Growing lavender in Western Australia

Aileen Reid

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GROWING LAVENDER in WESTERN AUSTRALIA

The Centre for New Industries Development
Researched by
Aileen Reid
The Centre for New Industries Development
Agriculture Western Australia

Photographs Courtesy of
Nedlands Lavender Farm, Morinington Peninsula, Victoria
# GROWING LAVENDER in WA

## INDEX

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>Botany</td>
<td>4</td>
</tr>
<tr>
<td>Markets and marketing issues</td>
<td>4/5</td>
</tr>
<tr>
<td>Uses</td>
<td>5</td>
</tr>
<tr>
<td><strong>Production of lavender</strong></td>
<td></td>
</tr>
<tr>
<td>Site selection</td>
<td>5</td>
</tr>
<tr>
<td>Cultural requirements</td>
<td>7</td>
</tr>
<tr>
<td>Shelter</td>
<td>7</td>
</tr>
<tr>
<td>Plant selection</td>
<td>8</td>
</tr>
<tr>
<td>Propagation</td>
<td>8</td>
</tr>
<tr>
<td>Plant design</td>
<td>8/9</td>
</tr>
<tr>
<td><strong>Plantation management</strong></td>
<td></td>
</tr>
<tr>
<td>Pruning</td>
<td>9</td>
</tr>
<tr>
<td>Pest and diseases</td>
<td>9</td>
</tr>
<tr>
<td>Weed control</td>
<td></td>
</tr>
<tr>
<td>Harvesting</td>
<td>10</td>
</tr>
<tr>
<td>Processing</td>
<td>10</td>
</tr>
<tr>
<td>Extraction</td>
<td>12</td>
</tr>
<tr>
<td>Chemical composition</td>
<td>12</td>
</tr>
<tr>
<td>Value adding</td>
<td>14</td>
</tr>
<tr>
<td>Economics</td>
<td>14</td>
</tr>
<tr>
<td>Conclusion and summary</td>
<td>16</td>
</tr>
<tr>
<td>More information</td>
<td>17</td>
</tr>
<tr>
<td>Useful websites</td>
<td>18</td>
</tr>
<tr>
<td>Contacts</td>
<td>18</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>18</td>
</tr>
</tbody>
</table>
Lavender oil is an essential oil, derived from plants (genus Lavendula) primarily by steam distillation of the flowers. There are several types of lavender oil. The 'true' lavender oil, and the most highly prized, comes from Lavendula augustifolia; it is primarily used in the fragrance and perfume industry. World production is about 200 tonnes per year.

Spike lavender oil, derived from Lavendula latifolia, has a world production of about 150-200 tonnes per year. Lavandin oil is derived from hybrids of L. augustifolia x L. latifolia that yield much higher than L. augustifolia but the oil is lower quality, hence it is considerably cheaper. World wide production of lavandin is thought to be about 1000 tonnes/year. Lavandin oils have largely replaced lavender oil except for the most expensive products. The oils are also used in some food and industrial products. There is a small but increasing use in aromatherapy.

Both Australia (Tasmania, Victoria) and New Zealand (Central Otago, Canterbury, Nelson and Hawkes Bay) have areas of commercial lavender production. However, while New Zealand has chosen to focus on cultivars such as Grosso, one of the lavandins, Bridestowe Estate in Tasmania produces oil from cultivars of L. augustifolia.

Markets and marketing issues

Lavandin and L. angustifolia oils are produced in large quantities worldwide. The major suppliers are France, Russia, Australia, Spain, Italy and Bulgaria. In some of these areas production capacity and supply may exceed demand so international prices tend to be competitive.

There are two major ways of selling lavender oil. For the smaller producer, local, niche markets can usually be found. With an increasing interest in aromatherapy, this provides another potential outlet. Many small producers target the tourist trade and sell their oil through local outlets.

For larger producers, selling internationally, it is necessary to look at the established buyers, flavour and fragrance houses or companies which deal in essential oils. New producers need to understand that consistent quality is the key factor in the market place. Once an end user finds a regular supply of a particular oil that is produced at a consistent quality, then they will tend to stick with this source, as other oil sources may affect the quality of their end product. Therefore you need to shop around and talk to as many of the brokers, traders and flavour and fragrance houses as possible to determine the market requirements for lavender.
Much lavandin is grown on the south-eastern plateau of France, mainly between latitudes of 44-55°N. Central Otago in NZ where Grosso is grown, has a latitude of 43-44°S. Winters are quite cold (mean January temperature 2-4°C) and summers are warm (mean July temperature about 20°C). L. angustifolia is typically grown at higher altitudes (up to 900 m above sea level) while lavandin and spike cultivars grow better at lower altitudes and warmer locations. Norfolk in England (52-53°N) hosts a large farm of L. angustifolia.

GROWING LAVENDER in WA

Australia’s largest farm producing lavender oil is the Bridestowe Estate near Nabowla in the north-east of Tasmania, which was established by the Denny family in 1921. The estate currently produces a high quality lavender oil following many years of line selection from L. angustifolia. Oil produced by this plantation is highly regarded by the industry. Oil yields at the Bridestowe Estate have been reported to average 50 kg/ha but may be up to 70 kg/ha in good years. Recent annual production at this estate has been about two tonnes per year.

Changes in the economies of countries like Bulgaria and the former USSR in recent times, make the price of lavender and lavandin oils fluctuate markedly.

The ratio of lavender to lavandin production worldwide is about 1:5 with the prices for lavandin being lower. Lavandin plants produce more oil and are hardier than lavender plants.

Lavandin oils have been progressively replacing lavender oils for all but the most expensive products. Though lavender oils bring higher prices, the higher yield of lavandin makes it worthy of consideration. While there is no shortage of all three of these oils, a stable supply of high quality lavender oil similar to that produced in France and Tasmania is likely to always have a market.

Spike lavender has its main production area in Spain but grows wild over a large part of the Mediterranean, preferring warmer and less elevated regions than lavender and lavandin. World wide production of spike lavender oil is 150-200 tonnes per year.

Prices obtained for lavender oils in the bulk market vary widely based on quality and batch size and also over time. L. angustifolia usually fetches about twice the price of lavandin. Five years ago prices for lavandin were about half their current price of $30/kg.

PRODUCTION OF LAVENDER

Site selection

Much lavandin is grown on the south-eastern plateau of France, mainly between latitudes of 44-55°N. Central Otago in NZ where Grosso is grown, has a latitude of 43-44°S. Winters are quite cold (mean January temperature 2-4°C) and summers are warm (mean July temperature about 20°C).

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Uses

The oils from lavender, lavandin and spike lavender have long been used separately, and in combination with other essential oils in the fragrance and perfumery industry. Absolute from L. angustifolia is the only oil suitable for use in cooking. Although the oil is expensive, it is believed to impart a more favourable texture. Minor uses, in terms of quantity, include aromatherapy which relies on the calming and sedative effects of lavender oil vapours. The most likely component to be active in this regard is linalool. Recent medical research is also looking at the use of lavender and some other essential oils for the treatment of baldness in humans and psoroptic mange in chickens. Lavender is also cited in various scientific papers as having local anaesthetic, antifungal, antihistamine and antiviral properties.
Note: For ease of comparison the seasons for Norwich and Digne have been changed.
Cultural requirements

Lavender tolerates a wide range of soils and climate conditions but prefers well-drained soils with pH 6-8.

Plants are tolerant to both moderate frosts and drought but not high humidity. Severe and especially late frost will damage plants and/or flowers. Soils of neutral (7) pH are preferred but successful crops have been produced over the range 5.8 to 8.3 pH. High summer temperatures adversely affect oil quality.

Regular fertiliser applications are required. Studies indicate that nitrogen is the most influential nutrient with regard to oil yield and quality. Rates of around 80-100 kg/ha of nitrogen are generally recommended. Higher rates may decrease oil quality. Soil testing for phosphorus and potassium before planting is advisable to ensure supplies are adequate.

In New Zealand, and other states of Australia where lavender is grown, irrigation is only used for the first one to two years until the crop has become established. This frees up the system to be used elsewhere. This approach is not recommended in Western Australia, especially on the lighter soil types as rainfall can be quite erratic. If the crop dries out at a critical stage, such as flower initiation, then a whole season could be jeopardised, therefore irrigation is recommended to ensure good yields and quality. Trickle irrigation may be preferable to reduce leaf diseases. It is also possible that overhead irrigation could contribute to plant losses through destabilisation.

Shelter

As with most crops, shelter is desirable. Wind destabilises plants which may topple or become predisposed to collar rots which enter through wounds. In addition, volatile oil components may evaporate, especially if temperatures exceed 28°C.

Take care not to use species such as Eucalyptus for windbreaks, their aromatic foliage may contaminate the crop if picked up at harvest time.
Plant selection

For the production of lavender oil to be sold on the international market, the use of the appropriate genotype or variety of lavender is essential because site characteristics will interact with the lavender cultivars and thus affect both oil yield and quality.

There are two main paths to follow in selecting lavender varieties. One is to start from scratch, the approach taken by Bridestowe Estate, Australia’s largest farm producing lavender oil. It was established in 1921 and their selection program started in 1949. They originally imported seed of *L. angustifolia* from high in the Alps of France. Preliminary trials yielded 487 promising genotypes of which only 13 gave large yields of good oil and three produced superior yields of very good oil. Twenty-three years later, these three formed the basis of their plantation.

Many other commercial producers have also selected their own material which means many of the currently grown cultivars are not readily available - if at all.

The other approach is to obtain currently available commercial varieties of lavender plants and trial them for yield and oil quality. Consider the geography and climate of your site against those growing known varieties. Table 1 shows data for a range of existing and potential lavender production sites. Then select a number of varieties for a detailed trial planting. This process may take several years. It is essential that harvest and oil distillations, over more than one year, be undertaken. Test marketing to potential clients together with assessment of oil quality by the use of gas chromatography and organoleptic testing will also be needed since there are international standards to which lavender oils must conform (ISO 3515, ISO 8902, ISO 3054 and ISO 4719). In 1984, a range of *L. angustifolia* and lavandin cultivars were tested by the Department of Agriculture and Natural Resources in Delaware (Tucker et al. 1984). It is worth reading this paper to gain an appreciation of the importance of oil quality.

Experience to date has shown that Grosso, a lavandin cultivar, performs best in only quite narrow conditions. It performs adequately in New Zealand (Hawkes Bay, Motueka), Tasmania and the south of France. Oil yields tend to increase with altitude. Trials with true lavender in NZ have not so far produced oil of acceptable quality.

Many lavender producers grow several different cultivars which may be blended to provide a standardised product.

Propagation

To ensure genetic uniformity only cuttings or tissue cultured plants are used. Two options exist - grow your own, or buy in. If you select your own cultivars you have to propagate your own plants or contract out to a reliable nursery. Be sure to have them sign a licensing agreement so your material is secure. If you use commercially available cultivars, either option is viable but be aware that growing your own stock requires a space commitment to stock beds and specialised facilities for cutting propagation. Lavender plants tissue culture relatively easily but this is not a backyard option.

Planting design

This will depend in part on which cultivar you grow. In New Zealand, lavandin (cv. Grosso) is grown at 800-11,000 plants/ha - 1.5-2.0 m between rows and 0.5-0.75 m between plants. *L. angustifolia* however, is normally planted in rows 1-1.2 metres apart with 0.4 metres between plants which gives a density of about 20,000 plants/hectare. Higher densities mean higher establishment costs but also higher early yields. Plants also tend to support each other, so are more stable and last longer.

If you intend to machine harvest you will need to match row spacing with your machinery.

The first year of the plantation should be for establishment. Whether or not you harvest in the second year will depend on the vigour of a particular stand.
The productive life of plants varies from 5-15 years and may be more. Soil factors adversely affecting plant life for a lavandin cultivar included high organic matter, poor drainage, low or high soil pH, high fertility. Water stress, especially in the establishment phase and plant damage during harvesting are also significant factors. One of the most critical factors to success is well rooted, not rootbound cuttings. This means planting out your rooted cuttings as soon as they arrive, not several weeks later.

**PLANTATION MANAGEMENT**

**Pruning**

In the first year or two depending on cultivar, establishment of a sturdy plant framework is important so flower buds should be pruned off. In later years, pruning will need to be carried out in a separate operation after harvesting, usually in autumn. The reason for this is that harvesting for oil leaves most of the stalk on the plants. Prune back to leave 2-3 leaf bearing nodes on the plant for vigorous cultivars, more for slower growing cultivars. Pruning can be mechanised with the use of hedge trimmers or even a tractor mounted saw.

There are several disease and pest problems that occur in overseas plantations. Australian plantings have been relatively free from pests, although in Tasmania the light brown apple moth has caused some problems. In New Zealand the most commonly seen disease is alfalfa mosaic virus which is transmitted by aphids from such crops as lucerne, clovers and other legumes. Plants develop bright yellow patches on the leaves in spring and the young shoots may be twisted. Root knot nematode is reported to be a problem in India and is also likely to cause problems in Western Australia on sandier soils. Root diseases such as *Phytophthora*, *Fusarium* and *Armillaria* are also reported. The most serious disease of lavender in Europe is yellow decline, caused by a mycoplasma. It is not reported in either New Zealand or Australia. Grosso is resistant.
The flower heads must be dry before being extracted. Oil yield and quality are dependent on processing the flower heads as soon after harvest as possible, therefore distillation facilities need to be readily available.

Yields of lavender oil vary depending on the variety of lavender and plant age. For *L. angustifolia*, yields from 0.1-0.5% (L. oil/kg fresh flower heads) have been quoted from New Zealand, 0.4% from Norfolk and 0.8% from Tasmania. For lavandin the yields are much higher — 1.0-2.5% and one small scale grower in New Zealand was getting 2.8%. Table 2 (extracted from McGimpsey and Porter, 1999) shows lavender yields in kg oil/ha for a range of cultivars at Clyde in Central Otago. Clearly some of these yields are uneconomic.

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Processing

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Table 2: Lavender yields (kg oil/ha) for a range of cultivars at Clyde in Central Otago.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>3rd season</th>
<th>4th season</th>
<th>5th season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munstead (Clyde)</td>
<td>15.7</td>
<td>10.7</td>
<td>9.5</td>
</tr>
<tr>
<td>Munstead (Omarama)</td>
<td>15.0</td>
<td>5.8</td>
<td>32.2</td>
</tr>
<tr>
<td>Munstead 5/14</td>
<td>5.7</td>
<td>2.5</td>
<td>5.4</td>
</tr>
<tr>
<td>L. angustifolia (Tarras)</td>
<td>5.8</td>
<td>8.3</td>
<td>33.3</td>
</tr>
<tr>
<td>L. angustifolia (Christchurch)</td>
<td>9.7</td>
<td>9.0</td>
<td>17.6</td>
</tr>
<tr>
<td>Twickel Purple</td>
<td>22.7</td>
<td>27.4</td>
<td>33.1</td>
</tr>
<tr>
<td>Grosso</td>
<td>68.3</td>
<td>145.3</td>
<td>240.9</td>
</tr>
<tr>
<td>Super</td>
<td>55.5</td>
<td>116.8</td>
<td>161.6</td>
</tr>
<tr>
<td>Impress Purple</td>
<td>105.1</td>
<td>162.3</td>
<td>188.3</td>
</tr>
<tr>
<td>Bogong</td>
<td>121.5</td>
<td>135.6</td>
<td>243.4</td>
</tr>
<tr>
<td>Old English</td>
<td>19.8</td>
<td>54.8</td>
<td>64.1</td>
</tr>
<tr>
<td>Grey Hedge</td>
<td>18.6</td>
<td>58.9</td>
<td>105.1</td>
</tr>
</tbody>
</table>
Container type will depend on several factors including the scale of operation, type of essential oil and client preferences. Large scale producers favour 200 litre galvanised steel drums which are usually double or triple galvanised to ensure no reaction of the oils with the steel. Stainless steel containers, while very good are usually too expensive for widespread use in bulk operations. For small scale production, brown glass bottles with appropriate lids are usually suitable. All containers should be filled to the top to reduce contact with trapped air. Larger producers of essential oils may opt to replace the air space in the top of the drum with nitrogen.

Essential oils have considerable advantages over fresh produce in terms of high value to volume and long storing abilities. If stored in the correct containers with a minimum of airspace and correct temperature most essential oils can be stored for several seasons. This provides the producer with the option of storing the oil when the price is low and re-entering the market when the price is high.

Potential buyers look for oil quality and quantity to be relatively consistent from year to year. Once a reputation has been established advance orders are usual.

A range of the components of the steam distilled products obtained from gas chromatography are shown in Table 3. As with most essential oil products the final test for quality will be the organoleptic (taste or smell) opinion of the flavourists.

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Table 3: Acceptable range for selected components of four lavender and lavandin oils according to international (ISO, AFNOR) standards. Units are peak area % of the whole oil as measured by gas chromatography. ns - not specified.

<table>
<thead>
<tr>
<th>Character</th>
<th>Lavender</th>
<th>Grosso Lavandin</th>
<th>Abrialis Lavandin</th>
<th>Spike Lavender</th>
</tr>
</thead>
<tbody>
<tr>
<td>density</td>
<td>0.877-0.890</td>
<td>0.890-0.898</td>
<td>0.855-0.867</td>
<td>0.895-0.917</td>
</tr>
<tr>
<td>camphor %</td>
<td>0-0.5</td>
<td>6-8%</td>
<td>7-11</td>
<td>8-20%</td>
</tr>
<tr>
<td>1,8-cineole %</td>
<td>0-15</td>
<td>4-7</td>
<td>6-11</td>
<td>20-35</td>
</tr>
<tr>
<td>Trans-β-Ocimene %</td>
<td>2-6</td>
<td>ns</td>
<td>3-7</td>
<td>ns</td>
</tr>
<tr>
<td>Cis-β-Ocimene %</td>
<td>4-10</td>
<td>ns</td>
<td>1.5-3.5</td>
<td>ns</td>
</tr>
<tr>
<td>linalool %</td>
<td>25-38</td>
<td>25-36</td>
<td>20-28</td>
<td>25-50</td>
</tr>
<tr>
<td>linalyl acetate %</td>
<td>25-45</td>
<td>28-38</td>
<td>20-28</td>
<td>trace</td>
</tr>
<tr>
<td>terpinen-4-ol %</td>
<td>2-6</td>
<td>2-4</td>
<td>0-1</td>
<td>0.5-3</td>
</tr>
</tbody>
</table>
GROWING LAVENDER in WA

Value adding

A farm producing lavender oil has several opportunities for value adding:

a) Oil. The aromatherapy market is expanding and so there is a market for small quantities of oil (10-100 mL bottles). These are sold locally at greatly inflated prices (up to $8 for 10 mL, retail depending on quality). There is potential here to market oils with slightly different characteristics and even to blend lavender with other oils for particular markets.

b) Fresh flowers/plants. Whilst the crops grown for oil cannot be used for fresh flowers, other varieties may be grown to provide a visual attraction or for wholesale or retail sale. The cutflower market for lavender is small and not high priced. Currently as a nursery crop it is riding a wave and many new cultivars are coming on the market all the time. This will not last. Be aware that growing lavender for either of these uses really amounts to an entirely separate, new venture and may be more trouble than it is worth.

c) Dried product. Lavender has many uses as a dried product — from pot pourri to dried arrangements. Often this will be in combination with other flowers so these have to be either bought in or grown.

d) Food. Lavender is also quite a trendy cooking ingredient at the moment. Lavender shortbread, lavender icecream, lavender flavoured sugar and even lavender tea.

e) Miscellaneous. Lavender is also used for honey production, as a fragrance in soaps and incense and other household products.

Economics

To be viable in the commercial essential oil trade, an operation of significant size must be established. Estimates are in the order of 40-50 hectares. If a tourist operation can be combined with the oil producing enterprise then an area required may be less. If the target is the niche markets of a small corner shop, aromatherapy use or tourists, an operation of smaller scale can be considered.

The spot prices (June 2000) for lavender in drum lots offered by essential oil traders are:

- Bulgarian 40/42% ester: $US65/kg
- Dalmation: $US35/kg
- Spike: $US29.30/kg
- French 40/42% ester: $US63.70/kg

With the information available at the time of writing the author could not find a way to develop a commercially viable enterprise based solely on lavender oil. Many potential lavender growers consider the benefits of combining a lavender with another enterprise such as a restaurant to offset production costs. This may alter the return requirements for a lavender enterprise.
GROWING LAVENDER in WA

Nedlands Lavender Farm, Mornington Peninsula, Victoria

Home-made still
Further development of the lavender industry will require a more in-depth understanding of the economics of lavender production. There are many unexplored variables, from which sort of lavender to the type of venture. Unfortunately, to some degree, each depends on the other. Even for a single selection of lavender, yields vary widely from location to location. Large commercial ventures have selected their own cultivars over a number of years. Even a selection program based on currently available commercial cultivars would take three to four years. There may be merit in developing a long-term selection program given the obvious ‘poor fit’ of either *L. angustifolia* or ‘Grosso’ to Western Australian conditions. What one has to consider though is the cost of such a program against the economics of production and potential value of the industry that may develop.

**Conclusion/summary**

The costs associated with developing a stand-alone lavender oil enterprise from the ground up are such that the venture is not likely to succeed. The chances for a lavender oil enterprise developed on an existing farm where much of the necessary machinery already exists, are much better. However, the scale of the enterprise would still need to be in the order of 20-40 hectares.

Most of the lavender farms in New Zealand and Victoria, even in France, combine a number of aspects of lavender production to create a more viable enterprise where labour can be used more efficiently all year round. Such farms sell lavender oil in small 10-100 mL bottles for aromatherapy, other products made from lavender such as potpourri, various food products (shortbread, icecream, flavoured sugar), fresh/dried flowers and scented candles. This is the most likely scenario to succeed.
GROWING LAVENDER in WA

More information

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Hussain A.; Virmani O.P.; Sharma A; Kumar A; Misra L.N., 1988. Major essential oil-bearing plants of India. Central Inst. of Medic.& Aromatic Plants, Lucknow, India


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Useful websites

http://www.norfolklavender.com – Norfolk Lavender Farm.

Contacts

The Australian Lavender Growers’ Association Inc
President: Peter Manders
Secretary: Neil Chasemore
LongSwamp Consulting
8 Sangria Court
Mt Clear
Vic 3350
Fax: (03) 5330 3396
Email: longswam@netconnect.com.au

Liaison Officers for Western Australia
Lee and Graham Upson
Somerset Hill Lavender
RMB 891 McLeod Road
Denmark WA 6333
Ph: (08) 9840 9388
Fax: (08) 9840 9394