

Haitian Moringa, the Plant that Nourishes, Heals and Enriches

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Abstract: Native to India, *Moringa oleifera* is a species that grows in almost all tropical regions. Thanks to its ability to resist drought and light frosts, *M. oleifera* is widely cultivated throughout the world. Located in the center of the American continent and in the Caribbean, Haiti has the soil and climate conditions favourable to Moringa growing. This plant is considered an essential tool to fight malnutrition in the country contributing to the dietary balance of consumers due to the high nutritional value. The medicinal properties of *M. oleifera* give it great importance in contributing to the prevention or treatment of certain diseases such as diabetes, blood sugar, cancer, anemia, malnutrition, constipation, urinary tract infections, and others. Because of its particularities, Moringa offers great opportunities for the country's entrepreneurs and other actors in the sector. Thus, the objective of this article is to give an overview of the importance of this plant and to encourage the Haitian state and institutions to strengthen production and research on Moringa. The interest of this work is also to get the attention of the scientific community to the potential of *M. oleifera* and to encourage any research that could valorize this precious resource.

Keywords: market, *Moringa oleifera*, nutrition, traditional medicine.

Introduction

Since ancient times, medicinal plants have always been part of the daily life of humans as they are used for food (Mykhailenko et al.,

2020), medicine (CONABIO, 2006; Gurib-Fakim, 2006; Salmerón-Manzano et al., 2020) and sometimes in religious rituals (Benkiki, 2006). Today, medicinal plants are a valuable resource for most rural and urban populations around the world (Badiaga, 2011). In recent years, about 200,000 species of medicinal and aromatic plants are used worldwide, especially in empirical and cultural herbal medicine (Păun and Mihalea, 1981; Muntean et al., 2016). Already, about 65-80% of the world's population use traditional medicines due to poverty and lack of access to modern medicine (Ang-Lee et al., 2006; Palomo, 2010; OMS, 2013; Boissiere, 2018).

In Haiti, Rouzier (2014) listed 225 medicinal plants among which *Moringa oleifera* is mentioned as one of the best known species. *Moringa oleifera* is used to combat certain diseases (Kalkunte, 2006; Patel et al., 2010; Emmanuel et al., 2014; Jung, 2014). Known as Benzoliv, it occupies an important place in traditional Haitian being used worldwide as medicine for diseases such as diabetes (Gupta et al., 2012), hypertension (Dahot, 1988; Okorie, 2019), cancer, gastric ulcers, malnutrition, anemia, etc. (AGROCONSULT HAITI, 2016). In addition to its medicinal properties, Moringa is one of the most nutritious plants in the world with its 90 nutrients and 46 antioxidants (Aimée, 2022). Thus it contributes greatly to the dietary balance of its many users and is one of the main tools in the fight against malnutrition in Haiti. From an economic point of view, Moringa is a rapidly expanding market in the country and is growing rapidly in North America and Europe (Le nouvelliste, 2017). For this reason, for several years now, certain actors in the sector have been involved in the development of Moringa in Haiti and the State, through certain ministries which are trying to promote the production of this plant (AGROCONSULT HAITI, 2016).

Despite the efforts of the Haitian state and other ONG, several constraints, related to global policy development, production, processing and marketing, have been identified in the Moringa sector (Le nouvelliste, 2017; Jean, 2019). Thus, the objective of this manuscript is to provide an overview of the importance of this plant and to encourage the Haitian state and institutions to strengthen production and research on Moringa. Therefore, the present research paper presents the characteristics of *M. oleifera* in Haiti and focuses on its medicinal, nutritional and economic importance.

Geographical distribution

Moringa oleifera is a tree native to India, precisely in the foothills of the Himalayas (Price, 1985; Nadeem and Imran, 2016). It spread to Egypt (Barakat and Ghazal, 2016) and then Africa and reached the Mediterranean and eventually acclimatized in almost all tropical countries (Di Pietro, 2008). In Haiti, the city of “Léogâne” is considered the main *Moringa* planting area (AyizBlog, 2018), but the country has a very interesting production potential in almost all its territory (Antonio, 2011) (Figure 1).

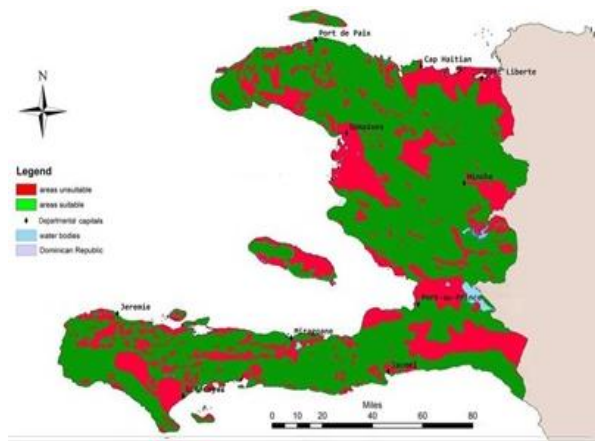


Figure 1. *Moringa oleifera* potential growing areas in Haiti
(Source: Antonio, 2011)

Classification

The genus *Moringa* is the only genus in the family Moringaceae; it comprises thirteen tree species and is classified according to the developed by Cronquist (1981) as follows (Antonio, 2011):

Domain: Eukaryota Kingdom: Plantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Capparidales
Family: *Moringaceae*
Genus: *Moringa*
Species: *Moringa oleifera*

Botanical presentation

M. oleifera, also known in Haiti as Doliv or Benzoliv, is a fast-growing, perennial tree (Figure 2) that can reach heights of 7-12 m (Toussaint, 2014).



Figure 2. Moringa tree
(Source: <https://urlz.fr/jLyX>)

Root

The root system is a tubular structure, with a central pivot that can penetrate up to 1.30 m deep into the soil, giving it great resistance to drought (Rosa-Dalla, 1993).

Trunk

The trunk of *Moringa oleifera* is usually straight, but sometimes it is very shallow. It usually grows to 1.5-2 m in height before branching and is 20-40 cm in diameter (Foidle et al., 2001).

Branches

The branches grow in a disorganized manner and the canopy is parasol-shaped (Toussaint, 2014).

Leaves

The leaves are alternate and bi- or tridentate and grow mainly in the terminal part of the branches (Figure 3). The leaves are 20-70 cm long, long-stalked with 8-10 pairs of pinnae each consisting of two pairs of opposite leaflets, plus one at the apex (Toussaint, 2014).



Figure 3. Leaves of *M. oleifera*
(Source: <https://urlz.fr/jI3d>)

Flowers

The flowers are 2.5 cm wide and occur in axillary and drooping panicles of 10 to 25 cm (Figure 4). They are usually abundant and have a pleasant smell. They are white or cream colored with yellow dots at the base (Toussaint, 2014).



Figure 4. Flowers of *M.oleifera*
(Source: <https://urlz.fr/jI37>)

Fruits and seeds

The fruits form three-lobed pods, 20-60 cm long, which hang from the branches (Figure 5A). When dry, they open into three parts (Toussaint, 2014).



(A)



(B)

Figure 5. Fruits (A) and seeds (B) of *M. oleifera*
(Source: <https://urlz.fr/jI3n>)

The seeds are round, with a semi-permeable brown shell (Figure 5B). A tree can produce 15,000 to 25,000 seeds per year and a seed weighs on average 0.3 g (Makkar and Becker, 1997).

Characteristics of Haitian Moringa

In Haiti, Moringa is used in planting models in three main forms: in fences (Figure 6A), integrated in conservation and soil protection structures (Figure 6B) or isolated in the middle of plots (Figure 6C) or in other peripheries. Moringa is also grown in association with other crops such as sisal, vegetables, maize, sorghum, beans, etc. (AGROCONSULT HAITI, 2016).

In Haiti, Moringa produced at farm level is consumed in different ways. Surveys conducted by AGROCONSULT HAITI in 2016 revealed that 80% of producers consume all or part of their Moringa production. The study also shows that about 18% of farmers consume the leaf and are at the same time involved in small-scale processing of the product. However, in areas where processing

initiatives exist, the level of self-consumption is between 1 and 2% of farms. The highest yield of whole peeled root was achieved with a minimal spacing between plants in row (13,829 kg/ha). Compared to the one year marshmallow the two year marshmallow had higher yield of raw peeled root for 4664 kg/ha.



(A)



(B)



(C)

Figure 6. *Moringa oleifera*: (A) used as a fence plant; (B) seedlings inserted in soil conservation; (C) isolated plant
(Source: (A) - original photo; (B)-(C) - AGROCONSULT HAITI, (2016))

Nutritional value of Haitian Moringa

Cultivated in one way or another, Haitian Benzoliv has very particular nutritional, medicinal or economic values. Unfortunately, there are not many analyses available to characterise Haitian Moringa. The few nutritional analyses that have been carried out concern only the leaf, whereas other parts of the plant are also valued. For example, one of the most recent analyses of Moringa leaves from Haiti was conducted at the University of Milan in 2015 (Leone et al., 2015).

Moringa leaves from Haiti are rich in many nutrients, fiber, lipids, starch, glucose, fructose, calcium, magnesium and bioactive components such as antioxidants, salicylic and ferulic acids (Table 1). The concentration of protein, iron and β -carotene in Moringa leaves is relatively high compared to other foods. The results also show the presence of salicylic and ferulic acids in Moringa leaves from Haiti.

Table 1

Nutritional characterization of *Moringa oleifera* leaves from Haiti expressed as dry matter

Nutrients	Unit	Average amount \pm standard deviation
Protein	g/100 g	ND
Fats	g/100 g	7.05 \pm 0.11
Total fibre	g/100 g	37.63 \pm 1.00
Insoluble fibres	g/100 g	30.09 \pm 1.40
Soluble fibres	g/100 g	7.54 \pm 0.40
Starch (estimated by difference)	g/100 g	13.75 \pm 0.31
Glucose	g/100 g	4.57 \pm 0.16
Fructose	g/100 g	4.81 \pm 0.31
Sucrose	g/100 g	1.77 \pm 0.08
Maltosis	g/100 g	ND
Ashes	g/100 g	9.62 \pm 0.02
Sodium	mg/100 g	262.50 \pm 5.45
Calcium	mg/100 g	2150.26 \pm 56.07
Iron	mg/100 g	11.91 \pm 0.82
Zinc	mg/100 g	2.18 \pm 0.06
Magnesium	mg/100 g	533.51 \pm 23.87
Copper	mg/100 g	0.66 \pm 0.00
Phytates	g/100 g	2.55 \pm 0.19
β -carotene	mg/100 g	10.01 \pm 0.07

(Source: Leone et al., 2015)

M. oleifera compared to some foods of equal weight shows very striking differences in terms of nutritional value (Xavier, 2018) (Figure 7). Due to its nutritional value, the Ministry of Public Health and Population (MSPP) has recommended it to children, pregnant and lactating women as well as adults suffering from malnutrition and/or nutritional deficiencies.

In addition, the consumption of Moringa is strongly recommended in several health centers across the country for nutritional recovery, supplementation, and fortification, in the

rebalancing of protein and mineral intake as well as diet of Haitians in general (AGROCONSULT HAITI, 2016). Finally, this nutritional treasure has not escaped the interest of non-governmental organizations (UNICEF, Red Cross, ACF) that are fighting malnutrition in Haiti (Xavier, 2018).



Figure 7. Nutritional value of *M. oleifera* compared to other foods (Source: <https://urlz.fr/jIpk>)

Consumption patterns of Doliv in Haiti

Since all parts of the plant are edible, the use of Benzoliv is very varied among consumers, depending on their purpose. For example:

- The leaves are often consumed as a powder and eaten with rice, bean purée and sauces. In addition, the powder is consumed in juice or other liquid foods. The young leaves are also edible and are commonly eaten cooked, like spinach, or prepared in soup or salad;
- The resin from the trunk is used to thicken sauces;
- The flowers are eaten raw as a salad ingredient;
- The young pods are eaten boiled like beans;
- Moringa seeds are edible after being boiled for a few minutes or simply eaten roasted. The seeds are also dried and ground into powder and used to season sauces. The oil from the seeds can also be used in cooking and is also used by women to care for their hair;
- The roots of young plants can also be dried and ground into a powder for seasoning (AGROCONSULT HAITI, 2016).

Uses of *Moringa oleifera* in traditional medicine in Haiti

In addition to its nutritional values, the *Moringa oleifera* species cultivated in Haiti has an undeniable place in the prevention or treatment of certain diseases. Its richness in elements gives it the capacity to strengthen the immune system, reduce inflammation, stimulate libido, support the digestive system, stabilize high blood pressure, combat ageing, increase memory, increase vitality, combat malnutrition and deficiencies, cleanse the liver, increase skin healing, combat cardiovascular disease, etc. (Aimée, 2022).

Moreover, Moringa leaves are used against anemia, to increase lactation in women, against gastric pain, stomach ulcer, diarrhea, dysentery and colitis.

The plant is also used to fight colds, bronchitis, fever, headaches, rheumatism, muscle cramps, bruises, and insect bites (Fondation Ensemble, 2008).

Economic values

Used in Haiti in the form of powder, oil, soap or syrup, Moringa is a real income-generating activity (Toussaint, 2014). In several regions of the country, this sector is already gaining in importance, with producers, processors, traders and exporters undertaking personal or cooperative activities to promote the processing and valorization of Moringa. For its part, the Haitian state through four ministries (MARNDR, MSPP, MENFP, and MDE) is increasingly involved in supporting producers and promoting Moringa in Haiti (AGROCONSULT HAITI, 2016; Haiti Libre, 2014).

As a result, the Moringa trade is gaining more space on the local market with at least one processing initiative in each geographical department of the country and an estimated fifty processing units involved in the manufacture of Moringa products (AGROCONSULT HAITI, 2016).

It should be noted that Moringa powder is also produced according to the requirements of organic farming. This is the case of the fair trade powder produced in Haiti by the Coopérative Agro-Artisanale de Femmes en Action (COOPAAFA) and marketed in France under the brand name Hecosfair and certified by the "Agriculture Biologique" organization (Blaise, 2021). Other organizations in the country are also involved in exporting Moringa, such as AFASDAH, which exports to the USA, and the DL biofuel

processing company, which exports Moringa products in bulk to a Canadian company known as Zest of Haiti, which specializes in e-commerce and redistributes Benzoliv worldwide (AGROCONSULT HAITI, 2016).

Conclusions

Given its particular nutritional and medicinal properties, *Moringa oleifera* is one of the most valuable plants in Haiti. Also known as Gabriyèl, Moringa offers great opportunities to the different actors of the sector to enrich themselves directly through the production, transformation or marketing of its products (leaf powder, oil, cosmetics, syrup) or indirectly through its use in beekeeping. As a result, this plant is attracting the attention of the countries agricultural and health authorities as well as non-governmental organizations, all of whom are seeking to enhance the country's wealth, fight malnutrition and feed the country's tax base through local and international trade.

However, the technical and financial means of the various actors in the sector limit their scope for action that could increase Doliv production and the availability of products on the markets. In addition, the technical and administrative difficulties of the actors in this sector limit the possibilities of certification and export of products to other countries.

Nevertheless it is interesting to note the interest shown in Moringa by international development organizations, particularly those linked to the United Nations system (FAO, WHO, UNICEF, WFP).

On the other hand, Moringa does not grow in Europe, yet its exceptional industrial properties (food, pharmaceutical, cosmetic, oil and biofuel industries, and perfumery) are of great interest to some businessmen, institutions and development organizations in this continent. Finally, given the importance of this plant in traditional medicine throughout the world and also the studies carried out in other countries in the recent years, *M. oleifera* is increasingly attracting the attention of some international researchers and actors in the international market, which could be considered a great asset for Haitian entrepreneurs.

To this end, we strongly encourage the implementation of technical assistance for Moringa producers and the increase of processing units. We also opt for the granting of subsidies to the

various activities related to the exploitation of the plant. It should also be mentioned that despite the importance of Benzoliv and the recognition given to it, there is very little recent scientific research that could lead to a better knowledge and valorization of the plant. Thus, we strongly encourage all researchers or institutions willing to take steps to promote agricultural research in the country and to continue to make known that *Moringa oleifera* is a plant that can feed, heal and enrich.

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