diseases

Phytophthora

The following is modified from de Boer (1996).

The main disease problem of some Acacia species is the fungal pathogen Phytophthora which causes root rot or collar rot. Another fungal pathogen Cylindrocladium scoparium which causes damping-off, blight and root rot was found in combination with Phytophthora on Acacia plants and this combination was found to cause the death of the plants in question. Both have been associated with the deaths of A. pycnantha and A. leprosa, and so may well be responsible for disease
problems in other *Acacia* species. *Phytophthora* attacks the root system of the host plant causing the roots to rot, which leads to poor plant growth and vigour and eventually to plant death.

*Phytophthora* is one of the water mould fungi that survive in soil as resting spores. In warm (20-30°C), saturated soils the fungus releases the spores which swim in water and infect the fibrous roots.

So, spores of *Phytophthora* can be dispersed over substantial distances in ‘run-off’ water and can also be spread by the transport of infected soils between areas.

**How can you avoid the threat of Phytophthora on your property?**

Once *Phytophthora* has become established in an area it is difficult to control - so as a rule, prevention is better than the cure!

**Points to remember**

- Avoid the introduction of *Phytophthora* on planting material - do this by the selection of outwardly healthy plants grown in soil free media or a pasteurised soil media.
- Avoid transporting contaminated soil between growing areas.
- Practise good hygiene by using: clean boots, tools and machinery when working between different areas. Disinfecting foot and machinery baths can be installed.
- Ensure that run off water from irrigation or rainfall does not flow into adjacent growing areas.

**Chemical control of Phytophthora**

- Fumigate isolated patches of the disease
- Use protective fungicides on areas which are disease free, to prevent infection.

**Other diseases**

Fasciation, the abnormal flattening and fusing of plant stems and leaves can also be a problem in some *Acacia* species. Fasciation will not cause plant death, but it does make the plants’ foliage look unattractive and this would be a problem for plants grown for cut flower or foliage production.

In France the main disease problem is *Septoria* rust, this causes the leaves to become red, and is followed by leaf drop.

Samples of diseased material should be sent for correct diagnosis to a diagnosis laboratory. The Crop Health Services listed above also identify and recommend control measures for plant diseases.

**10.3. Vertebrate pests**

Large animals can be a real threat to the health and growth of *Acacia* plants in the crop situation. Animals such as rabbits, livestock, kangaroos and wombats cause serious damage or death by grazing on or near the plants or by digging around them. If animals could cause problems, animal proof fencing should be installed prior to planting.

**10.4. Weed control**
The following is summarised from Slater (1996).

An important consideration when growing any flower crop is the control of weeds which will grow around the plants. Weeds need to be controlled as they are in competition for the water and nutrients provided to the flower crop, and they can also harbour pests and diseases.

Before preparing land for flower production, identify any existing weed problems on the property. Correct identification of the weeds will enable the choice of the most suitable method of control.

The four main methods of weed control are:
- Mechanical control or cultivation
- Chemical control using herbicides
- Weed-mat, and
- Organic mulches

More successful and economically sustainable control is gained by using combinations of these weed control methods, i.e., chemical control using herbicides and organic mulches.
11. Postharvest Care of Cut Flowers and Foliage

11.1. Harvesting

The following is modified from Cass and Jones (1996).

When to harvest

*Acacia* stems can be harvested when 10% of the flower buds have opened and the remaining flower buds have reached the yellow-bud stage of development, provided that a bud-opening treatment is used at harvest. Harvesting at this stage ensures that all of the flower buds will open and that the longest possible vase life can be obtained from the flowering stem. It is also very important that *Acacia* stems are not harvested in the rain or when they are wet, as the flowers will become brown when stored and therefore unsaleable.

Minimising water stress

It is important when harvesting cut flowers that they are exposed to as little water stress as possible, and therefore the time of harvest and the harvesting methods used are critical. To minimise water loss through transpiration from the flowering stems and maintain their ability to take up water, flowers should be cut at the coolest part of the morning or evening, and placed into water containing a germicide preservative soon after harvest. It is good practice to place buckets of water in the rows where harvest is taking place. It is best not to leave flowers out of water for more than one hour.

A cover over the trailer carrying the buckets of flowers should also be used to prevent direct sunlight drying and overheating the flowers.

It is critical that *Acacia* flowers are transferred into the recommended postharvest solution (described in Postharvest vase solutions), as soon as possible after harvest.

Use sharp secateurs

When harvesting flowers, use very sharp secateurs to achieve a smooth cut. Jagged or torn cuts leave splinters in the water conducting vessels, causing blockage and impeding the future uptake of water by the stem.

11.2. Cooling

Cooling is most valuable immediately after harvest and before transport. If flowers are not cooled the in field temperature is normally high enough to dry them out and do severe damage in just a few hours. Reducing the temperature of the flowers immediately after harvesting will slow down the process of respiration, a process which produces internal heat in the plant, and prevent further water loss. Cooling will also slow down the rate of development and aging of the flowers.

Flowers should be placed in a postharvest solution, in a cool room at 1-4°C for open flowers and 10°C for stems with 10% flowers open, with a relative humidity of 90-95%, as soon as possible.
after harvesting to reduce the effects of aging. A high relative humidity (amount of water vapour in the air) will slow down the loss of water from flowers to the atmosphere.

Cool rooms can be designed to have 90% humidity if the insulation is good, the coil area high, the temperature differential on the thermostat is small and if the compressor power is high enough. It is worth consulting an expert in horticultural cold rooms.

It is important to avoid excessive air movement over the flowers in a cold room, particularly if the humidity is low eg. 60%. This can be done by placing flowers out of the direct air flow or by covering the flowers.

Cooling flowers passively, in cool rooms is not always as efficient as desired. In particular, flowers packed in cartons only cool very slowly this way. The alternative is forced air cooling, after the flowers are packed in cartons. Forced air or pressure cooling, will cool large quantities of flowers in cartons, 10 times faster than passive room cooling. Boxes containing holes in each end, are arranged in a stack and placed against a fixed wall of a plenum chamber containing a fan which sucks cold air through the boxes. For further details see the AUF Fresh Produce Manual (Blacker, 1989), Cass and Jones (1996), Jones (1996), or consult an experienced refrigeration expert.

Cooling flowers in cool rooms is not always efficient in reducing the heat produced by the field and internal temperature of the flower. An alternative cooling method, such as forced-air cooling, is often necessary, particularly if flowers are to be transported for a few days prior to selling. This should be implemented after the flowers have been treated with a postharvest solution.

11.3. Postharvest solutions

When harvested and placed into water with no additives, *Acacia* stems generally have a short vase life of two to three days. *Acacia* stems often do not continue to take up water after harvest and so flowers and leaves rapidly wilt and dry out. The addition of preservatives to the solution will facilitate flower bud opening and extend total flower life in *Acacia* to over 7 days.

The preservative solution developed for *Acacia* contains:

- A non-ionic detergent, such as Agral, at a low concentration
- A germicide, aluminium sulphate

The non-ionic detergent and germicide extend flower life by aiding the uptake of water in flower stems. Non ionic detergents act as a lubricant and so increase water uptake, whilst the effect of aluminium sulphate is to lower the pH of the solution, which kills the microorganisms in the water which can block up the stem ends.

The formula for this solution is shown in Table 3.

**Table 3. 16 hour Agral Pulse for *Acacia* stems**

<table>
<thead>
<tr>
<th>Per 10 litre bucket of water</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>100 g</td>
</tr>
<tr>
<td>Agral 600</td>
<td>1 ml</td>
</tr>
<tr>
<td>Aluminium sulphate</td>
<td>2 g</td>
</tr>
</tbody>
</table>
Flowering stems should be placed in this solution straight after harvest for around 16 hours (overnight), and before the flowers are sent off for distribution.

Treatment can be carried out in:
- In the buckets the flowers are picked into
- The coolroom at 1 to 4°C for stems with open flowers
- Or at 10 to 20°C for stems with 10% of flowers open
- The postharvest solution should be administered to the stems within one to two hours of harvest
- During insect disinfection

After treatment with the Agral solution, stems are ready for local distribution or export. Stems for local distribution can be transported in buckets containing a solution of 100 to 200g/10L sucrose and 0.5g/10L granulated chlorine as sodium dichloroisocyanuric acid (DICA) and water. If DICA is not available other forms of chlorine, such as sodium hypochlorite at 0.5g chlorine per 10L or calcium hypochlorite at 0.5g chlorine per 10L can be substituted. Alternatively commercial preservative can be used. If buckets can't be used, stems for local and export markets can be packed tightly in fibreboard boxes. It is important that flowers are kept cool, ideally at 2 to 4°C, during this distribution phase and flowers for export must be disinfested of insects.

11.4. Packaging

Flowers are transported either in buckets or boxes. It is advisable when transporting flowers in buckets to have them wrapped in a plastic sleeve. The plastic sleeve not only protects the bunch of flowers from drafts, which may physically damage the flowers or dry them out, it also increases the humidity around the flower bunch which prevents greater water loss. An alternative is the specially designed carton which contains a bucket of water in its base.

Although it is preferable to transport flowers in water, it is not always practical, particularly for long distance freighting in Australia or for overseas export. In these cases, fibreboard boxes with pre-cooled flowers wrapped in box liners or perforated sleeves, provide effective transport if flowers are packed tightly to minimise physical damage and maintain humidity levels.

However, plastic packaging should only be used where it is known that flowers will not be exposed to temperatures above 15 to 20°C or widely fluctuating temperatures during transport. At higher temperatures the flowers are likely to sweat inside the packaging, which can cause the flower heads to become brown and unsaleable.

For best results when transported in fibreboard boxes, *Acacia* stem ends should be:
- Perforated sleeves should be wrapped around the bunches, providing that temperatures around the flowers do not exceed 20°C.
- Placed into blocks of florist foam which have been moistened in water and germicide for 24 hours prior to use.
- The florist foam should be wrapped in small plastic freezer bags to stop water leakage onto the flowering stems and to prevent the foam drying out.
- Orchid vials filled with water should not be used, as these can leak during transport and cause damage to the *Acacia* flowers in the form of browning.
- Flowers should not be transported at temperatures above 15 to 20°C.

Bunches of *Acacia* which have been treated with the Agral pulse and packed in perforated flower sleeves and florist foam, have achieved a total flower life of anywhere between 7 to 14 days.
After transit in fibreboard boxes, florists should be informed of the need to recut the stem ends, under water if possible, to aid water uptake in the stems once more. Leaves or flowers which may be below the water line should also be removed. For best results the recut stems should be placed in a preservative solution such as a ready made commercial preservative and water.

11.5. Insect disinfestation

It is imperative that insect pests are controlled in the field, so that when the flowers are harvested there is no insect damage and there are as few insects as possible on the stems. When flowers are harvested for export, insect disinfestation will still be required to ensure that no insect pests are found on the stems when they arrive at their ultimate destination.

Which insect disinfestation method should be used for Acacia?

- As *Acacia* flowers are fragile and relatively short lived, many methods of insect disinfestation are unsuitable for use as they require treatment over a long period of time or involve wetting the flowers which may damage them. Disinfestation treatments which involve dipping the flowers in a liquid insecticide should be avoided as this method damages the delicate *Acacia* flowers. The methods which are adopted should have treatment times of less than 24 hours and should involve a dry method of application. For example fumigation with:
  - Pyrethrum (from Pestigas®), at 0.02 g/m³ and dichlorvos (from Insectigas®) at 0.1 g/m³ for 2 hours at a temperature of 15°C to 20°C.
  - Methyl bromide for 2 hours at a temperature of 15°C to 20°C and at an initial concentration of 32 g/m³.

It is recommended that the amount of gas to be released into the fumigation chamber is weighed periodically, to check that the correct amount is being used, as any differences between the nozzles of the gas cylinders will lead to differences in the amount of gas released.

New fumigant treatments are being tested at Knoxfield and CSIRO as part of current RIRDC projects.

For further information refer to the Western Australian Department of Agriculture's Farmnote on insect disinfestation (Seaton, K. and Joyce, D., 1988).
12. Export

Exporting is a specialised business. The following information has been summarised from the Flower Export Council of Australia Inc publication "Export Guide for Australian Flowers and Foliage" (FECA, 1997). Copies of this book and lists of current exporters are available from FECA (address below) and the Institute for Horticultural Development.

12.1. What do you need to know?

The option to export can be an important part of a flower producer's business strategy, especially in the case of a product such as *Acacia* which the overseas markets of Japan, America and Europe are familiar with. Exporting offers the grower opportunities to:

- Increase the number of markets supplied
- Increase the market size
- Reduce supply pressure on the domestic market

For the export process to be a success, the export markets should be thoroughly researched and understood. This involves:

- Identifying and understanding the needs and wants of the market - consult existing exporters, AUSTRADE and AQIS
- Understanding the cultural and social customs of the market
- Identifying the fashions and trends which affect the buying patterns of that market
- Being aware of the quality of the product when it arrives at its destination
- Being able to keep the market supplied with the product
- Maintaining consistency in the quality of the product - implementing a Total Quality Management program
- and identifying a marketing mix - including appropriate pricing and promotion of the product

There are also a number of logistical and mandatory requirements which must be met when it comes to exporting flowers or foliage, these include:

- **Legal requirements**
  In order to export the following documentation is required: Environment Australia permits, Australian Quarantine Inspection Service (AQIS) phytosanitary certificates, import permits, duties, tariffs and customs documentation, and plant quarantine clearances on arrival in some export markets.

- **Export logistics**
  Freight forwarders services, domestic transport, direct flights, the EXIT Customs clearance system, export documentation, packaging, pressure cooling, cool storage, the distance from international airport services and fumigation services.

- **Financial requirements**
  Capitalisation, operating capital, cash flow, export economics, payment terms and timing, air freight costs, government grants.
• **Commercial documents**
  Commercial invoice, Packing list/Weight list detailing the precise contents of the export shipment

• **Transport documents**
  Air Waybill, document issued by the airline acknowledging the receipt of the goods to be dispatched.

• **Insurance documents**

• **Other documents**
  Certificate of Origin and Value, these are required for duty and import control purposes and the information on value is required for customs duty purposes by the country of importation. Certified Commercial invoices, certified by the Chamber of Commerce, these may be required by customs overseas. Consular invoice, an invoice which is certified by the Consul of the country to which the goods are to be exported. Importing Country documents, these relate to documents imposed by the customers own government, ie a Phytosanitary Certificate. Special Documents, these documents are issued by Australian authorities because of the special nature of the goods exported.

For further information on the requirements of importing countries contact:
• AQIS operations staff in your state
• Your exporter
• Your importer

The export of native flower requires a permit, or authority, from Wildlife Protection, Environment Australia. For further information contact:

Wildlife Protection
Ph: 06 250 0300
Fax: 06 250 0303
Email: wps@dest.gov.au

If you wish to write to this department the postal address is:

Environment Australia
GPO Box 636
Canberra ACT 2601
Attention: Wildlife Protection

In addition, bush picking requires a permit from the relevant state authority.

**12.2. Flower Export Council of Australia Inc (FECA)**

FECA was formed in 1990 in line with the rapid growth of Australian flower exports in recent times. FECA is a dedicated group of Australian floricultural exporters who strive to build international flower share and profitability on behalf of it's members. FECA has a long term commitment to the promotion of Australian fresh and dried flowers and foliages in world flower markets.

Membership is invited, contact:
Flower Export Council of Australia Inc
PO Box 137
Nedlands WA 6009
ph: 08 9324 1778
fax: 08 9324 1779
Email: feca@iinet.net.au
Web: http://www.iinet.net.au/~feca/
13. Economics

The returns which a grower can expect from any flower crop will vary, and these are dependant on the plant and it's suitability for growing in a particular site, the price of the flowers, the management practices, the establishment costs, the level of marketing and the proximity of the producer to the market.

The establishment costs, gross margins, on-going running costs and returns, when setting up and running a wildflower farm are covered in Appendix 1. Gross margins are not available for *Acacia* as, it is an emerging crop, but gross margins are presented for Geraldton Wax, Thryptomene and *Protea repens*.

There is limited production information available for *Acacia*. Sedgley and Horlock (1997) give details for a South Australian property: expenses $16,960/ha, income $19,800/ha, gross margin $2,840/ha. This is based on approximately 3m x 2m spacings, a yield of approximately 75,000 stems/ha and a price of approximately $0.25/stem. Closer spacing and higher prices markedly increase profits. In a trial plot of *A. retinodes* at Knoxfield, two year old plants, at 1.5 m by 1.5 m spacings (too close to run machinery between rows!) were approximately 2 m tall and produced 25 stems/plant, approximately 110,000 stems/ha. Good quality flowers of *A. retinodes* sent to Japan in a trial shipment in February 1997 would have received between ¥60 and ¥120 ($0.70 - $1.40) per stem in the auction system, the same price as European mimosa.

For further information on wildflower economics, gross margins and the costs of exporting refer to Karingal (1994) and Considine (1996).
14. References


Seaton, K. and Joyce, D., 1988 Post-harvest insect disinfestation treatments for cut flowers and foliage. Farmnote No. 89/88, Western Australian Department of Agriculture.


15. Further Reading


16. Appendix

WILDFLOWER ECONOMICS

W. Tregea


Establishment Costs

The establishment costs presented here are based on suitable arable land and all major infrastructure being available, e.g. packing facilities, coolroom, irrigation mains and machinery. The major establishment costs are weed-mat, planting material and irrigation equipment. Details of establishment costs are presented below. An additional cost in the establishment phase will be the costs of growing the crop during the first few years when there will be no harvest. This cost would be in the order of $4000 per hectare per year, but will vary depending on the crop being grown.

Table 1 Establishment costs for several crops (per hectare).

<table>
<thead>
<tr>
<th></th>
<th>Geraldton wax</th>
<th>Protea</th>
<th>Thryptomene</th>
<th>Eucalyptus</th>
<th>Your estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants per ha</td>
<td>1667</td>
<td>1667</td>
<td>4167</td>
<td>1667</td>
<td></td>
</tr>
<tr>
<td>Plant costs</td>
<td>$2000</td>
<td>$5000</td>
<td>$3334</td>
<td>$2000</td>
<td></td>
</tr>
<tr>
<td>Labour (planting)</td>
<td>$200</td>
<td>$200</td>
<td>$500</td>
<td>$200</td>
<td></td>
</tr>
<tr>
<td>Irrigation*</td>
<td>$2800</td>
<td>$2800</td>
<td>$2800</td>
<td>$2800</td>
<td></td>
</tr>
<tr>
<td>Basal fert</td>
<td>$200</td>
<td>$200</td>
<td>$200</td>
<td>$200</td>
<td></td>
</tr>
<tr>
<td>Buckets</td>
<td>$300</td>
<td>$300</td>
<td>$300</td>
<td>$300</td>
<td></td>
</tr>
<tr>
<td>Weed-mat*</td>
<td>$4000</td>
<td>$4000</td>
<td>$4000</td>
<td>$4000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$9500</td>
<td>$12500</td>
<td>$11134</td>
<td>$9500</td>
<td></td>
</tr>
</tbody>
</table>

* Some growers do not use all these items because of their added expense.

Gross Margins

What is a gross margin?

Gross margins are a relatively simple business budgeting tool used to determine the profitability of a farm enterprise. A gross margin is the difference between gross income (i.e. yield multiplied by price received) and variable costs. Variable costs are those directly attributable to the enterprise and which vary in proportion to the size of the enterprise. Examples include fertilisers, freight, casual labour and packing materials.

Gross margins are commonly calculated on a per hectare basis. They also may be expressed in terms of other limiting resources such as labour, irrigation water or capital invested.

Gross margins are particularly useful for the following two purposes:
To illustrate the costs and returns for selected crops.
To show the effect on enterprise profitability of a change in yields, prices or agronomic practices.

When comparing the gross margins of different crops make sure they have been calculated on the same basis.

The limitations of gross margins

The cost and returns in this publication are based on suggested cultural practices and are averages only. The estimates should be used as a guide only. Growers should modify these estimates according to their own expectations of yields, prices and costs.

A gross margin is not the same as farm profit. It does not take into account fixed or overhead costs such as administration and permanent labour. Overhead costs will be incurred regardless of the area of crop grown.

Care must also be taken when assessing the profitability of introducing new enterprises or changing the size of existing enterprises where additional capital or permanent labour is required. If changes in capital are required then other forms of budgeting need to be used.

Costs

Land Preparation
Time requirements for the preparation of 1 hectare are:
- Plough or deep ripping 7 hours
- 2 discings 3 hours
- Cultivation 2 hours
- Bedding up 25 hours
**Total labour** 37 hours

Overhead costs include:
- Postal
- Phone/fax
- Rates
- Insurance
- Accountant fees
- Vehicle registration
- General repairs

Returns

Table 2 Yields in stems per plant of several wildflowers.
<table>
<thead>
<tr>
<th>Plant</th>
<th>Spacing (m)</th>
<th>Density plants/ha</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thryptomene (bunch/plant)</td>
<td>0.8 x 3</td>
<td>4167</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Geraldton wax (bunch/plant)</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>4</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Protea neriifolia</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>Protea repens</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Protea cynaroides</td>
<td>1.5 x 3</td>
<td>2222</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Serruria florida</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>5</td>
<td>30</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Leucospernum cordifolium</td>
<td>1.8 x 3</td>
<td>1852</td>
<td>0</td>
<td>10</td>
<td>18</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Leucadendron Silvan red</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>50</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Leucadendron discolor</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>30</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Leucadendron gandogeri</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Leucadendron laureolum</td>
<td>2 x 3</td>
<td>1667</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: E. Skipworth WA Dept Agriculture and adapted for Victoria

Also need to know the following for particular crops:
- Life of the crop.
- Commencement of production.
- Volume of production.

Economic data is not readily available for many wildflower crops. What has been presented here is information that will be required to determine crop growing and harvesting costs.

You will need to obtain your own data and estimates. Crop yields vary between species, years, locations, growth conditions (fertiliser, irrigation) and plants. Research has not been carried out on yield and what affects yield in many wildflower crops. These will need to be estimated by you for your particular location.

The following three gross margins are based on growing the crops in Victoria under irrigation, fertilisation and standard cultural management practices.
### Table 3  Geraldton wax gross margin.

**GERALDTON WAX**  
**Gross Margin For 1 Hectare**

1667 Plants/Ha

<table>
<thead>
<tr>
<th>Income</th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>bunch/plant*</td>
<td>0</td>
<td>4</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>bunch/Ha</td>
<td>0</td>
<td>6668</td>
<td>16670</td>
<td>16670</td>
<td>16670</td>
</tr>
<tr>
<td>price/bunch ($)</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>0</td>
<td><strong>10002</strong></td>
<td><strong>25005</strong></td>
<td><strong>25005</strong></td>
<td><strong>25005</strong></td>
</tr>
</tbody>
</table>

**Variable Costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertiliser</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Weed control</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>Insect control</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Irrigation</td>
<td>250</td>
<td>520</td>
<td>520</td>
<td>520</td>
<td>520</td>
</tr>
<tr>
<td>FORME (fuel, oil, repairs, maint, elect)</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>4094</strong></td>
<td><strong>4364</strong></td>
<td><strong>4364</strong></td>
<td><strong>4364</strong></td>
<td><strong>4364</strong></td>
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</table>

**Picking and packing costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour 40 bunches/hour @ $12/hr</td>
<td>0</td>
<td>2000.4</td>
<td>5001</td>
<td>5001</td>
<td>5001</td>
</tr>
<tr>
<td>Boxes @ $3.60 ea</td>
<td>0</td>
<td>1333.6</td>
<td>3334</td>
<td>3334</td>
<td>3334</td>
</tr>
<tr>
<td>Elastic bands, tape locks</td>
<td>0</td>
<td>70</td>
<td>140</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Bleach/germicide</td>
<td>0</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>STS/preservative</td>
<td>0</td>
<td>160</td>
<td>480</td>
<td>480</td>
<td>480</td>
</tr>
<tr>
<td>Fumigation</td>
<td>0</td>
<td>100</td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Stationery</td>
<td>0</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>0</strong></td>
<td><strong>3754</strong></td>
<td><strong>9395</strong></td>
<td><strong>9395</strong></td>
<td><strong>9395</strong></td>
</tr>
</tbody>
</table>

**Freight Costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm to Melbourne $2.50/box</td>
<td>0</td>
<td>555</td>
<td>1389</td>
<td>1389</td>
<td>1389</td>
</tr>
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</table>

**TOTAL VARIABLE COSTS**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>4094</strong></td>
<td><strong>8673</strong></td>
<td><strong>15148</strong></td>
<td><strong>15148</strong></td>
<td><strong>15148</strong></td>
</tr>
</tbody>
</table>

**GROSS MARGIN**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>-4094</strong></td>
<td><strong>1329</strong></td>
<td><strong>9857</strong></td>
<td><strong>9857</strong></td>
<td><strong>9857</strong></td>
</tr>
</tbody>
</table>

* Estimated yield under irrigation.
Table 4 Thryptomene gross margin.

<table>
<thead>
<tr>
<th>Income</th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>bunch/plant</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>bunch/Ha</td>
<td>0</td>
<td>0</td>
<td>12501</td>
<td>16668</td>
<td>20835</td>
</tr>
<tr>
<td>price/bunch ($)</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>0</td>
<td>18752</td>
<td>25002</td>
<td>31253</td>
</tr>
</tbody>
</table>

**Variable Costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertiliser</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Weed control</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>Insect control</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Irrigation</td>
<td>250</td>
<td>520</td>
<td>520</td>
<td>520</td>
<td>520</td>
</tr>
<tr>
<td>FORME (fuel, oil, repairs, maint, elect)</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>4094</td>
<td>4364</td>
<td>4364</td>
<td>4364</td>
<td>4364</td>
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**Picking and packing costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour 80 bunch/hr @ $12/hr</td>
<td>0</td>
<td>0</td>
<td>1875</td>
<td>2500</td>
<td>3125</td>
</tr>
<tr>
<td>Boxes @ $3.60 ea</td>
<td>0</td>
<td>0</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
</tr>
<tr>
<td>Elastic bands, tape locks</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>70</td>
<td>90</td>
</tr>
<tr>
<td>Bleach/germicide</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Sugar/preservative</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>100</td>
<td>130</td>
</tr>
<tr>
<td>Fumigation</td>
<td>0</td>
<td>0</td>
<td>70</td>
<td>100</td>
<td>130</td>
</tr>
<tr>
<td>Stationery</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>0</td>
<td>0</td>
<td>3595</td>
<td>4770</td>
<td>5945</td>
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</table>

**Freight Costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm to Melbourne $2.50/box</td>
<td>0</td>
<td>0</td>
<td>1041</td>
<td>1389</td>
<td>1736</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>0</td>
<td>0</td>
<td>1041</td>
<td>1389</td>
<td>1736</td>
</tr>
</tbody>
</table>

**TOTAL VARIABLE COSTS**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4094</td>
<td>4364</td>
<td>9000</td>
<td>10523</td>
<td>12045</td>
</tr>
</tbody>
</table>

**GROSS MARGIN**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-4094</td>
<td>-4364</td>
<td>9752</td>
<td>14479</td>
<td>19208</td>
</tr>
</tbody>
</table>

* Estimated yield under irrigation.
### Table 5  *Protea repens* gross margin.

<table>
<thead>
<tr>
<th>PROTEA REPENS</th>
<th>Gross Margin For 1 Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>1667 Plants/Ha</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income</th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>stems/plant</td>
<td>0</td>
<td>5</td>
<td>15</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>stems/Ha</td>
<td>0</td>
<td>8335</td>
<td>25005</td>
<td>50010</td>
<td>66680</td>
</tr>
<tr>
<td>price/stem ($)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>4168</td>
<td>12503</td>
<td>25005</td>
<td>33340</td>
</tr>
</tbody>
</table>

**Variable Costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertiliser</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Weed control</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>Insect control</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Irrigation</td>
<td>250</td>
<td>520</td>
<td>520</td>
<td>520</td>
<td>520</td>
</tr>
<tr>
<td>FORME (fuel, oil, repairs, maint, elect)</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>4094</td>
<td>4364</td>
<td>4364</td>
<td>4364</td>
<td>4364</td>
</tr>
</tbody>
</table>

**Picking and packing costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>0</td>
<td>1111</td>
<td>3334</td>
<td>6668</td>
<td>8890</td>
</tr>
<tr>
<td>Boxes @ $3.60 ea, 110 stems/box</td>
<td>0</td>
<td>273</td>
<td>818</td>
<td>1636</td>
<td>2182</td>
</tr>
<tr>
<td>Elastic bands, tape locks</td>
<td>0</td>
<td>50</td>
<td>100</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Bleach/germicide</td>
<td>0</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Sugar/preservative</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Fumigation</td>
<td>0</td>
<td>200</td>
<td>250</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Stationery</td>
<td>0</td>
<td>50</td>
<td>100</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>0</td>
<td>1729</td>
<td>4652</td>
<td>8954</td>
<td>11772</td>
</tr>
</tbody>
</table>

**Freight Costs**

<table>
<thead>
<tr>
<th></th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
<th>year 4</th>
<th>year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm to Melbourne $2.50/box</td>
<td>0</td>
<td>189</td>
<td>568</td>
<td>1136</td>
<td>1515</td>
</tr>
</tbody>
</table>

**TOTAL VARIABLE COSTS**

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>-4094</strong></td>
<td>-2114</td>
<td>2919</td>
<td>10551</td>
<td>15689</td>
<td>10551</td>
</tr>
</tbody>
</table>

* Estimated yield under irrigation
11.3 Capital And Machinery

This section contains a list of capital and machinery that a wildflower farm may/will require at some stage during the crop's life. No prices have been allocated due to extreme variation of equipment size, models, condition and etc.

I. Land
   A. size of operation (4 hectares minimum for one person)

II. Packing Shed (150m² minimum)
   A. guillotine / bunch cutter
   B. banding / strapping machine
   C. sorting benches
   D. sleeve holder
   E. good lighting

III. Cool Room Storage Area (15m² floor space minimum)

IV. Vehicles
   A. 4wd cars
   B. 4wd bikes
   C. tractors
   D. trailers
   E. mower/slasher
   F. forklift

II. Refrigerated Transport

III. Spray Equipment
   A. boom sprayer
   B. misters
   C. portable units (200 litre tank)
   D. chemical store

IV. Safety Equipment
   A. gloves
   B. masks
   C. helmet
   D. overalls
   E. apron
   F. boots

V. Scales
   A. heavy
   B. light

VI. Dip Bath And Drying Area or gas fumigation facilities
I. Harvesting Equipment
   A. secateurs
   B. buckets
   C. pallets

II. Water storage, pumps, mains, motors etc.

III. Office
   A. desks
   B. phone/fax
   C. staff facilities
17. Colour Plates

Figure 1. *Acacia baileyana*

Figure 2. *Acacia baileyana*

Figure 5. *Acacia merinophora*

Figure 3. *Acacia cultriformis*

Figure 4. *Acacia pacifica*

Figure 6. *Acacia retinodes*