Production guide

Kalahari melon oil

*Citrullus lanatus*
FOREWORD

It has been our pleasure and privilege to support the publication of this Kalahari melon oil production guide.

Global demand for vegetable oils continues to increase, creating an opportunity for local producers to exploit this market need by increasing their production of these sought-after oils. Producers who consistently produce oil that meets international buyers’ requirements in terms of quality and quantity, can enter the export market.

This material has been developed to promote the growth of the vegetable oil industry in South Africa, in support of existing producers and, in particular, to assist new and potential producers who consider becoming involved in this expanding industry, whether as primary crops or as a means of diversification.

We trust that the information contained in this material will empower you, a primary stakeholder in the vegetable oil value chain, to increase your production volumes, expand the range of oils you produce, and meet the quality standards that will distinguish your oils from those of less quality-oriented suppliers and enable you to meet your production, quality and price targets.

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1. INTRODUCTION

The Kalahari melon is considered the original wild watermelon and the evolutionary ancestor of the common, sweet watermelon, distinguishable by its smaller size, pale yellow flesh and bitter taste.

The plant is widely considered to be a weed where it grows wildly, particularly in Botswana, Central and Eastern Namibia, and the Free State, North West, Northern Cape and Western Cape provinces of South Africa.

The Kalahari melon has been used for over 4,000 years by the San people of the Kalahari (Wikipedia).

2. CLASSIFICATION

<table>
<thead>
<tr>
<th>Common name:</th>
<th>Kalahari melon, karkoer, tsamma</th>
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<tbody>
<tr>
<td>Scientific name:</td>
<td><em>Citrullus lanatus</em></td>
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<tr>
<td>Family:</td>
<td><em>Cucurbitaceae</em></td>
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<tr>
<td>Genus:</td>
<td><em>Citrullus</em></td>
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3. PLANT DESCRIPTION

3.1 General description

*C. lanatus*, commonly known as Kalahari melon, is a trailing herb of up to 10 m long, with broad leaves and yellow flowers. The stems can be either prostrate or climbing.

3.2 Habitat and distribution

*Citrullus lanatus* has a wide distribution in Africa. It is an inhabitant of the Kalahari regions of Botswana and Namibia, where it occurs in several morphological forms together with other *Citrullus* species. Its centre of origin has been traced to both the Kalahari and Sahara deserts in Africa.

It is commonly found on riverbanks, dry lakes, drainage areas, open plains, disturbed areas (such as lands used for industrial crops), and even alongside roads.

3.3 Flowers and fruit

*C. lanatus* generally produces its white to yellow flowers during January-April, with the fruits appearing in February-May.
The yellow to green or yellow fruits are soft and fleshy with a length of 9.7-25 cm and width of 6.1-16 cm. Fruits of wild plants are small, with a diameter of 15-20 cm, while cultivated fruits are larger, with a diameter of 30-60 cm.

The fruits vary from a pale yellow or light green (wild form) to dark green, with or without stripes, and the pulp varies from yellow or green to dark red (Jeffrey, 1978).

The seeds are numerous, flat and oval, and are mostly 6-12 mm long. They vary in colour ranging from red, black or dark brown; and sometimes even white or mottled.

Selection of superior seeds was done in Botswana and extensively in Namibia, but not in South Africa yet.

3.4 Leaves

The leaves are herbaceous but rigid, becoming rough on both sides; 60-200 mm long and 40-150 mm broad, ± ovate in outline, sometimes unlobed and ± entire, but usually deeply 3-lobed with the segments again lobed or doubly lobed. The central lobe is the largest. The leaf stalks are somewhat hairy and up to 150 mm long (SANBI, 2011).

4. OIL DESCRIPTION

Kalahari melon seed oil is light yellow in colour and rich in essential fatty acids.

The oil has a very low saponification value, with an iodine value that ranges between 100 and 150, and has good properties of absorbing oxygen on exposure to the atmosphere. The typical iodine value is 119 Wijs.

The generally low peroxide values of oils from the Cucurbitaceae family indicate that they are less liable to oxidative rancidity at room temperature (Odoemelam, 2005; Anyasor et al., 2009).

Phytochemical analysis of the fatty acid content of the oil revealed that linoleic acid is present in the highest concentration followed by oleic, palmitic and stearic acids.

The oil contains a high level of γ-tocopherol (70.56 mg/100 g) as the major component, followed by α-tocopherol (25.94 mg/100 g).

Amongst the phytosterols, β-sitosterol (485.49 mg/100 g) is the key phytosterol extracted from Kalahari melon seed oils, followed by campesterol (130.41 mg/100 g) and stigmasterol (25.87 mg/100 g).

The main phenolic acids present are gallic, protocatechuic, p-hydroxybenzoic, vanillic, caffeic, syringic (trace), p-coumaric and ferulic acids (Nyam et al., 2009).
5. CULTIVATION REQUIREMENTS AND PRACTICES

5.1 Site requirements

5.1.1 Soil

Kalahari melon prefers loose, sandy and well-fertilised soils. The crop does best on a rich, sandy loam, although it will grow in most soil types, provided the soil is well drained.

It grows best at a soil pH of between 5.6 and 7.0, but will tolerate a pH as low as 5.0.

5.1.2 Slope and altitude

Kalahari melon is found in most lower lying areas in all provinces of South Africa and surrounding countries. This annual grows in grassland and bushland, mostly in sandy soils, often along water courses or near water. It has been collected at altitudes of 0-1,785 m.

5.1.3 Temperature

The crop is slightly sensitive to cold temperatures, and is best suited in any climate that has a long, warm summer, with temperatures ranging from 18° C to 35° C.

5.1.4 Rainfall

Generally, it thrives in desert and semi-desert areas, but has been found in low rainfall areas as well.

5.2 Planting and propagation

It is important to have a soil analysis done before any land preparation is actually undertaken. Once the results are known, proper preparation procedures must be followed. If the results from the soil analysis test indicate the pH is too low (i.e., the soil is acidic), calcitic lime must be used to increase the pH to acceptable levels. The lime can be applied at least one month before planting. The soil should be prepared one month before planting.

The field should be deeply ploughed and the ground levelled, using a harrow. All stones should be removed. Raised beds of about 10 to 50 cm high are recommended to improve drainage and rooting. It is planted in rows 2-2.5 m apart with 0.5-2 m spacing between the plants.

Remove all the weeds, particularly perennial grasses, before planting.

Seeds are planted like pumpkins and watermelons, usually directly seeded. It can be planted mechanically or manually.

The biggest risks are floods and excessive rain.
5.3 Crop maintenance

5.3.1 Fertilization

Fertilizer application should be based on the soil analysis.

The soil may be fertilized with organic material such as dried manure or organic compost. It is often intercropped with maize and sorghum.

Generally, the plants require regular applications of nitrogen to promote healthy growth flushes and flower production. Organic fertilizers are best because the trees are subject to fertilizer burn. Sandy soils require larger fertilizer applications than loam or clay.

5.3.2 Irrigation

To the best of our knowledge, there is no documented water requirements for Kalahari melon as a cultivated crop— it is rather seen as a drought survivor. It has been found to be adversely affected by too much rain, though.

No irrigation has been applied in the cultivated areas although the cultivation is expected to be the same as watermelon and mush melon, albeit on a larger scale. C. lanatus can be irrigated to improve yield, but overhead irrigation should be avoided to minimise wetting of the leaves at can result in leaf mould.

5.3.3 Pest and disease control

Kalahari melon fruits have been reported to be damaged by pests.

The melon bug and other insects lay their eggs (developing into larvae) in the fruits, causing poor growth of the fruits and sometimes fruits can go off early, i.e., before the oil extraction period, rendering the seeds unsuitable. Many fruits showed signs of deformity that may be the result of insects attacking the immature fruits. The affected fruits could hardly produce seeds, similar to the same case of the original cultivars, i.e., those that have not hybridized.

The most important pests, among others, are aphids, spider mites, spotted and striped cucumber beetle and thrips. Some natural predators such as ladybirds and soldier beetles can be used to feed on the eggs or adults of some pests. It was reported that repellent plants such as broccoli and radish can be planted with C. lanatus melon to ward off some pests like cucumber beetles. A mixture of wood ash with hydrate lime or hot pepper and garlic in water can be sprayed onto the leaves to control some of the pests. Other pests, such as root-knot nematodes (Meloidogyne incognita), should also be controlled when detected.

The plant is susceptible to a wide range of diseases, among others, downy mildew (Pseudoperonospora cubensis), Cercospora leaf spot (Cercospora citrullina), damping off (Macrophomina phaseolina) and anthracnose (Colletotrichum). Diseases can be controlled by planting disease-free seeds. Other methods such as soil fumigation, good sanitation, crop rotation and mulching are recommended to control diseases.
Standard pest control principles and checklist:

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<tbody>
<tr>
<td><strong>1</strong></td>
<td>An integrated pest management programme should be used as first choice.</td>
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<tr>
<td><strong>2</strong></td>
<td>Regular scouting of the crop is needed, at least twice a week.</td>
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<tr>
<td><strong>3</strong></td>
<td>Early detection and management of pest problems can often prevent major problems.</td>
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<tr>
<td><strong>4</strong></td>
<td>Correct identification of pests and natural beneficial predators.</td>
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<td><strong>5</strong></td>
<td>Correct nutrient deficiencies or excesses.</td>
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<td><strong>6</strong></td>
<td>Introduce and use biological measures to control natural predators, parasites, nematodes, fungi, bacteria and beneficial viruses. Avoid using chemicals that kill such organisms.</td>
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<tr>
<td><strong>7</strong></td>
<td>Other organic methods such as reflective mulches, beneficial insects, insecticidal soaps, plant extracts, traps and handpicking pests should be implemented.</td>
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<tr>
<td><strong>8</strong></td>
<td>Use controls that target specific taxonomic groups, eating habits or life stages: insecticidal soaps, horticultural oils such as neem oil, pheromones and growth regulating natural substances.</td>
</tr>
<tr>
<td><strong>9</strong></td>
<td>Select target-specific synthetic pesticides and insecticides, which often must be applied at a specific point in the life cycle of the pest or disease.</td>
</tr>
<tr>
<td><strong>10</strong></td>
<td>Use only registered pesticides with extreme caution according to manufacturers’ specifications.</td>
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<tr>
<td><strong>11</strong></td>
<td>Produce should not be contaminated with pesticides when harvested.</td>
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<tr>
<td><strong>12</strong></td>
<td>Ensure that live insects and mites do not infest packaging of export shipments.</td>
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<tr>
<td><strong>13</strong></td>
<td>Make use of material safety data sheets (MSDSs) to ensure correct handling, safety procedures and first-aid measures in case of spillage.</td>
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<tr>
<td><strong>14</strong></td>
<td>Records of pests, control measures and results must be kept.</td>
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5.3.4 Weeding and mulching

Weeds compete with plants for nutrients and sunlight, so it is important to control weeds if the crop is to grow successfully. Exclusion of sunlight is one of the best weeding practices. In addition, when Kalahari melon is grown organically and has been certified as such, the price of the oil almost doubles. It is therefore not recommended to use normal inorganic chemicals for weed control.

Mulching is another means of controlling weed growth, thus ensuring that the plants get optimum nutrients and sunlight.

Weeding and hoeing are very important as they affect the yield and quality of oil.

Interrow cultivation can be done by a tractor-drawn cultivator or hand hoe. Take care not to damage roots.

Weeds are usually controlled between rows in the field by means of mechanical mowing with a rotary cutter (slasher driven by a tractor). Chemical control (if not organically certified) is normally followed by mechanical mowing. The advantage of this method is that mechanical mowing is limited, resulting in less traffic on the land. As an alternative to chemical mowing, herbicides can be applied at low concentrations. The objective is not to kill off all the weeds but to slow down their growth.

Mulching with straw, bark chips or shredded hardwood bark mulch is recommended to conserve soil moisture and prevent splashing of soil onto plants during heavy rains, which
may spread disease. Apply mulch after the soil warms in the spring. A 2-5 cm layer of mulch is adequate to reduce high soil temperatures during the summer, prevent soil crusting, improve aeration and reduce weed growth.

6. HARVESTING

The fruits of Kalahari melon reach maturity within 75-95 days after planting. When the fruits are ready for harvest, the tendril right behind each fruit will normally dry down to the base.

The fruits are easy to handle because they are firm when they ripen on the land. The skin is tough enough not only to resist bruising but to give the fruit a good shelf life too.

Kalahari melons being harvested in the Free State

Observations indicate that although different plants produce their fruits at different times, each drops 80% of its fruits within a period of two weeks. During times of drought, it was noticed that the plants yielded a large number of fruits.

A sharp knife is used to cut the fruit from the vine, rather than pulling, twisting, or breaking it off (to reduce the chances of stem decay).

The fruits are sorted and graded according to size and colour. Damaged fruits are discarded. The fruits should be cooled as soon as possible after harvest and can be stored satisfactorily at 15° C for up to two weeks. For long-term storage, the fruit should be kept at about 12° C. It has been reported that fruits can be kept intact for up to two years without withering or rotting.

It is important to ensure that a processing plant is located within reasonable distance (30-40 km, maximum) so that the transport costs do not detrimentally affect profitability. The harvested crop can be packed into new, clean bags, loaded onto trucks and transported to the processing plant. The bags must not be too tightly packed or compressed. The fruit is susceptible to breakage and bruising and should be handled and transported with care.

The ripe fruits are normally collected from the ground by hand.
Vegetable seed oils are generally obtained by means of a screw press (ram press), whose operation entails a considerable amount of work. South African manufacturers offer high-quality ram presses that are used across the world. Temperatures should generally be kept as low as possible.

Effective methods for extracting the seeds exist, but they can be improved. Some enterprises use high-technology decorticators designed for peanuts. For rural homesteads an affordable and simple, still relatively labour-intensive technology would be ideal. Rural women could then decorticate their own seeds in their own time.

The Kalahari melon seeds are removed from the fruit after cutting it open and then they are washed clean and dried before further extraction or decortication is done.

The two current methods of oil extraction are:

- The kernels are extracted from the seed husks by means of a mechanical decorticator, which removes the hard, outer part. The kernels are then sieved out for pressing.
- The kernels are pressed without decortication.
Seed oils can oxidize and therefore need to be handled with care. Keep them in dark, airtight, glass bottles or food-grade plastic or lined high-quality metal drums and do not expose them to heat or heavy metals.

The 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. Vegetable seed oils remain potent for 6 months to 2 years with proper care. If freshness is suspect, the oil should be discarded.

8. CERTIFICATION

Organic production principles are advised as organically grown oil sells at a premium price. In order to secure better prices, the crop has to be organic, hence no inorganic fertilizers, herbicides or pesticides are to be applied to the crop during cultivation.

Produce can only be certified as being organic if it complies with the applicable standards and regulations. Farmers should therefore contact a relevant certification body for an assessment.
Accredited certification bodies are listed on the South African National Accreditation System (SANAS) website (www.sanas.co.za).

Inspection or auditing and certification must be carried out before a product can be regarded as organic. Photographs of the site intended for production must be taken prior to any cultivation. Affidavits must be signed by the local council official as proof that no agricultural activity has been carried out on the land. The U.S. Department of Agriculture (n.d.) suggests that the land should have been lying fallow for the preceding three years. Any other form of documentation that would support claims that the land has been fallow for a certain period should also be obtained.

9. COMMERCIAL PROGRESS

There has been commercial planting in the form of lands but generally the plants are well distributed in rural areas and can be managed in a sustainable way.

A number of improved clones producing larger fruits and therefore, producing higher yields, and which have a variety of skin colours, have been developed in South Africa and neighbouring countries.

There are lessons to be learnt from Namibia’s Kalahari melon seed development project 2008-2009 (Kaura, 2009). Market development, species selection and cultivation need to be coordinated, especially if a project is funded and there is community involvement. Very valuable information was gathered that can be used in the future. Traceability and training were the main shortcomings and should be addressed in the future.

Standards for the oil are also being considered, which should enable producers to negotiate better prices and prove their products’ authenticity to the export market.

In addition to job creation and poverty alleviation, attention needs to be given to benefit sharing and transparency. Producers who are members of SAEOPA are participating in a joint interest group in the form of a Kalahari Melon Producers’ Chamber. They share common concerns and discuss the market and quality requirements on a regular basis via this platform.

Further research should be done on plant selection, which is the most burning issue for research endeavours. Improved selection of outstanding wild plants for production of fresh fruit, processed fruit products and nuts is needed. A larger fruit having a smaller stone and perhaps a thinner skin would obviously be more desirable for most purposes. Selections with improved fruit form, size and higher yield would be highly beneficial, as was done in Namibia (CRIAA SA-DC, 2009).

10. MARKETING

The market remains underdeveloped and still needs substantial development.
Bigger commercial markets will provide income opportunities for rural producers lacking the space or capital to plant thousands of trees for commercial purposes. Kalahari melon can contribute to rural development on many levels, including nutrition and food security, for people pursuing means of income.

Well-established groups can also progress and introduce value-adding where they may be able to make products that use the oil as an ingredient or package the oil into smaller containers which can be sold to retail outlets such as chemists or spas.

There are marketing agents in the industry who buy oil from and sell it to local and international buyers. The processors have done all they can to ensure maximum oil yield from the crop, and it is now up to the marketing agents to secure the best possible price for the oil on the market, for a commission.

The market for vegetable seed oils in South Africa is divided into local buyers and international buyers. Local buyers include marketing agents and companies from chemical and pharmaceutical as well as food and flavouring industries. International buyers are divided into flavour and fragrance houses, cosmetics and personal health care, aromatherapy and food manufacturers, who all buy in large quantities. Kalahari melon oil is used in the cosmetics and food industries, with pharmaceutical applications being a potential market due to Kalahari melon’s high content of vitamin E (tocopherol).

Websites that can be accessed to identify and contact potential buyers, include:

- B2B Central - Euromonitor (https://www.b2bcentral.co.za/channel/pharmaceutical-cosmetic-review/?section=tag&id=8694)
- CBI (https://www.cbi.eu/market-information/natural-ingredients-cosmetics/finding-buyers)
- Comtrade (https://comtrade.un.org/)
- Cosmetics Europe (https://cosmeticseurope.eu/)
- European Federation for Cosmetic Ingredients (https://effci.com/)
- European Federation of Essential Oils (https://www.efeoe.eu/)
- European Flavour Association (https://effa.eu/)
- Exhibitors’ lists on trade fairs’ websites, such as:
  - Biofach (https://www.biofach.de/#)
  - In-Cosmetics (https://www.in-cosmetics.com/)

➢ International Trade Centre (https://www.youtube.com/playlist?list=PLBD125D3A2EB0D420 and https://www.trademap.org/Index.aspx)

➢ Natural Food Colours Association (https://natcol.org/)

➢ Organic Market Info (http://organic-market.info/organic-links.html)

REFERENCES AND FURTHER READING


Taylor, F. (1975 to current). *Veld Products' research and development and impact on poverty alleviation programs in Botswana*. Personal communication and documented database.


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The Global Quality and Standards Programme (GQSP) is a large-scale programme, which was designed to encourage systematic trade development along specific value chains by strengthening quality infrastructure institutions and service providers, enhancing the compliance capacity of private sector actors, particularly SMEs, and creating a culture of quality among all stakeholders. The GQSP is funded by the Swiss Confederation, through the Swiss State Secretariat for Economic Affairs (SECO) and implemented by UNIDO.

The objective of the GQSP South Africa (GQSP-SA) project is to strengthen the quality and standards compliance capacity to facilitate market access for SMEs in the essential and vegetable oils value chain destined for food, health and cosmetic markets.

One of the interventions under GQSP-SA is to promote a culture of quality by supporting SMEs and institutions to embed the need for quality at the individual, institutional and policy levels to build the reputation of the products, and improve the productivity and quality along each stage of the value chain.

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