



## 4.5 *Citrullus lanatus*

<b>Latin:</b>	<i>Citrullus lanatus</i>
<b>Family:</b>	Cucurbitaceae
<b>English:</b>	Kalahari Melon, Tsamma melon, Wild watermelon
<b>Shona:</b>	Mashamba
<b>Ndebele:</b>	Amajodo
<b>Regions found in Zimbabwe:</b>	Zambezi, Kalahari, Central, Save-Limpopo

### Botanical Description

The Kalahari Melon is the wild ancestor of the watermelon, native to the Kalahari sands of western Zimbabwe. It is an annual herb with prostrate or climbing stems up to 10 m long, covered in long spreading hairs. Tendrils are robust and usually divided in the upper part. Leaves are more or less narrowly ovate in outline, up to 20 × 19 cm, usually deeply palmately 3-5 lobed; hairy when young, particularly on the veins beneath, becoming roughly punctuate when older, with margins almost entire. Flowers are solitary, axillary, yellow in colour and unisexual on the same plant, with a five-lobed calyx.

In southern Africa the flowering time of *C. lanatus* is mostly from January to April and the fruiting time mostly from February to May (Welman, 2011). Fruits vary considerably in morphology, the wild Kalahari forms are small and round and the cultivated forms are large oblong fruits. In addition, they vary from pale yellow or light green (wild form) to dark green (cultivars), and with or without stripes; the pulp varies from yellow or green (wild forms) to dark red cultivars (Vermaak et al., 2011). Fruits are smooth, in wild plants they can be 1.5-20 cm long, greenish with darker mottling, white striped; cultivated fruits are much larger and often more elongated, up to 60 × 30 cm. The flesh in the wild form and some cultivated forms is firm and rather hard, white, green-white or yellowish. In cultivated forms the flesh is somewhat spongy in texture but very juicy and soft, pink to bright red-pink.

The Kalahari melon is highly adapted to surviving drought and the harsh light of the desert environment. Although found all over Southern Africa, it is most closely associated with the Kalahari sands of Namibia, Botswana, south-western Zambia and western Zimbabwe (AfriNatural, 2020). It grows in grassland and bushland, mostly in sandy soils, often along water courses or near water.

### Traditional Uses

There is archaeological evidence of the Kalahari melon being in use for over 4,000 years by the San (Vivaness, 2020). Traditionally in Zimbabwe, Kalahari melons have been consumed as food as well as animal feed. The fruit can be eaten fresh or cooked. A prominent traditional dish in Matebeleland is called *umxhanxa* (a mixture of cooked melon, boiled maize grain and sugar) (Moyo, 2020). The tender young leaves and fruits are cooked as green vegetables, while the fruit flesh may be cooked as porridge with maize meal. The hollowed fruit can be used as a container for cooking or storing berries (Alka et al., 2018). The pulp and seeds are prepared in a number of different ways for eating. The fruit excluding the rind, is cut into slices for drying in the sun, or for mixing with meat. Seeds can be roasted and salted and eaten as a snack. Kalahari melon seeds can also produce butter which can be used in place of peanut butter. The fruits and/or seeds are used in different ways in different countries. In the Kalahari region in Africa, *C. lanatus* is used as a source of drinking water. The rind of some cultivars is made into a pickle or a sweet preserve in the United States and in the south of France, the preserved melon is popular for jams. The seeds are usually roasted and salted and the pulp used as soup thickener in Sudan, Egypt and Western Africa (Vermaak et al., 2011).

Rural women of Namibia produce an oil from the seed in their homesteads, and use it for healing applications, massages, cooking oil, and as a skin moisturizer (Lendelvo et al., 2012). The San use the Kalahari melon seed oil to moisturize their skin and encourage hair growth, while the pulp mixed with water is used as a sunblock (Vivaness, 2020). Traditionally, *C. lanatus* melon seed oil is prepared by first pounding the sun-dried seeds to a fine powder and then soaking them in water. This mixture is then filtered through a mesh of straw into a three-legged iron-cast pot. The mixture is then boiled for several hours until the oil separates out from the boiling mixture. The layer of oil that forms on top of the mixture is decanted over time as the boiling process continues. The oil is then stored in glass bottles (Cheikhoussef et al., 2017). The residue from oil extraction is made into balls that are fried to produce a local snack in Nigeria (Van der Vossen et al., 2004). The seed oil, known since the time of ancient Egyptians, was used to care for the skin to maintain its healthy appearance and aid in its regeneration (Athar and Nasir, 2005).



In addition, the oil has traditionally been used for making soap. Tar extracted from the seeds is used for the treatment of scabies and for skin tanning. In Central America and India the oil extracted from the seeds is applied to herpes lesions, venereal sores, stubborn leg ulcers and the face to treat acne vulgaris (Van der Vossen *et al.*, 2004). It has also been used medicinally as a diuretic, for treating urinary diseases and fever. A patent has been filed which mentions the use of the oil in a self tanning formulation but it is listed amongst several other possible ingredients (Vermaak *et al.*, 2011). The oil cake which remains after the oil has been extracted is used mainly as an animal feed (Bie'nabe *et al.*, 2010).

### Commercial History

The main commercially relevant product of the wild Kalahari Melon has been the seed oil. First developed in the late 1990s by Namibian producers, Kalahari Melon Seed oil was adopted by the trade association PhytoTrade Africa in 2001 as a focal value chain for commercial development. This encouraged producers from Botswana and Zimbabwe into the value chain, and today there are a number of businesses across the southern African region engaged in processing and marketing of Kalahari Melon seed oil for both local and export markets. A variety of European cosmetics manufacturers have incorporated the *C. lanatus* melon seed oil into products sold as moisturizers, skin regeneration, and restructuring formulations (Nyam *et al.*, 2009), and this has created a significant draw. As a by-product of the cold pressing process, a seedcake is also marketed in Zimbabwe as a stock-feed.

### Potential Commercial Uses

Kalahari Melon Seed oil is already well-established in the cosmetics industry. *C. lanatus* seeds are comprised of 50% oil and 35% protein). The unusual fatty acid content of the oil, over 50% linoleic acid, with significant quantities of oleic, palmitic and stearic acids (Cheikhoussef *et al.*, 2017), give it an exceptionally light feel, which is highly desirable in cosmetic formulations. Kalahari Melon Seed oil is also useful for soap manufacturing due to its thick, sticky consistency which does not form a hard dry film. The high natural levels of Vitamin E in the oil give it a good shelf-life, and phytosterols within the oil contain strong anti-oxidant properties.

An alternative and very viable use of the oil is as an edible oil. Traditionally consumed as a food oil in Nigeria for many years, under the local name *egusi*, the oil is tasty and healthy. Because it has long been used already internationally, it is also unlikely to require regulatory approval for international market access.

A further potential commercial use, again building on traditional uses, would be to market the seeds as edible seeds. Containing appreciable levels of vitamin C, B2 and key minerals, they are highly prized in some West African countries as a protein-rich snack food (baked or roasted). The growing demand for plant-derived protein continues to drive growth in interest as an alternative to meat in many vegan recipes (Zion Market Research, 2018).

One final potential commercial use would be as a source of a L-Citrulline. This is an amino acid with particular health benefits and medicinal uses (including the commercially interesting treatment of high blood pressure and erectile dysfunction). L-Citrulline is found in all varieties of *C. lanatus*, but there is evidence that it occurs naturally in larger quantities in the wild Kalahari Melon. This is found in the skin of the fruit.

### Market Potential

The demand for cold-pressed oils continues to grow, and already exceeds US\$30 billion/yr (Allied Market Research, 2019). This is driven by a strong consumer preference for natural alternatives to mineral oils, primarily around health concerns relating to petrochemicals. Kalahari Melon seed oil fits well within this category and there is significant growth potential for its use in the cosmetics industry. Although well-suited to all markets, there is a particular demand for non-greasy oils in the Asian market.

The markets for both the seeds and the edible seed oil are huge. The nuts and seeds market, on the back of the growing vegan population across the world, is currently valued at around USD 1,000 billion/yr, and is expected to reach USD 1,345 billion by 2024 (Zion Market Research, 2018). The edible oil market is some USD 100 billion/yr and is projected to reach USD 120 billion by 2025 (Research and Markets 2020). Undoubtedly the primary focus should be within Africa, where the oil and seeds could be positioned as a premium products targeting health-conscious consumers at a moderate price-point.

The market for L-Citrulline would be harder to identify. However, approaches to specialist manufacturers of amino acids (including the Japanese company whose patented L-Citrulline product uses Kalahari Melon as its base) could yield fruitful results. If this was extracted at source as a by-product of the oil/seed production, it could prove an extremely valuable additional revenue stream.

### **Cultivation/ Domestication Potential**

Kalahari Melons have been cultivated in Southern African with other crops like sorghum and maize since pre-colonial times (Alka *et al.*, 2018). They can grow in any type of soil, but do best on well drained sandy-loam with good moisture retention capacity and high organic matter. Raised beds of 30cm are recommended to improve drainage and rooting. They are propagated by seed. The inter-row spacing (between rows) ranges from 2 to 2,5 m and intra-row spacing (between the plants) 0,5 to 2 m. The seeding rate per hectare ranges from 1 to 3 kgs. It can also be intercropped with maize and

sorghum, although this is not recommended under organic production as it poses a higher risk of contamination.

The soil may be fertilised with organic or inorganic material. The crop responds well to fertiliser and the quantity required, depends on the nutrient status of the soil. When using poultry or pig manure, a 10 kg bucket is recommended to cover an area which is 20 cm wide and 15 m long. The same procedure is applicable for the use of kraal manure, but a 10 kg bucket is recommended to cover 5 m. Weed control can be done mechanically using hoes. The most important pests, among others, are aphids, spider mites, spotted and striped cucumber beetle and thrips. 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.

The plant is susceptible to a wide range of diseases, among others, downy mildew, *Cercospora* leaf spot, damping off and anthracnose. 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. As soon as rotting is noticed, turning the melons so that the rotting side faces upwards can be useful. The fruit of wild melon reaches maturity within 120 to 125 days after planting depending on the variety. When the fruit is ready for harvest, normally the tendril right behind each fruit will dry down to the base. The fresh fruit yield ranges from 20t to 30t per hectare and the seed yield ranges from 0.4t to 0.6t per hectare depending on the management practices, climatic and soil conditions.

