Peppermint production

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DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES
Directorate: Plant Production
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Part I: General aspects

1. CLASSIFICATION

Scientific name: Mentha x piperita

Common names: Peppermint, black mint

Family: Lamiaceae

Of the members of the mint family under cultivation the most important are the several varieties of peppermint (Mentha x piperita), extensively cultivated for years as the source of the well-known volatile peppermint oil, used as a flavouring and therapeutic agent.
2. ORIGIN AND DISTRIBUTION

The origin of peppermint species cannot be determined. Dried leaves were found in the Egyptian pyramids dating back to 1 000 BC. Two species of mint were used by the ancient Greek physicians, however, some writers doubt whether one is the modern peppermint, though there is evidence that *M. x piperita* was cultivated by the Egyptians. It is mentioned in the Icelandic pharmacopoeias of the thirteenth century, but only came into general use in the medicine of Western Europe about the middle of the eighteenth century, and then was first used in England.

Pliny the Elder, 79 AD, an ancient Roman author, natural philosopher and naval and military commander of some importance who wrote *Naturalis Historia*, tells us that the Greeks and Romans crowned themselves with peppermint at their feasts and adorned their tables with its sprays, and that their cooks flavoured both their sauces and their wines with its essence.

The plant is found throughout Europe, in moist situations, along streambanks and in wastelands.

3. PRODUCTION LEVELS

South Africa

Under irrigation and good management, peppermint will yield 20 to 25 tons of plant material per hectare per year, at an oil recovery rate of 0,3 % or 60 to 75 kg essential oil per ha. Dryland production will generally be less, but it will depend entirely on the quantity of rainfall and its frequency throughout the season.

Internationally

World production is more than 4 000 metric tons per year, with the USA accounting for 80 % of this and, in addition, being an importer and re-exporter. The USA mint produces an average 25 tons of herbage and 78,3 kg oil per ha at a 0,3 % oil recovery rate.

Production of *M. x piperita* also takes place in Canada, Europe and Britain, Australia, Tasmania and New Zealand. The Asian continent also produces mint oil
with India and China as the largest of these producers. The Japanese, cultivate *M. arvensis*, var. *piperascens*. The Chinese cultivate *M. arvensis*, var. *glabrata*, both have a higher menthol content than *M. x piperita*, but with lower overall quality. The increase in worldwide demand is currently at about 5% a year, predominantly as a result of Asian market expansion.

4. **MAJOR PRODUCTION AREAS IN SOUTH AFRICA**

Peppermint can be grown in most parts of South Africa where rainfall of higher than 1 000 mm per annum occurs with long periods of sunlight and cool night temperatures. The latter are needed for the correct balance of high-quality oil production and it limits the constituent menthofuran, which is undesirable in the oil.

There are indigenous mint species growing in South Africa in the temperate zones and these are indicators of where the crop can be grown successfully. The best areas are the escarpment of Mpumalanga, Gauteng, Eastern Free State, higher altitudes of KwaZulu-Natal, and areas in the Eastern and Western Cape.

5. **DESCRIPTION OF THE PLANT**

*Mentha x piperita* L. is a sterile, perennial herb originating from a hybridisation between watermint (*Mentha aquatica*) and spearmint (*Mentha spicata*), and therefore must be propagated vegetative-ly. The entire plant has a very characteristic sharp, mint odour, because of the presence of the volatile oil.
Stem

Peppermint is a summer-growing perennial with upright, usually purplish, smooth stems growing to 1 m in height.

Leaves

The lance-shaped leaf margins are finely toothed, their surfaces smooth, both above and beneath, or very slightly hairy (hardly visible), on the principal veins and midrib on the underside.

Flowers

The whorled clusters of little reddish-violet flowers are in the axils of the upper leaves, forming loose, interrupted spikes, and rarely bear seeds.

Essential part

The whole plant is cut at flowering stage for steam distillation. The oil is found on the undersides of the leaves.

Mint leaves. From left to right peppermint, Eau de Cologne mint (M. citrata), Japanese mint (M. arvensis var. piperascens, also known as var. japonica), horsemint or silver mint (M. longifolia), Moroccan green mint (M. spicata), pineapple mint (M. suaveolens) and Carinthian mint (M. carinthiaca = M. arvensis x M. suaveolens)
(Source: Gernot Kazer’s Spice Pages)
6. SPECIES AND CULTIVARS

Two main selections are currently used in commercial essential oil production throughout the industry.

- Black Mitcham is the original cross. It is highly valued but susceptible to a soil-borne fungal disease, *Verticillium* wilt.
- Todd Mitcham is a more wilt-tolerant selection which currently forms the bulk of the world’s production.

Japan cultivates *M. arvensis*, var. *piperascens* which has a very high menthol percentage, but is inferior in quality to *M. x piperita*. The Chinese cultivate mostly *M. arvensis*, var. *glabrata*.

7. CLIMATIC REQUIREMENTS

Temperature

Peppermint is grown in cool to temperate regions. It needs long day lengths with warm to hot conditions and cool nights for the right balance of oil compounds to be produced during the growing phase.

Less desirable compounds, particularly menthofuran, form when the conditions are too warm, especially at night.

Rainfall

Peppermint needs adequate rainfall on a regular basis in excess of 1 000 mm per season if planted on dryland.

8. SOIL REQUIREMENTS

Peppermint will grow well in most soil types, including heavy, moist soils if drainage is sufficient. On lands that are under water in winter it will not perform vigorously and plants may even die off. The best soils are deep, well-drained, rich in humus, with good moisture retention. Soil samples are taken for analysis to determine base fertility levels before mint is planted. The soil pH should be kept between 5.5 and 7.0.
Part II: Cultivation practices

1. PROPAGATION

All commercial mint varieties are sterile hybrids and must therefore be propagated vegetatively. Propagation is usually done by using the underground stolons (runners or rootstock) from a nursery site. Dormant stolons are ploughed up.

The stolons cannot be stored for more than a few days because they deteriorate rapidly owing to heat or dehydration. Stolons can be planted by hand or mechanically. Stolons should not have too much top growth. About 1 ha of mother material can supply a cropping area of 7 to 10 ha.

2. SOIL PREPARATION

- 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 nutrient 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 starting a soil-building programme.
- 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.)
- If mechanical harvesting and weed control is envisaged, prepare row widths adapted to the machinery to be used.
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

3. PLANTING

Planting density/spacing

Young shoots are planted 40 to 90 cm between rows and 15 to 45 cm within rows lightly covered with soil. This practice will give a total of 55 000 to 75 000 plants per ha and will cover the soil quickly. A plantation lasts about 3 to 5 years, depending on cultivation, soil and climatic factors. The best yields are obtained from the second year.

Planting date

The plants are propagated in spring.

Design

The young shoots are transplanted into new soil, in shallow furrows. Another way of planting is to spread the stolons over the land, using a modified manure spreader and then discing it in lightly.

3. FERTILISATION

The soil should have at least 120 kg phosphorus and 500 kg potassium available per ha. If the soil sample indicates levels lower than what is recommended, fertiliser should be applied before planting.

Peppermint has to be fertilised properly to achieve a good crop. Nitrogen fertilisation is essential for foliage stimulation and improving the flavour and quality
of oil. Fertiliser rates are generally high in order to allow good vegetal growth and development of the maximum number of leaves. Frequent nitrogen applications are required throughout the growing season to maintain soil fertility.

When manure or organic compost is used, it should be analysed for its properties to ensure correct application rates. The quality of the manure or compost has a great effect on the characteristics of the oil. In trials in the USA application of nitrogen at 200 kg/ha and organic mulch enhanced essential oil yield with improved water-use efficiency. Potassium application was found particularly useful against a form of chlorosis or ‘rust’ (*Puccinia mentho*) (Mitchell, 1998).

5. **IRRIGATION**

Peppermint requires frequent and adequate irrigation, which is used to supplement rainfall. When the plants are fully developed they are watered at least three times a week. It is important to keep the soil constantly moist, although well drained. The crop has high water demands in summer. Care has to be taken to prevent a waterlogged soil, especially in winter, as this will influence growth. Peppermint can be grown under flood and sprinkler irrigation. Pivots and booms are the most labour-saving irrigation systems.

6. **WEED CONTROL**

Weed control programmes should be maintained strictly as weeds compete with mint for available nutrients, thereby reducing yields. Care should be taken when harvesting to avoid inclusion of weeds, which could result in volatile compounds being extracted and reducing the oil quality. Certain weed species are more harmful and can reduce the marketability of the oil.

*Amaranthus* spp. (pigweed) and *Datura* spp. (thorn-apple) can reduce oil quality severely. Hand removal of weeds may be necessary. Always remove the weeds in time before they form seed.

Annual grasses can be a problem and have to be removed before they grow too tall. Perennial weeds are sometimes a bigger problem, especially the *Cyperus* spp. (nut sedges). It is more difficult to control these when the crop is established because the chemicals to be used will affect essential oil quality.
7. PEST CONTROL

Pests on peppermint include cutworms, loopers, mites, weevils, aphids, grasshoppers and soil nematodes. Most pests are troublesome on older mint fields, especially nematodes. Using rootstocks from old lands for planting new lands can introduce pest problems into the new lands.

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

### 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 control measures, 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.
- The knowledge of certain herbs that repel or attract insects can be used in companion planting for pest control.

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* Obtainable from the Resource Centre, Directorate Communication Services, Private Bag X144, Pretoria, 0001. Tel: 012 319 7141/7085. Fax: 012 319 7260
If organic practices are to be applied, make sure that products are certified for use.

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

Peppermint is susceptible to several diseases of which rust, *Verticillium* wilt, leaf spot diseases and anthracnose are important.

*Verticillium* wilt is a fungus which is soil-borne and can survive in the soil indefinitely once spores build up in the soil. Infection occurs through natural openings and wounds on roots. Crop rotation is only effective if it has been followed from the beginning, before the pathogen is well established. It is good to rotate, using a nonsusceptible crop every 3 to 4 years. Onions, maize and soya-beans are good crops to rotate with mint to reduce the likelihood of buildup of verticillate propagules in the soil. Todd’s Mitcham peppermint is less susceptible than Black Mitcham peppermint.

*Mint rust* is considered a severe problem. The symptoms include light-yellow, blister-like lesions on young shoots in the spring, and brownish-red spots surrounded by a yellow halo on the leaves later in the season. Affected leaves fall off and defoliation can be severe. It is important to plough the mint beds to bury overwintering spores. Elimination of volunteer mint plants will also reduce the available rust inoculum.

*Root lesion nematode* (*Pratylenchus penetrans*) and other plant parasitic nematodes such as *Trichodorus* are frequently found on peppermint and nematodes are soil-inhabiting pests that feed on the roots and stunt plant growth. Nematodes have a synergistic relationship with *Verticillium* wilt in that they will increase the number of wounds through which the *Verticillium* can infect the plants, thereby causing the plant to express more severe wilt symptoms.

* Obtainable from the Resource Centre, Directorate Communication Services, Private Bag X144, Pretoria, 0001. Tel: 012 319 7141/7085. Fax: 012 319 7260
Use the publication* A guide for the control of plant diseases – 2003, compiled by Annette Nel, Mareli Krause, Neervana Ramautar & Kathy van Zyl.

9. OTHER CULTIVATION PRACTICES

Mint is sometimes cultivated as a fresh herb or processed in dried form for tea and culinary use.

10. HARVESTING

Maturity time and methods

Timing of harvest is critical to the quality of the oil. Preharvest sampling can be done to ensure that harvesting occurs when oil quality is best. In this sampling changes in oil composition from early January onwards are examined. Optimum oil yield and quality is usually obtained when 10% of the crop is in the flowering stage. Harvesting should be carried out on a dry, sunny day, in the late morning, when all traces of dew have disappeared. The crop is cut, using conventional hay mowers. It is very important to make a clean cut without splintering the stems or shattering of the leaves as this will result in lower oil yields and inhibit regrowth of the plants.

The cut mint is left in the field to wilt, after which it is chopped up with a forage harvester into a mobile distillation pot or trailer to be transported to the stationary distillation facility. Lower moisture content ensures economic oil extraction. Even under the best conditions of wilting, there is a certain loss of essential oil from lying in windrows or heaps for any length of time. Fermentation can occur if not checked, reducing the quality and quantity of the oil. Some producers prefer to distil the crop fresh as soon as cut.

If the crop is well irrigated and matured in time, a second crop can be obtained in the same year. Unlike other essential oil plants, oil yield of peppermint will decrease rapidly if the plant is subjected to either physiological or pathological stress.

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

1. SORTING AND DISTILLATION

The crop is steam distilled and the steam/oil vapour is condensed and separated. Condensing and separation equipment should be manufactured from stainless steel and a general processing hygiene followed to ensure no contaminants are present. The time for oil extraction varies, depending on the type of steam source, the herb weight, and the moisture content.

2. GRADING

The main chemical constituent of peppermint oil is menthol, however, it also contains menthyl acetate and isovalerate, menthone, cineol, pinene, limonene and other constituents. The quality of the oil is determined by the correct combination of chemical constituents, especially menthol and menthone and the absence of menthofuran. Once the oil is separated, the product is relatively stable for many months, provided it is stored out of direct sunlight and away from heat.

Japanese oil has the highest percentage of menthol, 85 %, English oil contains 60 to 70 % menthol, and the American oil 50 %. The odour and taste is a good indication of the quality of the oil, and by this means it is quite possible to distinguish between English, American and Japanese oils.

3. PACKAGING

Epoxy-lined, fluorinated plastic and galvanised drums are used for bulk storage and transportation.

4. STORAGE

Peppermint 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.
5. MARKETING

Essential oil market

The market for essential oils in South Africa 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.

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

The sale price

Price is largely regulated by the world supply and demand. Peppermint is presently being produced in countries with low labour costs such as China and India. This can make it difficult for a South African farmer to compete, unless there is a fair degree of value-adding applied. Organically grown mint oil is always in demand and will fetch better prices.

Part IV: Production schedules

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

When scheduling production, the important factor to bear in mind is to have sufficient knowledge of the crop that you are farming with
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<th>General crop schedule – peppermint</th>
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<tbody>
<tr>
<td><strong>Activity</strong></td>
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<tr>
<td>Field preparation</td>
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<tr>
<td>Rip and plough</td>
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<td>Disking</td>
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<td>Prepare seedbed</td>
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<td>Planting, cultivation and harvesting</td>
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<tr>
<td>Plant and transplant</td>
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<td>Irrigate</td>
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<td>Harvest</td>
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Part V: Utilisation

Main properties of peppermint are antiseptic, antispasmodic, carminative, cephalic, stimulative and stomachic.

1. INDUSTRIAL

Peppermint essential oil is mainly used as flavouring in toothpaste, ice cream, confectionery, soft drinks, tobacco, chewing gum, and other varieties of foods. It can also be found in shampoos, soaps, balms and liniments. The oil has a cooling effect for fevers.

Peppermint tea and tea blends are becoming more popular as a natural foodstuff. Peppermint tea is used for relief of palpitations of the heart and nausea.

2. COSMETIC

Constituent of certain perfumes are used for treatment of acne and dermatitis.

3. MEDICINAL AND THERAPEUTIC

The therapeutic peppermint value lies in its ability to relieve flatulence, bloating and colic, inhibit the growth of certain bacteria, and can assist in smoothing and relaxing muscles when inhaled or applied to the skin. It increases sweating, stimulates secretion of bile, assists in curing ulcers. Peppermint eases nervous headaches and is used for aid in cases of cholera and diarrhoea.

Peppermint is used to disguise the taste of unpalatable drugs, as it imparts its aromatic characteristics to whatever prescription it enters into. In aromatherapy the essential oil is used to stimulate hot and cold nerve endings and increase blood flow.

4. OTHER

Peppermint is a deterrent to pests such as mice, ants and other insects. Peppermint and spearmint oils are both effective in reducing nematodes in the soil. Recent concerns over the damage to the environment done by nematicides,
especially methyl bromide which also damages the ozone layer, have led to re-
search for safer methods of protecting crops from nematodes in the soil.

5. SAFETY DATA

Nontoxic, nonirritant. Sensitisation could occur because of the menthol concen-
tration. Use in well-diluted form. Because of its stimulant action, it should not be
used for prolonged periods of time.

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