

Moringa is a Superfood That Also Addresses Climate Change



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Moringa has the highest absorption rate of carbon-dioxide emission of all trees. Moringa can help combat climate change, and it is also a superfood that can combat world hunger.

In this paper, we are taking a look at a couple of projects that are exploring moringa's climate-change mitigating capabilities and the benefits of moringa as a superfood.

Growing moringa trees and herbs is relatively easy, and they yield results as early as the first year's planting, and it can produce up to a period of 10 years.

I. What is Moringa?

Moringa is native to parts of Africa and Asia. It contains 13 species from tropical and subtropical climates that range in size from tiny herbs to massive trees. Moringa species grow quickly in many types of environments. Based on growth habits, moringa can be subdivided into four categories: Bottle trees, Slender trees, Sarcorrhizal trees, and Tuberous shrubs.¹

1. Bottle Trees: *Moringa drouhardii*, *Moringa hildebrandtii*, *Moringa ovalifolia*, and *Moringa stenopetala*.

2. Slender Trees: *Moringa concanensis*, *Moringa oleifera*, and *Moringa peregrina*.

3. Sarcorrhizal Trees: *Moringa arborea* and *Moringa ruspoliana*.

4. Tuberous Shrubs: *Moringa borziana*, *Moringa longituba*, *Moringa pygmaea*, and *Moringa rivae*.

Of the 13 species, the most widely cultivated is **moringa oleifera** in the slender-tree category, which is native to the foothill of the Himalayas in northwestern India¹. It is a fast-growing, drought-resistant tree. Common names include moringa, drumstick tree, horseradish tree, and ben-oil tree or benzolive tree².

Moringa oleifera is widely cultivated for its young seed pods and leaves, used as vegetables and for traditional herbal medicine. It is also used for water purification. Although listed as an invasive species in several countries, *moringa oleifera* has “not been observed invading intact habitats or displacing native flora,” so “should be regarded at present as a widely cultivated species with low invasive potential.”²

India is the largest producer of *moringa oleifera*, with an annual production of 1.2 million tons of fruits from an area of 380 km². It is grown in home gardens and as living fences in South Asia and Southeast Asia, where it is commonly sold in local markets. In the Philippines and Indonesia, it is commonly grown for its leaves, which are used as food. It is also actively cultivated by the World Vegetable Center in Taiwan, a center for vegetable research. More generally, *moringa oleifera* grows in the wild or is cultivated in Central America and the Caribbean, northern countries of South America, Africa, South and Southeast Asia, and various countries of Oceania. As of 2010, cultivation of *moringa-oleifera* slender trees in Hawaii was in the early stages for commercial distribution in the United States.²

¹ “Moringa,” Wikipedia. Retrieved on August 1, 2022, <https://en.wikipedia.org/wiki/Moringa>

² “Moringa Oleifera,” Wikipedia. Retrieved on August 1, 2022, https://en.wikipedia.org/wiki/Moringa_oleifera

Another widely grown species, but to a much lesser extent than *moringa oleifera*, is an African species, ***moringa stenopetala*** of the bottle-tree category¹. *Moringa stenopetala* is also known as the African horseradish tree³.

Moringa stenopetala is a cultivated food plant reaching a height of up to 15 meters. Leaf infusion is a remedy for leprosy, hypertension, retained placenta, asthma, colds, and wounds. Roots of these trees are burned and the smoke is inhaled as a treatment for epilepsy. The leaves and roots are used in the treatment of malaria, stomach conditions, and diabetes. Young leaves are eaten raw or cooked. Young fruits, flowers, and seedpods are all edible. The seeds are used to purify water. Seed oil is used as a lubricant, and in perfumery and soap making. The wood is used to make paper, and as firewood and charcoal.³

Figure-1: Countries Where Moringa is Extensively Grown



Source: <https://www.pinterest.com/pin/301811612507895005>

II. Moringa Can Help Combat Climate Change

Moringa has the highest absorption rate of carbon-dioxide emission of all trees – 20x higher than any other tree, according to a 2009 Japanese study. It is estimated that when the growth of moringa is extended from 100,000 hectares worldwide to one million hectares, it can sequester about five billion metric tons of carbon in their trees⁴. The heavy flushes

³ “Moringa Stenopetala,” Plants for a Future. Retrieved on August 2, 2022, <https://pfaf.org/User/Plant.aspx?LatinName=Moringa+stenopetala>

⁴ “Can Moringa Help in Reducing the effects of Climate Change?” Science & Education, February 5, 2021. Retrieved on August 2, 2022, <https://www.openpr.com/news/2236922/can-moringa-help-in-reducing-the-effects-of-climate-change>

produced by the trees in the dry season function as good sink for carbon-dioxide absorption and utilization, thus reducing the level of atmospheric carbon dioxide⁵.

According to Baca Villa, a study on moringa and global warming revealed that each person emits 320 kg of CO₂ a year; it takes 23 Japanese cedar trees and 50 years to absorb this amount of CO₂ while it takes only two moringa trees and two years to do same.⁶

Since 2012, the U.S. and Europe started to promote moringa as a plant (food) with a lot of health benefits⁷. Moringa projects are being explored in their climate-change mitigating capabilities.

1. Kuli Kuli and its Moringa Journey

Kuli Kuli Inc. is a food business based in California, U.S.A. It is the first company to introduce moringa oleifera to the U.S. market in the form of energy bars, powders, smoothie mixes, and energy shots.⁸ Lisa Curtis founded the company in 2011 to help Americans experience the power of superfoods like moringa and to empower female farmers around the world⁹.

Kuli Kuli launched its “Plant a Tree” campaign in April 2020, in which it would plant a tree in Uganda for every Kuli Kuli moringa product sold in the month of April. A biodiverse farm, for example, will benefit from the planting of multiple species of plants, to help restore a healthy food forest.¹⁰

As of the first quarter of 2020, Kuli Kuli had already enabled the planting of more than 24.6 million moringa trees among 13 countries. These trees reduce atmospheric carbon concentrations, while also provide employment, a global market for moringa, and nutrition for hundreds of farmers.¹⁰

Project Drawdown is an organization that conducts ongoing review and analysis of practices and technologies that are able to reduce greenhouse-gas concentrations in Earth’s atmosphere¹¹. It estimates that if female small-holder farmers were to receive equal access to

⁵ “Moringa: For Food, For Climate,” Akash Bajagain, The Himalayan, February 25, 2019. Retrieved on August 2, 2022, <https://thehimalayantimes.com/opinion/moringa-for-food-for-climate>

⁶ “Moringa Highest Absorption Carbon Dioxide Emission,” Baca Villa. Retrieved on August 2, 2022, <https://blog.baca-villa.com/moringa-research/moringa-highest-absorption-carbon-dioxide-emission>

⁷ “中国哪适合种植辣木树” 手牵手的幸福 cl, 百度知道, March 30, 2018. Retrieved on August 8, 2022, <https://zhidao.baidu.com/question/1430994566265416179.html>

⁸ “Kuli Kuli Inc.,” Wikipedia. Retrieved on August 2, 2022, https://en.wikipedia.org/wiki/Kuli_Kuli_Inc.

⁹ “Kuli Kuli Inc.” Retrieved on August 3, 2022, <https://www.kulikulifoods.com/pages/about-kuli-kuli-foods>

¹⁰ “Meet Moringa: Kuli Kuli’s Superfood Addressing Climate Change,” Lily Comba, Thrive Market, April 22, 2020. Retrieved on August 2, 2022, <https://thrivemarket.com/blog/meet-moringa-kuli-kulis-superfood-addressing-climate-change>

¹¹ “Project Drawdown.” Retrieved on August 2, 2022, <https://www.drawdown.org/solutions>

productive resources, their farm yields will rise by 20 to 30 percent; 100 to 150 million people will no longer be hungry¹⁰.

When agricultural plots produce well, there is less pressure to cut and burn down forests for additional ground, thus avoiding emissions and further habitat degradation. This also would avoid an estimated 2.06 gigatons in carbon emissions.¹⁰

2. Solidaridad's Environmental Work

The Solidaridad Network is an international civil-society organization founded in 1969. Its main objective is to facilitate the development of socially-responsible, ecologically-sound and profitable supply chains. It operates through eight regional expertise centers in over 50 countries.¹²

In commemoration of World Environment Day on June 5, 2020, Solidaridad's Sustainable Landscape Management team partnered with ALMUFA to pilot a reforestation project in two villages in Zambia – Munenga and Itebe. The project aims to empower the communities through transferring skills as well as encouraging inclusivity and the concept of self-sustenance.¹³

This initiative involved planting moringa trees in the two villages to create a moringa value-chain as an alternative source of income and a means to mitigate climate change. The initiative hopes to see that the small-holders can engage in this new revenue stream of selling moringa and use that income to pay for energy sources other than charcoal – currently their main source of energy and income. Replacing the use of charcoal can reduce deforestation and the emission of greenhouse gases.¹³

III. Moringa is a Superfood

Moringa trees are being promoted as a dual solution to mitigate the impacts of climate change, while also providing an alternative source of income for families. With wide-ranging nutritional and medicinal properties, and ease of planting, the tree offers many benefits on the individual and community level.

Moringa is depicted as a kind of natural and healthy plant that is versatile and magical. University of Washington and Purdue University in the United States, University of Leicester in the United Kingdom, and University of Carolina in Guatemala have made detailed research reports about this plant.⁷

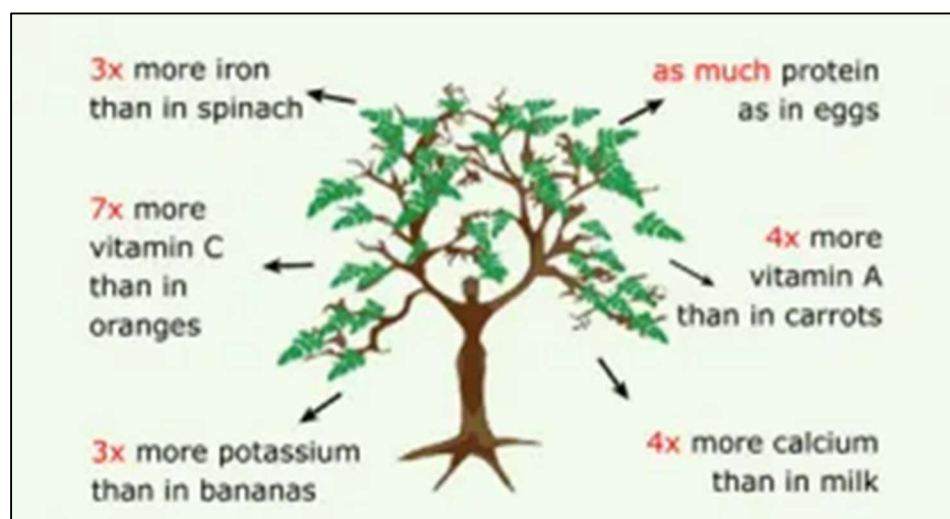
¹² "Solidaridad," Wikipedia. Retrieved on August 2, 2022, <https://en.wikipedia.org/wiki/Solidaridad>

¹³ "Moringa Trees Against Climate Change," Solidaridad, August 28, 2020. Retrieved on August 2, 2022, <https://www.solidaridadnetwork.org/news/moringa-trees-against-climate-change>

Moringa is a multi-purpose tree cultivated throughout the tropics and marketed as a dietary supplement, health food or source for herbalism practices. The fruit pods of moringa oleifera are increasingly consumed as food in many parts of the world, particularly in South Asia. The leaves are commonly used to make tea. Oils are made from the seeds, while powders can be made from the leaves and roots.¹

The World Health Organisation (WHO) and other international humanitarian-relief organisations have used moringa to combat malnutrition in many parts of the world because it is a nutrient-rich plant, which could substitute other mainstream food and solve the hunger problem.⁶

Figure-2: Nutritious Value of Moringa



Source: <https://blog.baca-villa.com/moringa-research/moringa-highest-absorption-carbon-dioxide-emission>

1. Benefits of Moringa

The moringa leaves, bark, pods, flowers, and seeds contain potent polyphenol antioxidants. These compounds benefit the cardiovascular and skeletal system as well as the vital organs when consumed as part of a healthy diet. Very Healthy Life (VHL) listed some moringa benefits:¹⁴

(1) Super-nutritious for the body: The crushed leaves contain vitamins B6, B2, A and C, and non-heme iron, magnesium, and plant-based protein; they are also packed with polyphenol flavonoids, carotenes, tocopherols, and phenolic acids. The pods are an excellent source of vitamin C.

¹⁴ “11 Mind-Blowing Moringa Benefits,” Very Healthy Life, January 11, 2019. Retrieved on August 3, 2022, <https://veryhealthy.life/11-mind-blowing-moringa-benefits>

(2) Beat inflammatory disease: The polyphenol antioxidants found in moringa eliminate free radicals and clear the blood of these harmful particles that create cell oxidation and cell death.

(3) Manage blood glucose: The polyphenol antioxidants and isothiocyanates found in moringa leaves assist the body with mopping up excess blood glucose. This effect reduces the time it takes to return to baseline levels.

(4) Control cholesterol: The polyphenol antioxidants relax the walls of blood vessels, allowing these antioxidants to flow smoothly through the arterial system. Moringa polyphenols also reduce the production of LDL, while increasing HDL.

(5) Boost hemoglobin: A lack of iron is one of the primary causes of anemia. An increase in dietary iron is required to reverse symptoms and return hemoglobin to optimal levels. Moringa leaf is one of the most abundant natural sources of iron. Each 100-grams of the leaf contains 4-grams of non-heme iron.

(6) Improve vision and skin health: Moringa is an excellent source of the polyphenol micronutrient beta-carotene which assists with maintaining eye health. The human body converts the polyphenol into retinol, a precursor of vitamin A. This critical vitamin improves the health of our immune system and skin. Moringa contains the polyphenol carotenoids lutein and zeaxanthin. Research found these micronutrients have a therapeutic effect on eye health.

(7) Rich source of healthy fats: Research in nutritional science shows that monounsaturated fats and saturated fats have tremendous benefits for health. Pressing moringa seeds into oil produces a product known as “ben oil,” a refined oil rich in beneficial fats. Due to its high smoke-point, ben oil is an excellent alternative to other vegetable and seed oils for frying and sautéing.

(8) Detoxifying antioxidants: Foods like spinach, kale, and moringa leaf are a rich source of these plant-based antioxidants.

(9) Enhance immune function: Over 70-percent of our immune system resides in the gastrointestinal tract. Eating foods that are rich in probiotics enzymes and micronutrients assist the development and diversification of gut flora. The polyphenol antioxidants in moringa leaves provide biomes with the ideal environment they need to thrive.

(10) Boost breast-milk production: Moringa leaf is a popular addition to the diet of new mothers: its high quantities of nutrients and micronutrients increases their lactation. It is also an excellent source of calcium, which is critical for bone density and a healthy skeletal

system, and also increases lactation, cell communication, and new cell generation, giving babies the nutrition they need to grow.

(11) Improve sleep quality and eliminate insomnia: Moringa contains a substantial quantity of L-tryptophan, increasing the body's production of serotonin and melatonin, which help regulate mood and assist the body in maintaining circadian rhythms responsible for sleep patterns.

2. Potential Risk of Moringa

While there are great benefits that moringa can provide, there are a few things that one should be aware of about moringa:¹⁵

(1) Liver enzyme impact: Like many plants, moringa contains a variety of micro and macro elements that could pose certain undesirable effects when ingested in large amounts over a period of time. For instance, in toxicology studies on rats, researchers discovered that liver-enzyme production may be impacted with very high doses of moringa-root extract. However, the same research also concluded that there were no overt adverse reactions in any of the test subjects.

(2) Alkaloids: Toxicity reports have identified in moringa root bark two known alkaloids, and a toxic hypotensive compound called moringinine. The same compounds are found in the root flesh as well, though in much lower concentrations. These compounds are benign in low doses but can become potentially dangerous in high concentrations. Some in vivo studies show a depressant-like effect that temporarily reduced the heart rate of rats.

(3) Pregnancy impact: Pregnant people may also want to avoid moringa leaves during pregnancy. In a 2015 experimental study, rats that were fed ground moringa leaves in their first trimester of pregnancy showed little weight gain and did not produce a litter. While the reasons are unknown, anyone who is pregnant or considering getting pregnant should be aware of this.

(4) Thyroid health: Some research suggested that regular consumption of moringa can alter thyroid hormone levels. These studies were performed on rats, with findings showing regular consumption of moringa can lower T3 and increase T4. The effect was also greater in females than in males. Moringa is also high in goitrogens which can modify the activities of thyroid-hormone-synthesizing enzymes and may lead to goiters mainly in iodine deficient environments.

¹⁵ "Meet Moringa: What is this Transformative Superfood Good For?" Ocean Robbins, Food Revolution Network, March 24, 2021. Retrieved on August 3, 2022, <https://foodrevolution.org/blog/moringa-benefits>

IV. Growing Moringa

Moringa is a hardy plant and does not demand stringent growing requirements. Moringa is a climate-smart crop that can well-adapt to growing in adverse conditions where many other plants would not, and it grows very fast. Flooded land, dry-river-bed or waste land which is otherwise unused could be utilized for moringa plantation. It can thrive well in semi-arid, tropical, and subtropical areas; however, it cannot stand a chilling climate.⁶

Unlike mainstream crops, moringa does not require intensive care – homemade compost and manure application with sporadic irrigation just to make the soil wet is sufficient for optimum result⁶.

Moringa oleifera grows best in direct sunlight under 500 meters altitude. It tolerates a wide range of soil conditions, but prefers a neutral-to-slightly-acidic (pH 6.3-7.0), well-drained sandy or loamy soil. Minimum annual rainfall requirements are estimated at 250 mm with maximum at over 3,000 mm¹⁶. The planting process includes a water-conservation approach that uses only 5 liters of water during planting and 250-100 ml per day afterwards, decreasing as the tree grows and its roots establish¹³.

Moringa trees can be easily grown from seed or from cuttings. They can comfortably grow in temperature ranges of 25-35°C (77-95°F), but the tree will tolerate up to 48°C in the shade and it can survive a light frost. Moringa seeds have no dormancy period, so they can be planted as soon as they are mature and they will retain the ability to germinate for up to one year. Moringa trees will flower and fruit annually and in some regions twice annually¹⁶. It is noted that the leaves and twigs need to be trimmed off after seeds are harvested⁷.

Moringa can be grown under high-density monoculture, or intercropped with other crops like the cowpea. An estimated 95,000 to 16 million plants can be cultivated on a hectare, with an average yield of 2 kg of leaves per harvest, and the product can be harvested for up to a maximum of 10 years.⁶

During its first year, a moringa tree will grow up to five meters in height and produce flowers and fruit. Left alone, the tree can eventually reach 12 meters in height with a trunk 30 cm wide; however, the tree can be annually cut back to one meter from the ground. The tree will quickly recover and produce leaves and pods within easy reach. Within three years, a tree will yield 400-600 pods annually and a mature tree can produce up to 1,600 pods.¹⁶

¹⁶ “Cultivation of Moringa,” Lowell J. Fuglie and K. V. Sreeja, May 2014, Moringa Farms. Retrieved on August 8, 2022, <https://moringafarms.com/wp-content/uploads/2014/05/Growing-Moringa-for-Personal-or-Community-Use.pdf>

V. Conclusion

We should continue to follow the development of moringa and their potential impacts to the world.

For now, increasing moringa plantation in different parts of the world can contribute to the dual purpose of reversing climate change and providing a superfood for the growing world population. A notion that should be seriously considered by governments, farming communities, and international organizations.

The trees can be grown on lands that may otherwise be unused, and they can be grown with minimum care and costs. More important, moringa trees can start absorbing carbon-dioxide emissions and produce food even in the first year of their planting, delivery quick and effective results.