



# **AGRICULTURE AND FOOD AUTHORITY**

## **NUTS AND OIL CROPS DIRECTORATE**

### **PROFILE FOR JOJOBA PRODUCTION AND MARKETING IN KENYA**

**Prepared by: Agriculture and Food Authority  
(Nuts and Oil Crops Directorate)**

**November, 2020**

## **Background Information**

Over 80% of Kenya is composed of arid and semi-arid lands (ASALs) (KARI, 2018) with only a few crops being grown mainly for subsistence purposes. These areas lack cash crops which are drought tolerant and irrigation systems are poorly developed. They experience frequent drought leading to crop failure hence overdependence on food relief. These areas have few natural plant resources that can be relied upon on a continuous basis. People in ASALs depend directly on the available natural resources such as firewood and charcoal for their survival and this makes the environment to be more arid resulting into greater poverty and poor dietary intake among the residents. Resources are always at the mercy of severe climatic changes and some species survive only precariously. Serious mitigation programmes are needed to combat global climate change which is anticipated to have far reaching effects in many parts of the world including Kenya as outlined by Ottichilo et al. (1991).

In recent years, there has been considerable interest in using ASALs more productively by promoting crops which can tolerate these conditions such as *Jatropha curcas* (Ngethe, 2017) and jojoba (*Simmondsia chinensis*). These are multipurpose crops, and have a potential use for rehabilitation as well as provision of income to the poor communities. Jojoba has been used to combat and prevent desertification in the Thar desert in India (Alsharhan *et al.*, 2003) and Negev desert in Israel (Benzioni, 1997). Jojoba needs little water for survival (a third or less of the moisture required by crops like citrus or cotton; however, economic consideration dictates that irrigation is essential for a healthy and profitable crop in many dry areas. A jojoba stand can be in production for 100-200 years depending on management and has a deep rooting habit. Jojoba has come at a time when there are dwindling natural resources and increased concern for the environment (Tremper, 1996) hence meeting the aims of Kenya Vision 2030 on rehabilitation of ASALs (NEMA, 2011; NVSC, 2006) and Millennium Development Goals 2015 on ensuring environmental sustainability (UNMD, 2000).

## **The Origin of Jojoba**

Jojoba (pronounced as Ho-ho-ba) is a native of Sonoran Desert of California, Arizona and New Mexico. The Red Indians of the United States of America (USA) have a long history of the traditional use of jojoba as food and medical remedy. Seeds were harvested and used for making necklaces for trade or roasted and eaten as nuts especially during the period of severe droughts. On the other hand, oil extracted from the seed was used for cosmetics, skin afflictions, as well as healing of wounds, kidney and other urine disorders (Gentry, 1958; Tremper, 1996).

## **Distribution**

Jojoba is widely distributed in the Sonoran Desert within the Islands of the Gulf of California and the coastal Sonoran. In Arizona, it is localized in the mountains around Tucson, south and east Phoenix, Catalina, Rincon, Santa Rita, Cerro Colorado, Babquivari and Ajo ranges (Higgins, 1949). In California, it inhabits the mountains around the Salton Sea basin of the Colorado desert and southern portion of San Diego county. It also grows in New Mexico (Higgins, 1949). Jojoba is grown in many countries including USA, Mexico, Argentina, Brazil, India, Israel, Egypt, Saudi Arabia, Australia, South Africa, Peru, Chile and Iran with Israel as the largest producers followed by USA and Mexico (Muthana, 1981; Undersander *et al.*,1990).

## **Climatic conditions**

Jojoba naturally grows in marginal areas with rainfall ranging between 220-400 mm per year. However, for it to produce reasonable seed yields, it requires adequate water supply of 400-700 mm per year. Jojoba is planted when soil temperatures are 20°C and irrigation is maintained for the first 3 years at a rate of 1 litre plant/day until sufficient root growth is established (CJP, 2007). Jojoba tolerates high temperatures ranging from 0-54°C with an optimum between 27-33°C. However, it requires at least, one month at 15-20°C to break flower dormancy. It has a tap root that can go down to 100ft to get moisture and they can survive up to two years of drought and are evergreen; however, they don't grow or produce berries during drought.

## **Production trends**

The crop is propagated through seed, tissue culture or rooted cuttings. It starts bearing seeds after three years and achieves its full yield capacity after 12 years. It's a dioecious shrub, meaning that male and female flowers do not grow on the same plant, for increased yields the ratio of the female to male should be higher since the male can pollinate multiple plants. Ideally there should be a ratio of one to seven. One can tell the gender of the plant by looking at the shape of the flowers. Once the female plant is wind pollinated it produces a green capsule enclosing up to three seeds. The oval shaped seeds slightly bigger than a coffee berry fall on the ground when ripe. Under good management a female jojoba plant has the potential to produce up to three kilograms of seeds. One kilogram produces half a litre of oil, which is seen to have huge economic potential. While jojoba can survive under high temperatures, extreme heat stresses it and causes the bud to abort, affecting the yields. It also needs constant supply of water.

Poor management of the existing jojoba bushes has led to low production through severe abortion of flowers and pods. This is mainly through competition for nutrients, water and space. Agronomical requirements of jojoba are still under experimentation especially in the tropical environment where little has been done (NRC, 2002). Jojoba is drought tolerant and offers promise for agriculture in harsh environments where many conventional crops cannot survive, yet it requires water for the first 2 to 3 years for proper root establishment (Forster and Wright, 2002). Similarly, for sustained high yields, watering is essential in areas with low rainfall, especially in desert areas with less than 350 mm annually. The seed production per bush is 2-3 kg per year which translates to 2 to 3 metric tons per 3 hectare (ha). The world jojoba oil production is estimated at 3, 500 tons per year, from the cultivated area of 8,500 ha whereas the demand ranges between 4 000 to 200 000 tons per year

## Usage and Utilization

Jojoba produces nuts with 45-55% of its weight as oil. The oil from jojoba is similar to that obtained from sperm whale (Hogan and Bemis, 1983), a species threatened with extinction (CITES, 2004). Currently, there is low production of jojoba globally mainly due to high male to female ratio in the plantations since they are mainly established from seed. The following are the specific uses of jojoba

- a) Jojoba produces oil referred to as wax mainly used in cosmetics (lotions, shampoos, moisturizers, hair oils, conditioners), lubricant industry (automobiles and very fast moving machines) and pharmaceuticals (anti-bacteria).
- b) Other uses include: transformer coolants, plasticizers, detergents, fire retardants, candles, polishing wax, antifoam agent in antibiotic production, electronics and computer industries
- c) Jojoba oil is a natural high temperature and high pressure lubricant. It can also be used as a lubricant in high pressure machinery and other industrial purposes.
- d) Jojoba oil is rare in that it is an extremely straight-chain wax ester making it superior base carrier for cosmetics, skin care products, hair care products and aromatherapy blends. The oil is soothing and stops multitudinous skin problems such as dandruffs and prevents premature aging and wrinkling due to exposure to ultra violet radiation. The latter is usually a common problem with albinism. Jojoba oil is used for medical treatments of ailments such as eczema, acute acne, skin cancer, psoriasis, sores, wounds, poison Ivy, cold and kidney malfunctioning
- e) Jojoba cake, a by-product of oil extraction, can be used as animal feed, since it contains 30% crude protein and has been incorporated in chicken feed (2000).
- f) About 80% of jojoba oil is utilized by the cosmetic industry and it is exported to Japan and Europe. Since there are only a few natural products that would directly compete with jojoba oils, the future of the product appears to be bright.

## **The Kenyan situation**

Jojoba was first planted in Kenya in 1977, and today, small trial plantings are scattered in various research stations, some few plants are known to be growing well near Lake Turkana. A private farm (Rukinga ranching company) in Mbololo Village, Maungu near Voi (Taita Taveta County) has the crop planted with seed from California which was first introduced in 1984. The sanctuary, hosting a seven (7)-acre plantation of jojoba (one of the largest and oldest in East Africa), lies along an important migratory corridor where hundreds of elephants seasonally traverse between Kenya's largest parks. Wildlife works which runs Rukinga Sanctuary consider the Jojoba farm a failed project due to the very low production of about 40 Kgs per annually. The seeds obtained are used for oil pressing realizing 37% to 44% oil which is domestically used within the conservancy. The initial farm established was more than 30 acres in size, it has however shrunk to lack of attention and maintenance over the years.

Jojoba in Kenya is grown for its exceptionally high quality oil, used as an additive in cosmetic products, pharmaceutical industry, weight reduction in livestock and as a motor vehicle lubricant. Despite the Rukinga plantation having great potential for liquid wax production, it was neglected until 2014. Wildlife Works, a conservation organization that has since taken over its management of the sanctuary has made efforts to revive the crop.

Ultimately jojoba can be commercially grown to replace common food crops such as maize and beans that are destroyed by wild animals. Unlike food crops such as maize or beans, jojoba is not eaten by wild animals. When eaten by humans or animals, jojoba suppresses appetite, a natural mechanism by the plant to prevent people and animals from eating it. Save for a few shrubs destroyed by natural causes, the plantation has remained intact more than 30 years after it was first planted.

## Ongoing activities in Kenya

Currently, there is low production in Kenya partly due to inappropriate agricultural practices, lack of awareness on the crop and its potential by the public. Hence the need for research on management of young field planted Jojoba seedlings using appropriate cultural techniques to improve their growth and successive seed yield for better economic benefits. Being a relatively rare crop, it took years of research before Wildlife Works could figure out how to commercially grow it, how the oil is processed and the markets available.

In 2014, the organization bought a jojoba oil-pressing machine and since then, it produces 20 litres of oil annually which retails at Ksh 4000/Litre. The firm also uses the oil to make soaps. Some other ongoing activities include:

- Reduction of the Male to female plant ratio which is currently at 75% male and 25% female. The ratio is unsustainable for optimal production and is currently blamed for the low productivity
- Replanting the orchard to increase the tree density. Most trees are destroyed by elephants as they rub their bodies on the crops, this has drastically reduced the number of trees. The original trees planted have aged, most of them are senile and their production has dwindled. Replanting is however frustrated by lack of planting material since the cuttings are difficult to root.
- Pruning and clearing the bushes surrounding the farm which has been a habitat for pests and insects cause abortion hence low production.

Wildlife Works sanctuary is experimenting with supplementary irrigation on one acre of the farm during extremely dry seasons. Depending on its effectiveness, irrigation will be expanded to cover the whole plantation. If jojoba performs well, the small berry could potentially help communities living around Tsavo improve livelihoods, protect the environment and tackle human wildlife conflict. Through irrigation, Wildlife Works hopes to increase the production capacity from 50 litres to 2,000 per year. Jojoba

plants could bring farmers that suffer perennial destruction of crops by wild animals and recurrent droughts out of their misery. The trees require little investment in terms of fertilizer and labor and produce twice a year in March and October, providing relatively easy source of income.

### **Existing global markets**

Jojoba oil is unique, and when substantial quantities become available in consistent supply and at moderate prices, many new uses are likely to be discovered. The oil has ready markets with the highest demand coming from the US. It remains stable during transport, and therefore, the whole world is its potential marketplace. Already, Japan is its largest user and has been importing a third of U.S. production in recent years, the equivalent of about 100 tons per year. In addition, West Germany and the Netherlands have together been importing a similar amount.

Most of the demanded oil has goes into specialty cosmetics. If production trends continue to increase consistently, it seems clear that in the next 10 years far more oil than the cosmetics market can absorb will be produced. This means that jojoba marketers have to quickly develop new outlets. At first, these will probably be markets that already use other oils and waxes.

Because of irregularities in the weather, the supply of jojoba oil to the market is still erratic and unreliable. As a result, potential purchasers have had no assurance of a consistent supply of dependable quality oil at a stable price. Consequently, major industrial corporations are not using jojoba in their products as yet.

### **Conclusion and recommendations**

The jojoba industry in Kenya is still young and in its formative stages despite the crop being scheduled. The crop's production potential is yet to be exploited as the crop is rare and largely unknown. The prevailing situation is a pointer to lack of information due to research gaps which must first be answered before public sensitizations and



commercialization can commence. Besides production the market requires to be vibrant and create demand for the produce and derivative products.

## **Research Needs**

Basic research, the underpinning for the crop's future development, deserves greater support. Government agencies, foundations, corporations, and individuals who fund agricultural research should support jojoba studies. The results of the studies will be useful to farmers, researchers, environmentalists and policy makers. Some particular needs are listed below.

### **Agronomic Research:**

Research is needed to understand its unique properties that can be manipulated for the crop to reach its fullest potential. Among agronomic questions that are yet to be readily answered in the Kenyan context include:

- The common pests and diseases which affect the crop
- How can the propagation be improved cuttings?
- What plant spacing is best?
- What ratio of females to males is best?
- When is the best time to irrigate, and how much water should be applied?
- What is the best method to control weeds?
- What are jojoba's fertilization requirements?
- When is the best time to prune? How little, how much, and what part of the plant to prune?
- What criterion should be the basis for selecting superior plants?
  
- What is the best way to harvest: By hand? By machine? And what type of harvester?

Due to the low genetic diversity, it is, therefore, recommended that superior genotypes be imported to increase the genetic diversity of jojoba in Kenya

## **Increasing Oil Content.**

It is important to select plants with a high percentage of oil in the seeds. Research findings have so far shown that the average oil content is 50 percent which is a substantial figure. This is important because the target for all growers, after all, should be not the seed yield per acre, but the oil yield per acre.

## **Market Development**

The jojoba industry can only realize its profit potential if same efforts applied to propagation and farming practices are applied to market development. One of the major challenge is to increase the number of companies that utilize jojoba in their products.

Potential users have already shown reluctance to incorporate jojoba into their products because they lack technical information, have only limited experience in handling it, and suffer from a dearth of cost benefit data, all of which has been compounded by the absence of an assured supply locally in Kenya. The sole grower and processor in Kenya must concentrate on helping the industry develop and market jojoba products by educating buyers and technical personnel on its usage and advantages.

## **Jojoba Value chain players in Kenya**

	<b>Name of Company</b>	<b>Role in the Value chain</b>	<b>Location</b>
1	Wildlife works Conservancy	Producer/farmer	Taita Taveta
2	Healthy u	Importer of canola seed	Nairobi
3	Forever Living	Importer of canola seed	Nairobi

## Jojoba oil exports by Kenya in 2019

Country	Quantity
Mexico	985
Germany	233
France	194
Belgium	155
United States of America	203
United Kingdom	97
Japan	124
Italy	95
New Zealand	51
Netherlands	29
Malaysia	238
Tanzania, United Republic of	72
Spain	21
Rwanda	35
Australia	6
India	6
Congo, Democratic Republic of the	51
Uganda	14
South Sudan	9
Zambia	5
Ship stores and bunkers	2
China	1
Burundi	5
<b>Total</b>	<b>2,631</b>