A guide to essential oil crops

agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

A guide to essential oil crops

February 2012

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES
Directorate: Plant Production

2012 Second print
2009 First print

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

Obtainable from
Resource Centre
Directorate Communication Services
Private Bag X144, Pretoria, 0001 South Africa

The web: *www.daff.gov.za/publication*s

Published by
Directorate Communication Services
Department of Agriculture, Forestry and Fisheries
Private Bag X144, Pretoria, 0001 South Africa

Further information or contacts
Directorate Plant Production, Division Industrial Crops
Tel: 012 319 6079/6072
Fax: 012 319 6372
E-mail: DPP@daff.gov.za

CONTENTS

1. Introduction 1
2. Major production areas in South Africa 2
3. Climatic requirements 2
4. Soil preparation 3
5. Weed control 6
6. Pest control 7
7. Disease control 9
8. Essential oils market 10
9. Production schedules 11
10. Utilisation 11

References 12

1. INTRODUCTION

Essential oil crops are crops that have volatile, aromatic oils in certain parts of the plant, and the oil is extracted through steam distillation, chemical extraction or CO_2 extraction. Recently, there has been great interest in the cultivation of essential oil crops from commercial, small-scale or emerging farmers in South Africa. As a result, this document has been developed to assist in addressing the problems of unavailability of information on suitable cultural practices and marketing of the products, which has been a discouraging factor to most interested groups.

Examples of essential oil crops are lavender, rose geranium, rosemary, basil, thyme, peppermint, chamomile, eucalyptus, buchu, amongst others. The information in this document is general for the production of all the crops, and production manuals for each of essential oil crops are available separately to assist farmers in the production of individual crops.

2. MAJOR PRODUCTION AREAS IN SOUTH AFRICA

Most of the essential oil crops produced in South Africa are mainly grown in KwaZulu-Natal, Eastern Cape, Western Cape and the Lowveld regions of Mpumalanga and Limpopo provinces. They are also produced in the cooler, high-lying regions of Gauteng and Free State provinces. Buchu, wormwood, fever tea and rose geranium are some of the indigenous essential oil crops commercially cultivated and wild harvested in South Africa.

3. CLIMATIC REQUIREMENTS

Temperature

Essential oil crops do well in temperate, mediterranean and subtropical regions, and most of them do well in many parts of the Republic of South Africa. Farmers are also encouraged to do onfarm trials in order to find a suitable crop for a particular farm or area as this is based only on the available general information. Some crops can tolerate frost, whereas others are sensitive to cold weather and cannot withstand frost.

Rainfall

The crops require sufficient water during seedling establishment stage, and most of the crops can do well in areas where rainfall is in excess of 300 to 1 400 mm per annum without supplemental irrigation. However, in areas where rainfall is less, the crops can be grown with supplemental irrigation.

4. SOIL PREPARATION

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 the 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.
- Organic matter content, soil texture, structure and type, nutrient and mineral status and the relationship thereof have to be known to ensure that there is no degradation taking place and improvement can be monitored.
- Use soil laboratories that can monitor the nutrient status as well as soil life and give appropriate advice.
- Good topsoils have an abundance of good soil life and a high humus content, balanced with minerals and sufficient plant nutrients.

Fertilisation

- 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.
- If organic practices have to be followed for certification, then the rules of the certification body have to be adhered to.
- If inorganic fertilisers will be used, some principles of organic practices will be beneficial to incorporate.

Organic matter

- To improve the soil organic matter, the production or addition of organic matter must exceed the decomposition of organic matter.
- Organic soil preparation practices are encouraged to ensure that the soil microorganisms and organic matter are present.
- Ample well-matured compost application is required at rates in line with the soil analysis.

Feed the soil, not the plant, is fundamental to organic soil management

- Humus is only part of organic matter in the soil, however, it has a profound effect on the structure of many soils.
- When humus is lost, soils tend to become hard and compact, forming clods.
- Humus affects aeration, water-holding capacity and permeability.
- Humus usually increases the ability of the soil to resist erosion.
- Humus enables the soil to hold more water and has the effect of promoting soil granulation and therefore maintaining large pores through which water can enter and percolate downward.
- An abundant supply of organic matter will favour the growth of beneficial soil organisms, which will benefit plant production.
- Excess nitrogen speeds up the decomposition of organic matter.
- Insufficient nitrogen slows down organic matter decomposition, leading to plant starvation.
- To improve soil organic matter, the production or addition of organic matter should exceed the decomposition of organic matter.
- High rainfall and temperature promote rapid plant growth, however, these conditions are also favourable to rapid organic matter decomposition and loss.

Soil microbes

- Good topsoils have an abundance of good soil life, high humus content and are balanced with minerals and sufficient plant nutrients

Ultimately, building organic matter and humus in the soil is a matter of managing the soil's living organisms

- Soil microorganisms cycle nutrients and provide many other benefits such as disease protection, mineral absorption and plant food.
- Organic matter is the food source for the soil organisms.

Tillage

- 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.)
- If mechanical harvesting and weed control is envisaged, prepare row widths adapted to the machinery to be used.
- Use cover crops to suppress weed growth and promote soil moisture capture.
- Some tillage practices and implements are extremely harmful to soil.
- Tillage speeds up the decomposition of soil organic matter and therefore it has to be done with caution.
- Tine implements are less harmful than mouldboard and disc ploughs.
- Mouldboard and disc ploughing unnecessary speeds up the decomposition of organic matter, destroys earthworm habitat, destroys soil texture and structure and increases erosion and compaction.
- Working the soil when it is too wet or too dry is harmful.
- Windbreaks, minimum tilling or no-till practices can be employed where wind can erode soil or damage crops.
- Contour sloped areas to ensure that the soil is not eroded by water.
- Improvements in the soil's physical structure facilitate easier tillage, increased soil water storage capacity, reduced erosion, better formation and harvesting of root crops, and deeper, more prolific plant root systems.
- The soil should have plant or mulch cover to protect it from water and wind erosion and extreme temperatures.

Soil aggregation is the process whereby individual soil particles are joined into clusters or "aggregates"

Some factors that destroy or degrade soil aggregates

- Uncovered soil surface exposed to the impact of raindrops.
- Ploughing soil when too dry or too wet.
- Removal of organic matter through crop production and harvest without return of organic matter to the soil.
- Use of chemical fertilisers such as unhydrous ammonia, which speeds up decomposition of organic matter.
- Excess nitrogen fertilisation.
- Allowing the build-up of excess sodium from irrigation or sodium containing fertilisers.

Producers who treat their soil correctly will have the benefit of producing crops of high value with less input in terms of weed, pest and disease control.

To build soil organic matter; the production or addition of organic matter must exceed the decomposition of organic matter

5. WEED CONTROL

Weed control guidelines

- Do not allow weeds to seed in the land.
- No-till practices result in less 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 machinery control.
- Organic control measures such as flame weeding and UV radiation can be used where applicable, and if the crop can tolerate the method.
- Some seeds germinate when exposed to sunlight. Use night ploughing as option for fewer weeds.
- Use herbicides with low toxicity and rapid breakdown in the soil.
- Select target-specific herbicides.

- Take care to use herbicides according to the manufacturer's specifications.
- Be aware of contamination possibilities.
- Make sure of correct handling, safety procedures and first aid measures if accidental poisoning takes place.
- Record keeping of herbicides, control measures and results.
- Ask for assistance from agricultural specialists if in doubt.

Use the publication* *A guide to the use of herbicides* – 2004, compiled by Hermien Grobler, J.B. Vermeulen & Kathy van Zyl.

6. PEST CONTROL

Pest control guidelines

- Natural pest control measures should be used as first choice.
- Follow a pest management programme.
- Regular scouting of the crop is needed.
- Early detection and management of pest problems can prevent major problems.
- Correct identification of pests and natural beneficial predators is essential.
- Introduce and use biological controls, natural predators, parasites, nematodes, fungi, bacteria, and beneficial microorganisms. Avoid using chemicals that kill such organisms.
- Other organic methods such as reflective mulches, insecticidal soaps, plant extracts, traps and handpicking of pests, water sprays and vacuum, can be used.
- Use controls that target specific taxonomic groups, eating habits, or life stages: insecticidal soaps, horticultural oils, pheromones, and growth-regulating natural substances such as neem oil can be used effectively.
- The knowledge of certain herbs that repel or attract insects can be used in companion planting for pest control.
- If organic practices are to be used, make sure that products are certified for use.

---

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

Safety

- All pesticides, whether organic or synthetic, are poisonous and should be treated with caution.
- When using commercial pesticides, use only registered pesticides with extreme caution according to the manufacturer's specifications.
- Read labels, mix correct dosages and apply according to the manufacturer's specifications.
- Make sure that pesticide safety levels are followed with regard to harvesting time.
- Use safety gloves, mask and protective clothing when applying or mixing pesticides.
- Produce should not be contaminated with pesticides when harvested.
- Make sure of correct handling, safety procedures and first aid measures if accidental poisoning takes place.
- Make sure that correct first aid treatment is given in case of accidental poisoning and have a stock of medicines in the first aid kit always in place.
- Train staff in correct handling of pesticides.
- Record keeping of pests, control measures and results are necessary tools for future planning.
- A proper storeroom for poisonous substances and chemicals is needed with a register to account for incoming and outgoing stock. The room has to be locked safely and the keys have to be accounted for.
- Ask for assistance from Agriculture specialists if in doubt and in need of information.
- Ensure that live insects and mites do not infest export shipments.

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.

---

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

Natural control such as parasitic wasps, spiders, and other general predators can help to keep pest populations at moderate levels

7. DISEASE CONTROL

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 needed.
- Natural organic disease control measures should be used as first choice.
- Use clean seed and plant material from a reputable supplier.
- Grow the crop in disease-free soil.
- Maintain disease-free fields.
- Rotate diseased crop with nonsusceptible crops such as oats, rye, buckwheat, and sun hemp or other crops specified.
- Remove diseased leaves or plants to reduce field inoculums' levels.
- Control moisture, because high humidity on plants strongly favours fungus diseases.
- Some crops need increased spacing between plants to improve air movement and reduce leaf wetness periods for fungus diseases.
- Encourage or introduce natural predators to control vectors that carry disease.
- Sufficient organic matter in the soil will enhance microbial activity and favour pathogen reduction.
- Laboratory analysis is recommended to identify the causal agent when diseases are encountered first.
- Ensure that no diseased material infests export shipments.
- Destroy diseased material properly by burning where a serious threat of contamination exists.

- Do not incorporate diseased material into compost. When producing organic products, make sure that chemicals used for disease control are certified organically.
- Keep proper records of disease control substances and effects.

Production scheduling is part of the overall farm management plan

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

8. ESSENTIAL OILS MARKET

The market of 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 essential oils 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 these 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 superior quality, there is an opportunity to effectively market naturally grown essential oils, should the above problems be addressed.

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

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

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.

9. PRODUCTION SCHEDULES

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

Production scheduling basics

- Soil preparation (soil sampling, analysis, rip, plough, disc, harrow, contour, etc.)
- Propagation (seed, cuttings, other propagation material)
- Planting date
- Growing the crop
- Irrigation
- Fertilising (each type separate)
- Weed control (each separate)
- Pest control (each method/pesticide separate)
- Disease control (each method/chemical separate)
- Harvest
- Post-harvest (distillation, extracts, drying, fresh).

10. UTILISATION

Essential oils are used in flavouring, pharmaceutical and fragrances industries for manufacturing of products such as beverages, detergents, perfumes, medicines, etc. They are valuable commodities in the fragrance and food industries.

Safety

Essential oils are naturally high in volatile organic compounds, and therefore should generally not be applied directly to the skin because of their rapid absorption rate.

The LD50s of most essential oils or their main constituents are 0,5 –10 g/kg (orally or skin test). Because of their rapid absorption rate, it is advised that essential oil should be applied with plants oils or other fats (carrier oil), such as olive, hazelnut, or any other "soft" oil (*http://en.wikipedia.org/wiki/Essential oil*).

REFERENCES*

Centre for the Promotion of Imports from Developing Countries (CBI's). 2007. *Essential Oils. CIB Market Survey: The market for natural ingredients for cosmetics in the EU*. On line: http://www.cbi.eu. Accessed 09 August 2006.

De Silva, K.T. 1995. *A Manual on the Essential Oil Industry*. Vienna, Austria: United Nations for Industrial Development Organization (UNIDO).

Denny, E.F.K. 1991. *Field Distillation of Herbaceous Oils*. Tasmania, Australia: Denny McKenzie Associates.

Coppen, J.J.W. 1995. "*Flavour and Fragrances of Plant Origin*". *Non-wood Forest Products* I. Rome, Italy: Food and Agriculture Organisation. Online: http://www.foa.org. Accessed 09 August 2006.

Graven, H.E. 2005. *History of Essential Oil Industry in South Africa. In: IFEAT conference proceedings*: 2006. Essential oils and aromatic plants symposium. Cape Town, South Africa: ASNAPP.

SAEOPA. 2000–2007. Data base, On line: http://www.safarmer.net/SAEOPA/. Accessed 10 August 2006.

Simon, J., Juliani, R. & Govindasamy, R. 2005. Marketing requirements for national, regional and international trade and the US regulatory dilemma for dietary supplements, in: *IFEAT conference proceedings*: 2006. Essential oils and aromatic plants symposium. Cape Town, South Africa: ASNAPP.

Teubes, C. 2003. Market opportunities for African essential oil products: opportunities and challenges, in: *IFEAT conference proceedings: 2006. Essential oils and aromatic plants symposium*. Cape Town, South Africa: ASNAPP.

Van Wyk, B., Van Outdshoorn, B. & Gericke, N. 1997. *Medicinal plants of Pretoria. South Africa*: Briza Publications.

Verlet, N. 1997. Commercialisation of essential oils and aroma chemicals, *Manual for Essential Oils*. CERDEPPAM, Ministry of Agriculture BP 36 26110 Nyons, France: UNIDO.

---

* Further information on references could be obtained from members of SAEOPA and KARWYL Consultancy.