

# Rosemary production



**agriculture,  
forestry & fisheries**

Department:  
Agriculture, forestry & fisheries  
REPUBLIC OF SOUTH AFRICA

# Rosemary production



**June 2009**

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DEPARTMENT OF AGRICULTURE  
Directorate: Plant Production

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2009

Compiled by Directorate Plant Production in collaboration with  
members of SAEOPA and KARWIL Consultancy

Obtainable from

Resource Centre  
Directorate Agricultural Information Services  
Private Bag X144, Pretoria, 0001 South Africa

The web: [www.nda.agric.za/publications](http://www.nda.agric.za/publications)

Published by

Directorate Agricultural Information Services  
Department of Agriculture  
Private Bag X144, Pretoria, 0001 South Africa

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*Rosmarinus officinalis*  
(Photo: W.S. Mokgobu)

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## Part I: General aspects

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### 1. CLASSIFICATION

**Scientific name:** *Rosmarinus officinalis*

**Common names:** Rosemary

**Family:** Labiatae

Most sources interpret the Latin name as *rosmarinus* “dew of the sea”.

## 2. ORIGIN AND DISTRIBUTION

Native to the Mediterranean, rosemary grows freely in large areas of southern Europe and is cultivated worldwide.

## 3. PRODUCTION LEVELS

### South Africa

The expected essential oil yield is 20 to 80 kg oil/ha. Yield of essential oil is between 0,2 and 1,3 % of the fresh mass. Yield of dried leaf should be 2 000 kg/ha.

### Internationally

Leading regions of rosemary production are the Mediterranean countries, Northern Africa, England, Mexico and the USA.

## 4. MAJOR PRODUCTION AREAS IN SOUTH AFRICA

Rosemary grows well in the interior of South Africa, right up to the foothills of the Maluti Mountains in the Eastern Free State. It is also cultivated in Gauteng, Limpopo, North West, Mpumalanga, Eastern and Western Cape provinces.



**Rosemary in the Eastern Cape**  
(Photo: R. du Preez)

## 5. DESCRIPTION OF THE PLANT

### Stem

Rosemary is an evergreen, shrubby herb that grows to a height of 1 to 2 m, with a unique aromatic odour and a camphoraceous undertone. The erect stems are divided into numerous long, slender branches that have ash-coloured and scaly bark.

### Leaves

The branches bear opposite, leathery thick leaves which are lustrous, linear, dark green above and downy white below.

### Flower

The flowers are small and pale blue to deep blue. Much of the volatile essential oils reside in their calyces.

### Essential part



Parts used: Stems, leaves and flowers. The oil of rosemary, distilled from the flowering tops, as directed in the British pharmacopoeia, is superior to the oil that is obtained from only the stem and leaves.

Nearly all the commercial oil is distilled from the stem and leaves of the plant before it is in flower, which then smells more of camphor.

**Rosemary at maturity**  
(Photo: K.M. Swanepoel)





Research for varieties with good-quality oil (Photos: K.M. Swanepoel and W.G. Alberts)



## 6. CULTIVARS

Many varieties are available from commercial nurseries, and these are Benenden Blue, Flora Rosa, Tuscan Blue, Majorca Pink, Arp, Albiflorus, Huntington Carpet, McConnell's Blue, Irene, Holly Hyde, Hill Hardy and numerous others. For commercial purposes, there are three main types described of which the chemical

properties are significant by the market in relation to the main constituent and geographical areas where they dominate:

- ◆ Camphor-borneol (Spain)
- ◆ 1,8 cineole (Tunisia)
- ◆ Verbenone (France)

The cineole and verbenone types are two of the oils which promise to have an impact on future markets.

A selection of a cultivar was made by SAEOPA and tested for good-quality oil. Current research is done at Ermelo Nooitgedacht research farm. Selected varieties for superior oil quality are the correct choice for a commercial producer.

## 7. CLIMATIC REQUIREMENTS

### Temperature

Rosemary is a hardy, temperate plant that can tolerate frost. It grows well at day temperatures of 20 to 25° C. The plant is very adaptable and is grown in almost all regions of South Africa.

### Rainfall

Rosemary is mostly grown under dryland conditions in South Africa. When under irrigation, care should be taken not to overirrigate. Irrigation at planting is essential and supplementary irrigation is advised until the plants are well established. Once established with a strong root system, rosemary can produce well if rainfall is above 500 mm per year. In wetter areas rosemary will not do as well unless ridged to allow excess water to drain away.

## 8. SOIL REQUIREMENTS

Well-drained sandy to clay loam soil with a pH range of 5,5 to 8,0 is required. A clay percentage of 30 % maximum can be tolerated by the plants.



Rosemary cuttings in a nursery  
(Photo: K.M. Swanepoel)

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## Part II: Cultivation practices

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### 1. PROPAGATION

Rosemary is propagated by means of seeds, cuttings, layering or division of roots.

- ◆ Seeds germinate very slowly. As there is always a problem of cross-pollination, growing true-to-type plants from seed is not a good practice unless controlled properly.
- ◆ Cuttings from actively growing stem tips are a good way to propagate new plants efficiently. Cuttings of 10 to 15 cm length are taken. The bottom two thirds are stripped from leaves. The cutting is inserted in a proper growing medium, half to two thirds of the length. Rooting hormones will assist in root formation within 2 to 4 weeks. A mist bed with a heated floor will give the best results.

- ◆ Layering may be accomplished readily in summer by pegging some of the lower branches under a little sandy soil. After roots have formed the plants can then be severed from the parent plant.

## 2. SOIL PREPARATION

Rosemary does not grow well in waterlogged or high clay soils. If the clay percentage of the soil is too high, application of gravel stone with a diameter of 1 to 2,5 cm can be made that can be worked into the soil before planting. This will assist in aeration of the roots. Other practices of incorporation of good compost will also be beneficial.

Herbal and essential oil crops grown on natural soils yield products that are of high quality and in demand globally.

### General soil preparation guidelines

#### *Soil sampling and analysis*

- ◆ Take soil samples according to correct guidelines.
- ◆ Have the soil analysed at a laboratory that will be able to check for mineral deficiencies and excesses, organic status and carbon ratios.
- ◆ A soil analysis will guide the producer in correcting the nutritional status of the soil in order to provide the crop with optimum growing conditions such as a balanced mineral status and correct pH.
- ◆ Soil fertility levels have to be within acceptable ranges before a soil-building programme is started.
- ◆ Correct the soil pH according to analysis and soil type.
- ◆ Fertiliser use has to be planned according to whether the crop will be grown inorganically or organically.
- ◆ Soil preparation has to be done according to good cultivation practices.
- ◆ Apply suitable soil preparation practices according to the farming operation. (rip, plough, disc, harrow, contour, etc.)



**Plant layout for mechanical harvesting**  
(Photo: W.G. Alberts)

- ◆ If mechanical harvesting and weed control is envisaged, prepare row widths adapted to the machinery to be used.

### **3. PLANTING**

#### **Slope**

Rosemary needs full sun. Rows should be orientated east west on the land if possible, and on sloped land planted on the warmer slopes facing north and west.

#### **Planting density/spacing**

Field spacing has to be done according to farming method applied. Seedbeds with a width of 1,2 m and row space of 40 to 50 cm are found effective with mechanised cutting.



Plants are established at 25 to 50 cm within the rows so that the soil is covered quickly. A total of 50 to 60 000 plants per ha is the norm.

### **Planting date**

The cuttings can be prepared in the greenhouse and be transplanted to the field in spring to midsummer.

## **4. FERTILISATION**

A basal fertiliser application containing nitrogen, phosphorus, potassium and sulphur should be applied annually, according to the soil analysis results. Rosemary responds well to additional applications of nitrogen usually made after each harvest to promote new shoot growth during the growing season. Do not give excess nitrogen because the quality of the essential oil may be affected as this reduces flowering, fragrance and flavour. An analysis of organic compost will assist to provide correct application rates.

## **5. IRRIGATION**

When establishing rosemary, irrigation is needed until the cuttings have developed well, i.e. when they have established roots and are growing actively. Do not allow the plants to dry out completely and do not overirrigate. Mature plants can cope with dryland conditions if rainfall is exceeding 500 mm per year.

## **6. WEED CONTROL**

Hand-weeding and hoeing are very important as weeds affect the yield and quality of oil. Generally, 2 to 3 weedings are necessary during the year. Inter-row cultivation can be done by a tractor-drawn cultivator or hand hoe. Care should be taken not to damage roots as rosemary is very sensitive to this and it could cause parts of the plant to die back. Effective plant density and canopy will eliminate weeds.

## Weed control guidelines

- ◆ Do not allow weeds to seed in the land.
- ◆ No-till practices result in fewer weeds.
- ◆ Shade out weeds by plant canopy, high plant density, closer row width, if moisture content of soil and crop specification allow for it.
- ◆ Use manual or mechanical control.
- ◆ Organic control measures such as flame weeding and UV radiation can be used where applicable, and if the crop is tolerant to the method.
- ◆ Some seeds germinate when exposed to sunlight. Night ploughing can be used as an option for fewer weeds.

## 7. PEST CONTROL

Rosemary is vulnerable to spider mites, mealybugs, whiteflies and thrips. Careful monitoring and crop rotation as well as applying insecticidal soap with light-weight horticultural oil will assist in keeping the foliage free of pests.

- ◆ Whiteflies have piercing/sucking mouthparts which they use to suck sap from the leaves of plants. They also excrete large quantities of honeydew which serves as a growth medium for sooty mould.
- ◆ Spider mites feed preferentially on the lower stem, and then move on to feed on the upper section of the plant and on leaves. Leaves may later turn yellow and drop. Silk webbing may be present when infestation is heavy.
- ◆ Mealybug females feed on plant sap. They attach themselves to the plant and secrete a powdery, white, waxy layer used for protection while they suck the plant juices.
- ◆ Thrips feed on leaves with their piercing and sucking mouthparts and damage the plants, causing browning and leaf drop. They can also be vectors of other diseases.

For further information on the identification of insects and diseases and for recommended control measures, extension officers should be contacted.

**For prospective producers of herbal and essential oil crops, the following pest control guidelines are recommended.**



**Waterlogging problems on rosemary**  
(Photos: W.S. Mokgobu)

Extension officers from the Department of Agriculture and researchers from agricultural institutes should be contacted for further information on the identification of insects and for recommended controls.

Use the publication\* *A guide for the control of plant pests – 2002*, compiled by Annette Nel, Mareli Krause, Neervana Ramautar & Kathy van Zyl.

## **8. DISEASE CONTROL**

- ◆ Fungal problems may arise when the plants are overirrigated.
- ◆ Powdery mildew and root rot occur in wet soil.

### **Disease control guidelines**

- ◆ Follow a disease management programme.
- ◆ Regular scouting of the crop is needed.
- ◆ Early detection and management of disease can prevent major problems.
- ◆ Correct identification of diseases is required.

Use the publication\* *A guide for the control of plant diseases – 2003*, compiled by Annette Nel, Mareli Krause, Neervana Ramautar & Kathy van Zyl.

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\* Obtainable from the Resource Centre, Directorate Agricultural Information Services, Private Bag X144, Pretoria, 0001. Tel: 012 319 7141/7085. Fax: 012 319 7260





**Frequent mechanical cutting and fine regrowth**  
(Photo: K.M. Swanepoel)

## **9. HARVESTING**

### **Maturity and methods**

Fields of rosemary are usually harvested once or twice a year, depending on the geographical area and whether the harvest is for plant material or essential oil. A first cutting can be obtained in the seeding year, however it is usually delayed until 18 months after seeding. More often harvesting is done by farmers with mechanical harvesting. The plants are then yielding more material from frequent regrowth.

### **Essential oil**

To obtain essential oil of the highest quality, plants should be in bloom and only the flowering tops should be harvested for distillation. With mechanical harvesting it is better to cut frequently because yields are higher from rapid regrowth.



### **Dried rosemary**

The crop is cut frequently before flowering commences, as the dried product contains only leaves.

#### **Dried rosemary**

For the fresh market, the herb is cut frequently at a young stage as young, fresh shoots are used in culinary preparations. Woody stems will lower the price. Fresh rosemary is harvested early in the morning and kept cooled at 5 °C before packaging for the market. With a temperature of 5 °C, a minimum shelf-life of 2 to 3 weeks can be expected. After temperature, prevention of excess moisture loss is the second most important post-harvest factor affecting the quality and shelf-life of herbs.



**Fresh rosemary**

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## **Part III: Post-harvest handling**

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### **1. SORTING AND DISTILLATION**

The dried product should be processed to remove the leaves from the stems and then sieved to remove dirt and to produce a uniform product. Several methods exist from sun to sophisticated driers. The use of sun-drying methods results in poor quality. Artificial drying methods allow better control of product quality. A forced air-flow drier is a suitable system to dry better-quality leaves.

Rosemary should be dried at temperatures lower than 40 °C to reduce loss of flavour through volatilisation of essential oil, and to maintain a good green colour. After drying, the leaves should be separated further from the stems, sieved and graded. Fresh produce should be clean of foreign material and with a fresh and crispy appearance and a good colour and flavour.

## 2. GRADING

Rosemary oil when distilled from the flowering tops has a clear, powerful refreshing minty-herbal smell with a woody, balsamic undertone. The oil is colourless to slightly yellow with a watery viscosity. Most producers in South Africa cut and distil the entire plant. This oil will have a higher camphor content and will be inferior in quality to the above. The practice to distil the flowering tops separately is more labour intensive.

There is an International Standard (ISO 11164:1995), prescribing quality requirements for dried rosemary. The essential oil content of the dried herb is an important factor contributing to the flavour intensity. Whole rosemary leaves should contain a minimum of 1,2 % volatile oil, maximum of 10 % foreign matter, maximum of 2 % woody stems, and a maximum of 7 % ash.

## 3. PACKAGING

Essential oils can be packaged in bulk or smaller quantities. Smaller quantities usually have higher prices owing to extra handling and packaging materials needed. Essential oils are volatile and as such need to be handled with care. Deterioration begins if the liquid is much darker or more viscous than normal. The relative humidity in the packing area, cold stores, and transport vehicles should be maintained at a high level (> 95 %) where practical.

Fresh rosemary is packaged in crates for bulk handling or in clear cellophane sachets that can be marketed directly in shops and supermarkets.

Dried rosemary is usually sold in either carton boxes or in glass or plastic containers. Moisture, heat, oxygen and light destroy the properties. Dark air-tight glass is preferred for preservation. Storing under 18 °C will extend shelf-life.



## 4. STORAGE

Rosemary essential oil should be stored in a cool, dry area until it is used. Once opened, refrigeration and tightly closing the cap will prolong its shelf-life. It should be kept in dark, air-tight glass bottles and not exposed to heat or heavy metals.

## 5. MARKETING

### Essential oil market

The market for essential oils in SA is divided into local buyers and international buyers. The local buyers include marketing agents and companies from chemical and pharmaceutical, as well as food and flavouring industries. The international buyers are divided into flavour and fragrance houses, cosmetics and personal health care, aromatherapy and food manufacturers who buy in large quantities.

The major market in the world for essential oils is the United States, followed by Japan and Europe. However, production continues to be concentrated in Europe, with seven of the world's largest essential oil processing firms. In the United States, the major users of essential oils are the soft drink companies. Japan accounts for 10 % of the world demand. The Canadian market is dominated by the United States perfume and flavouring industry. France is dominating the world perfumery market, and Switzerland is one of the leaders in the pharmaceutical field.

Britain and India are known to feature strongly in the flavouring sector. The essential oil industry is characterised by a number of difficulties, including lack of stable quality, inconsistent supplies, and variability of active ingredients owing to environmental effects. This has encouraged many of the end users to depend on synthetic oils in an effort to eliminate the above problems. The result is a weaker market for naturally produced essential oils.

With the increased interest in "natural" products and new health consciousness of the public, plus the fact that a natural product is perceived to have a superior quality, there is an opportunity to effectively market naturally grown essential oils, should the above problems be addressed.

The floral water also known as hydrolat and the oil, are bought by agents to supply cosmetic and aromatherapy companies.

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## Part IV: Production schedules

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As farming enterprises are so diverse, a very basic schedule is proposed. Producers must adapt the schedule to their own needs.

General crop schedule – rosemary												
Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Field preparation</b>												
Rip and plough												
Disking												
Prepare seedbed												
<b>Planting, cultivation and harvesting</b>												
Plant and transplant												
Weed control												
Pest control												
Disease control												
Irrigate												
Harvest												

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## Part V: Utilisation

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The main properties of rosemary are anti-inflammatory, astringent, carminative expectorant, nervine, emmenagogue, therapeutic, tonic and stimulant. Rosemary leaves increase circulation, reduce headaches and have antibacterial and antifungal properties, and improve food absorption by stimulating digestion, the liver, intestinal tract, and the gallbladder. It also is used in antiseptic gargles for sore throats, gum problems and canker sores.

### 1. COSMETIC

Rosemary acts on the hair follicles by stimulating growth and acts against dandruff. It is used in preparations for acne and dermatitis. Rosemary is also one of the ingredients used in the preparation of eau de cologne. It is added to liniments as a fragrant stimulant.

### 2. PHARMACEUTICAL AND THERAPEUTIC

Rosemary oil has a pronounced action on the brain as it clears the mind and aids the memory. It is an external stimulant and a relaxant for nervousness, muscle spasms, headaches, migraines, neuralgia, mental fatigue and nervous exhaustion. The antiseptic action of rosemary oil is especially suitable for intestinal infections and diarrhoea, and it also eases colitis, dyspepsia, flatulence, hepatic disorders and jaundice.

On the respiratory system rosemary oil is effective for asthma, bronchitis and whooping cough. It may ease congestion, puffiness and swelling and also may improve acne, dermatitis and eczema. The diuretic properties of rosemary oil are useful with water retention during menstruation, and also with obesity and cellulite. Because of its astringent action, rosemary oil can be effective for sagging skin; its stimulating action may benefit scalp disorders and encourage hair growth. Rosemary has been used as a folk remedy against rheumatism, and treating of wounds. It has been used in the treatment of cancer and as a tonic to the kidneys.

### 3. FOOD AND FLAVOURING

Rosemary is used in food products and nonalcoholic beverages. Fresh and dried rosemary leaves, whole or ground, are used as seasonings for soups, stews, sausages, meat, fish, and poultry. The hydrolat is bottled and sold as a refreshing drink.



Ground rosemary

### 4. INDUSTRIAL

It is used as an ingredient in soaps, creams, candles, deodorants, hair tonics, and shampoos. It is also used in many household cleaners and air fresheners. It is a major constituent of some organic pesticides. The antibacterial and antioxidant activity of rosemary is used to extend the keeping quality of fats and meat.

### 5. OTHER

Rosemary is used as a groundcover and garden plant. It can be planted as hedge. It is a good source of nectar for bees. The plant is used as an insect repellent.

### 6. SAFETY DATA

The essential oil may be irritating to skin and eyes. Rosemary should be avoided if you are suffering from epilepsy or high blood pressure, and during pregnancy. Recent studies have shown that rosemary extract may slightly decrease the likelihood of conception, but does not necessarily interfere with normal development of the foetus after implantation. Essential oils can be harmful if swallowed, and should be kept out of children's reach. Essential oils remain potent for 6 months to 2 years with proper care.

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