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Insights into the miracle plant *Moringa oleifera*

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Abstract

Moringa oleifera is native to India and is one of the most useful tree with an enormous amount of benefits in the world. Numerous research reports have appeared in different national and international scientific journals by studying its nutritional and medicinal properties over the past decades. Different reports also show that due to its multipurpose uses, it has recently got attention in different countries. It is a tree that is sometimes called a miracle tree as all its parts are used for nutritional and pharmacological properties. It is a very valuable food tree which is highly nutritive, grows very fast and having drought resistant characteristics. It can also play an important role in soil and water conservation and is very helpful for mitigating climate change. This study provides a brief overview about the multipurpose uses of *Moringa oleifera* and its implication in climate change mitigation.

Keywords: *Moringa oleifera*, Nutrient content, Medicinal use, Climate change mitigation

Introduction

Moringa oleifera is considered to have its origin in Agra, in the northwest region of India, south of the Himalayan Mountains. The use of these plants and their constituents in primary health care has ancient history as old as human beings. This plant has proven therapeutics implication in the health management via antioxidant, anti-inflammatory, anti-diabetic and other biological activities. The people of India knew that the seeds contain edible oil and they used them for medicinal purposes since years. It is probable that the common people also know its value as a fodder or vegetable. This tree can be found growing naturally at elevations of up to 1,000 m above sea level. It can grow well on hillsides but is more frequently found growing on pasture land or in river basins. It is a fast growing tree and has been found to grow to 6–7 m in one year in areas receiving less than 400 mm mean annual rainfall ^[1]. In the Dravidian language, there are many local names for this tree but all are derived from the generic root *Morunga* ^[2]. In English it is commonly known as Horseradish tree, Drumstick tree, Never Die tree, West Indian Ben tree and Radish tree ^[3]. It is now cultivated throughout the Middle East and in almost the whole tropical belt. It was introduced in Eastern Africa from India at the beginning of 20th century. As a non-cultivated plant it is known for its resistance to drought and diseases. The plant possesses many valuable properties which make it of great scientific interest for research. These include the high protein content of the leaves, twigs and stems, the high protein and oil contents of the seeds, the large number of unique polypeptides in seeds, the presence of hormones in the leaves, and the high sugar and starch content of the entire plant. This tree is genuinely connected to climate change ^[4] and therefore, planting these trees, which can sequester more carbon, can play important role in climate change mitigation. If it is grown on a much larger scale, there is great potential for the *Moringa* tree to not only store carbon, but to improve the livelihoods of many farmers ^[5]. This study provides a brief overview about the multipurpose uses of *Moringa oleifera* tree and its implication for climate change mitigation and also outlines its nutritional and medicinal properties.

Moringa oleifera – The miracle plant

Moringa oleifera (Figure 1), belongs to kingdom – Plantae, order – Brassicales, Family – Moringaceae, Genus – *Moringa* and Species – *oleifera*. The stem is normally straight. The tree grows with a short, straight stem that reaches a height of three meter before it begins branching. The extended branches grow in a disorganized manner and the canopy is umbrella shaped ^[6]. The leaves are alternate, 20-70 cm long, grayish-downy when young, long petiole with 8-10 pairs of pinnae each bearing two pairs of opposite, elliptic or obovate leaflets and one at the apex, all 1-2 cm long; with glands at the bases of the petioles and pinnae ^[7].

The flowers are produced profusely in axillary, drooping panicles 10 to 25 cm long. They are white or cream colored and yellow-dotted at the base. The five reflexed sepals are linear-lanceolate. The five petals are slender-spatulate. They surround the five stamens and five staminodes and are reflexed except for the lowest [7]. The fruits are three lobed pods which hang down from the branches and are 20-60 cm in length. When they are dry they open into 3 parts. Each pod contains between 12 and 35 seeds. The seeds are round with a brownish semi-permeable seed hull. The hull itself has three white wings that run from top to bottom at 120-degree intervals. Each tree can produce between 15,000 and 25,000 seeds/year. The average weight per seed is 0.3 g and the kernel to hull ratio is 75: 25 [8].



Fig 1: Photo Gallery of *Moringa oleifera*

An overview of the nutrient content of *Moringa oleifera*

It is a good source of provitamin A, vitamins B, and vitamin C, minerals particularly iron and the sulphur-containing amino acids. The composition of the amino acids in the leaf protein is well balanced [6]. The significant micro mineral elements present in *Moringa* are Calcium, Phosphorus, Magnesium, Sodium, and Potassium whereas micro elements are Iron, Manganese, Zinc and Copper [2]. The carotenoids present in leaves are alpha-carotene, beta-carotene, lutein, eoxanthin, violaxanthin, zeaxanthine, xanthophyll, carotenoids and chlorophylls with high physico-chemical properties like saponification value 182.9, iodine value 66.4, density at 20°C (g/ml) 0.89737, refractive index at 20°C 1.46.70, solidification point (pour point °C) 6 and free fatty acids (%) up to 2.98 [2]. A brief description of the nutritional properties of *Moringa* are summarized in Table 1. The percentage of fatty acid composition of *Moringa* seed oil are lauric acid, myristic acid, palmitic acid 5.45, palmitoleic acid, oleic acid, linoleic acid, linolenic acid, archidic acid, gadoleic acid, erucic acid, lignoceric acid, and nurvonic acid in trace [2,6]. It was also found that, the amino acid content (g/16g N) [2] of unextracted leaves is lower than that of extracted leaves which is due to the presence of a higher amount of non-protein nitrogen in the un-extracted leaves (4.7 vs 2.7%) [2]. The potential food value of the protein (as a source of amino acids) can be evaluated by comparison with the FAO reference pattern [9]. The amino acids present are lysine, leucine, isoleucine, methionine, cystine, phenylalanine, tyrosine, valine, histidine, threonine, serine, glutamic acid, aspartic acid, proline. It is also reported that *Moringa* seeds contain about 30-40% oil, 82% unsaturated fatty acids and 13% saturated fats [10]. It was suggested that, there are multipurpose uses of most parts of *Moringa oleifera* in making food for human consumptions such as cake [11], Yoghurt [12], Amla [13], weaning foods [14], bread [15], soups [16] and biscuits [17]. The potential uses of *Moringa oleifera* shows that, *Moringa* contain nutritional value and can be used as

bread, milk, spices, juices, sauces and tea [18]. Because of rich in proteins source *Moringa oleifera* leaves are suggested by doctors and nutritionists. All parts of *Moringa oleifera* i.e leaves, fruits, immature pods, and flowers are combined into the traditional food for human consumption [19]. The roots from young plants can also be dried and ground for use as a hot seasoning base with a flavor similar to that of horseradish. This is why the *Moringa* tree has been given the name - Horseradish Tree [20]. The young leaves are edible and commonly cooked and eaten like spinach or used to make soups and salad. The young green pods are very tasty and can be boiled and eaten like green beans. So, *Moringa oleifera* is having a great nutritional importance for consumption by humans.

***Moringa oleifera* as a plant growth enhancers, a forage plant and a biogas production unit**

The extract obtained from the *Moringa* leaves in 80% ethanol contains growth enhancing principles like cytokinin [2]. The extract can be used in the form of a foliar spray to accelerate the growth of young plants. Use of the growth hormone spray will also cause the plants to be firmer and more resistant to pests and disease [2]. Plants that are treated with this growth hormone spray will also produce more and larger fruit and will consequently have a higher yield. The extract can be obtained either through press extraction or by using an ultraturax and filtering 20g of tender leaves in a total volume of 675 ml of 80% aq. Ethanol [8]. Spraying the leaves of plants with the *Moringa* extract prepared in 80% ethanol and then diluted with water produced more vigorous life-span, heavier roots, stems and leaves, bigger fruits and higher sugar levels [2]. The extract produces an overall increase in yield of between 20-35% based on data such as the stem diameter, number of nodules, number of axels, number of flower buds, and number of fruits per flower bud [2]. The nutritional characteristics of the *Moringa* tree are excellent so it can easily be used as a fresh forage material for cattle. The leaves are rich in protein, carotene, iron and ascorbic acid and the pod is rich in the amino acid lysine [21]. Another important advantageous characteristic of *Moringa* is its high productivity of fresh material per unit area compared with other forage crops. *Moringa* plants (approximately 30 days old) were milled together with water. The fibre was separated by filtration through a mesh with 5 mm pores and the liquid fraction produced was then added to a biogas reactor [2].

***Moringa oleifera* used for water purification**

The study on the *Moringa oleifera* as a natural gift showed that, a billion people across world are assessed to depend on untreated water sources for their daily needs [22]. Numerous research reports shown that, *Moringa* seed powder can be used cleaning dirty water in simple and quick method. The *Moringa* seed powder joins with the solids in the dirty water and sinks to the bottom. This action can remove bacteria contained in water up to 90-99% [2]. Rather than using the chemical, aluminum sulphate, which are toxic to people and the environment, *Moringa* seed powder can be used to purify water as it is having no harmful effect to humans and environment. Water can be purified by adding 2 grams of *Moringa* seed powder to 20 liters into a bottle and shake for 5 minutes. Dirty water that is to be treated can be filtered through a clean cloth into the container. Until the water becomes clear and the impurities have sunk to the bottom leave the bucket undisturbed for one hour then filter the water

through a clean cloth boil the water before drinking [23]. *Moringa* seeds contain between 30-42% oil [2] and the press cake obtained as a by-product of the oil extraction process contains a very high level of protein. Approximately 1% of these proteins are active cationic poly-electrolytes having molecular weights between 7-17 K Da [2]. The cationic polyelectrolytes neutralize the colloids in muddy or dirty water since the majority of these colloids have a negative electrical charge. So, this protein can be precisely used as a non-toxic natural polypeptide for sedimenting mineral particles and organics in the purification of drinking water, for cleaning vegetable oil or for sedimenting fibers in the juice and beer industries [2]. So, this plant is proved to have a great importance in water purification and therefore can extensively be used for this purpose.

Animal feed fortification using *Moringa oleifera*

Study on the potential of *Moringa oleifera* for agricultural and industrial uses has shown that, *Moringa* leaves supplementary to livestock feed can increase up to 32% of daily weight gain. Supplementation of fresh *Moringa* leaves with 15 to 17 kg of daily feed of livestock [2] can increase milk production by 43% [2]. Milk production can be increased by 58% with the supplementation of 2 kg dry matter feed and milk production increased by 65% with the supplementation of 3 kg dry matter feed [6]. Generally, milk production increased with increased *Moringa* supplementation. The chemical constituents, organic matter digestibility, rumen degradable and un-degradable nitrogen, non-protein nitrogen, pepsin and presence of anti-nutritional factors in kernels, seed meal and in the residues obtained after removal of water soluble coagulants from kernels and seed meal obtained from the *Moringa* plant [6] are generally used as the ingredients for animal feed fortification.. Amino acid composition of these four fractions of kernels has also been analysed [8]. This information together with reported above for the *Moringa* forage will pave the way for better utilization of different fractions of *Moringa*, which are generated as by-products in the process of extraction of oil, growth hormones and coagulants, as animal feed.

Implications of *Moringa* plant to climate change mitigation

In general, climate change has a long-lasting impact on natural resources, economic activities, food security, health, society, and physical infrastructure and society. More than half of India's population live in rural areas and their livelihoods depend on climate-sensitive sectors such as agriculture, fisheries, and forestry. Hence, climate change adaptation measures are of national importance in order to ensure the protection of rural livelihoods, to preserve the countries natural resources. The study on the opportunities for linking adaptation and mitigation in Agroforestry systems indicated that, the impacts of climate change are handled at the level of natural resource base upon which smallholder farmers depend, at the individual and farming system level [24]. The research reported on the environmental and medicinal value analysis of *Moringa oleifera* specified that, farmers need to formulate adaptation strategies and mechanisms to reduce the climate change impacts [5]. To combat efficient for climate change mitigation and food shortages it is good to look at the potential that is already available in developing and third world countries. *Moringa* is therefore a very simple and readily available solution. *Moringa oleifera* is called a "Never Die plant" because of its adaptability to weather, soil

and other environmental positive impacts [25]. There is clear evidence that *Moringa oleifera* is, no doubt, a suitable crop for climate change mitigation because of its high level of adaptability and numerous nutritional, medicinal, agricultural, domestic and industrial values [26]. The heavy flushes produced by the trees even during the dry season act as good sink for carbon dioxide absorption and utilization, thus reducing the level of atmospheric carbon dioxide which is one of the major courses of ozone layer depletion and global warming. *Moringa* tree is a climate-change-adaptable crop for life sustenance against food insecurity threats [26].

Potential medicinal properties of *Moringa oleifera*

The plant is used as antispasmodic, stimulant, expectorant and diuretic. Fresh root is acrid and vesicant (has the taste of horse-radish). Internally it is used as stimulant, diuretic and antilithic. Gum is bland and mucilaginous. Seeds are acrid and stimulant. Bark is emmenagogue and even abortifacient, antifungal, antibacterial. Flowers are cholagogue, stimulant, tonic and diuretic and useful to increase the flow of bile. The plant is also a cardiac circulatory tonic and antiseptic [27]. Pods are antipyretic, anthelmintic; fried pods are used in diabetes. Root juice is employed in cardiac tonic, antiepileptic. Used for nervous debility, asthma, enlarged liver and spleen, deep-seated inflammation and as diuretic in calculus affection. Decoction is used as a gargle in hoarseness and sore throat. Root and fruit are antiparalytic. Leaf juice is used in hiccough (emetic in high doses); cooked leaves are given in influenza and catarrhal affections. Root-bark is used as antiviral, anti-inflammatory, analgesic. Stem-bark and flowers are hypoglycaemic [28]. Infusion of seed is anti-inflammatory, antispasmodic and diuretic, also given in venereal diseases [28]. Different studies shown that, all parts of *Moringa oleifera* (leaves, fruits, immature pods, and flowers) are incorporated into the traditional food of humans in many tropical and subtropical countries. Various parts of *Moringa* tree act as cardiac and possess antitumor, circulatory stimulants, antiepileptic, antipyretic, antiulcer, anti-inflammatory, antispasmodic, anti-hypertensive, diuretic, antioxidant, anti-diabetic, cholesterol lowering, antibacterial, hepato-protective and antifungal activities. *Moringa* leaves are the most commonly used part of the plant. *Moringa* leaves treat hyperglycemia, asthma, flu, heart burn, Dyslipidemia, malaria, syphilis, diarrhea, pneumonia, scurvy, headaches, bronchitis, skin diseases, eye and ear infections. Also reduces, blood pressure and cholesterol and acts as an anticancer, Antioxidant, antimicrobial, anti-atherosclerotic and antidiabetic agents, neuro-protectant [2]. Numerous researches reported that, *Moringa* seed powder can be used as for cleaning dirty water in a simple and quick method. A brief description of the medicinal properties of *Moringa* are summarized in Table 1.

Seeds of *Moringa* help in treating Crohn's disease, hyperthyroidism, rheumatism, antiherpes- simplex virus arthritis, cramp, epilepsy gout, and sexually transmitted diseases, can act as antimicrobial and anti-inflammatory agents. Root bark acts as an anti-ulcer, anti-inflammatory and cardiac stimulant agent. Many scholars shown that *Moringa* flowers act as anti-arthritic; hypocholesterolemic agents can cure urinary and cold problems [2]. *Moringa* pods treat liver, diarrhea and spleen problems, and joint pain [18]. Common diseases like diabetes and heart disease can be prevented by drinking *Moringa* as a tea. The health benefits of drinking *Moringa* plant is beginning to gain more popularity as a new

superfood for its highly nutritious profile and powerful anti-inflammatory, antioxidant, and tissue-protective properties among many other health benefits [2]. *Moringa* has become popular as a natural leaf powder supplement, although the pods, roots, bark, flowers, seeds, and fruits are also edible. It is used as a traditional remedy for many ailments, and here are few scientifically backed health benefits of consuming the *Moringa* leaf [22].

The mystery of the magic drumstick tree *Moringa oleifera* is presented in Figure 2. *Moringa oleifera* contains all the essential medicinal and nutritional properties and an extremely valuable food source that are vital for human and livestock consumptions [22]. *Moringa* reduces inflammation by suppressing inflammatory enzymes and proteins in the body, and moringa leaf concentrate can significantly lower inflammation in the cells. *Moringa* leaf powder has been effective at reducing lipid and glucose levels and regulating oxidative stress in diabetic patients, which means it lowers blood sugar and cholesterol and improves protection against cell damage [2]. *Moringa* leaf powder has heart-healthy benefits, particularly in blood lipid control, the prevention of plaque formation in the arteries, and reduced cholesterol levels. *Moringa* supports brain health and cognitive function because of its antioxidant and neuro-enhancer activities. It's also been tested as a treatment for Alzheimer's disease with favorable preliminary results [2]. Its high content of vitamins E and C fight oxidation that leads to neuron degeneration, improving brain function. It's also able to normalize the neurotransmitters serotonin, dopamine, and noradrenaline in the brain, which play a key role in memory, mood, organ function, responses to stimulus such as stress and pleasure, and mental health, for example in depression and psychosis [2]. *Moringa* contains high concentrations of poly-phenols in its leaves and flowers that protect the liver against oxidation, toxicity, and damage. *Moringa* can reduce liver damage and fibrosis and reverse oxidation in the liver [2]. *Moringa* oil can also restore liver enzymes to normal levels, reducing oxidative stress, and increasing protein content in the liver. *Moringa* has also blood-clotting properties in its leaves, roots, and seeds [2, 29]. Some very beneficial *Moringa* based commercial health care product available in online and offline market are discussed and tabulated in Table 2.

Package of practices for *Moringa* commercial cultivation

Moringa is fast growing, drought tolerant and easily adapted to varied ecosystems and farming systems. There are two types of *Moringa* (Annual and Perennial) available in Indian continent. For the cultivation of this vegetable, it does not require well fertilized soil, so it has the potential to be grown in the dry areas. It can be grown in a wide range of soil and climatic condition except heavy clay soil. It is propagated either by stem cuttings (limb cutting) or by seed. In perennial types, limb cuttings 100-150cm in length with a diameter of 14-16 cm are planted in situ during the rainy season. For annual crops the seedlings are raised from the seed in the polythene which is helpful for better crop stand and also there is a provision for gap filling in the main field if the seedlings die due to any unforeseen reason. Treatment of the seeds with Azospirillum cultures at the rate of 100 g per 625 g of seeds before sowing resulted in early germination, and increased seedling vigour, growth and yield. The seed requirement per hectare is 625g. When planted in single rows along with irrigation channels, a spacing of 2m is sufficient. In the main field is dugged with 60×60 cm pit which is filled with FYM

and soil and then the selected cutting of the stem or the seedlings are planted.

For the perennial crop the plant to plant distance will be 4.5m and the row to row distance will be 3.0 m. While planting, one-third of the cutting should be kept inside the pit. Under moderate clay situations, watering should be done just to optimum levels to avoid root rot. For the annuals spacing will be maintained 2.5×2.5m. One month before planting, each pit should be filled with 10 kg FYM, 100g urea, 100 g SSP and 50 g MOP and after one and half month after planting application of 100 g additional urea in each pit helps in increasing both crop growth and production, giving a plant population of 1600 plants/ha [30].

In addition to that fertilisers should be applied at the time of pinching (75 days after sowing) at the rate of 44: 16: 30 g NPK/ tree and Nitrogen @ 44g / tree must be applied as top dressing at first flowering (150-160 days after sowing) stage [31]. Plant population: It may vary with the spacing, but generally plant population of 1600 plants/ha is suitable if standard spacing is followed. The limb cuttings are planted in the pits during the months of June to August. The monsoon rains during the period facilitate easy rooting and further growth. The seeds of annual *Moringa* may be directly dibbled in the pit to ensure accelerated and faster growth of the seedlings. The best suited season for sowing the seeds is September under Southern Indian conditions. The time of sowing has to be strictly adhered to because the flowering phase should not coincide with monsoon seasons, which results in heavy flower shedding [30]. Growing *Moringa* plants may not require watering except during hot weather when they may be irrigated once a week. Annual *Moringa* responds well to irrigation and the yield can be doubled (vegetable *Moringa* fruit) by drip irrigation as compared to rain-fed crops, Drip irrigation at the rate of 4 lit/day can enhance yields by 57 per cent as compared to rain-fed crop [32]. Pinching and earthing up are the two practices which should be followed for *Moringa*.

Pinching the terminal bud on the central leader stem is necessary when it attains a height of 75cm (two months after sowing). This will promote the growth of many lateral branches and reduce the height of the tree. In addition, pinching also reduces the damage due to heavy wind and makes harvesting much easier [33]. It is found that early pinching of growing tips carried out 60 days after sowing is better than pinching 90 days after sowing for obtaining a higher yield. Sometimes, due to heavy rain or wind there is a possibility of breaking the tree so, earthing up of the soil at the base of the tree is useful to give it the strength. It has also been reported that spraying of GA3 @ 20 ppm on 90th day of sowing increased all the pod characters, such as length, specific gravity, number of seeds, flesh content and pulp, more than untreated check [30]. Generally, six to nine months after planting flowering started and there are some varieties which give production for two to three times but this kind of varieties are not popularly cultivated in Odisha. For perennial crops, fruits yields are generally low during the first two years (80-90fruit/year), but from the third year onwards a single tree yield increase gradually 500-600 fruit/tree/ year up to the fourth and fifth years. The pods are harvested mainly between March and June. A second crop is normally harvested from September to October. After harvesting the plant crop is cut keeping 1.5-2m from the soil then from that cut portion new branches come out that bear flowers and fruits.

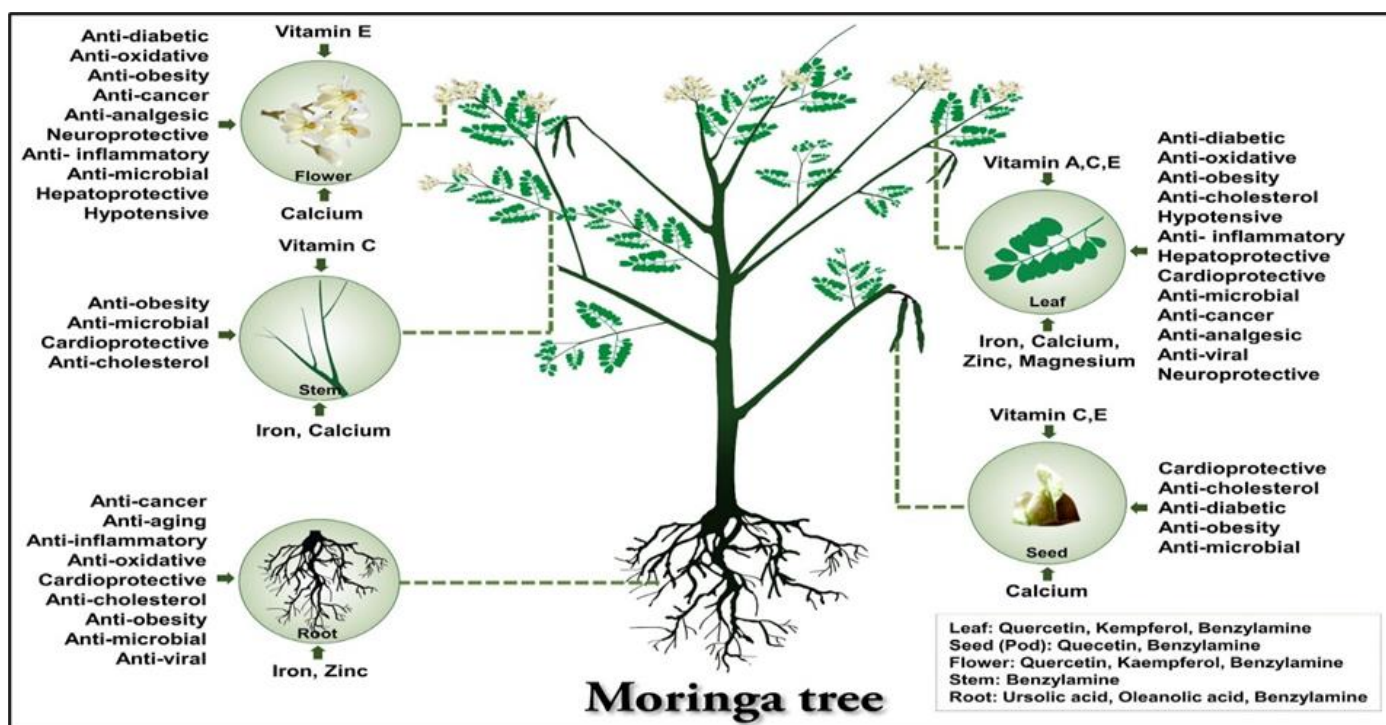
In annual *Moringa*, when the harvest is in, the trees are cut

down to a height of one metre above ground level for ratooning. These ratoon plants develop new shoots and start bearing four or five months after ratooning. Three ratooning operations are recommended during the production cycle, after each harvest is over. During each ratooning operation, the plants are supplied with the recommended level of N, P and K nutrients along with 20-35 kg of FYM. Perennial types are also pollarded back to a height of 0.3- 0.45m from ground level during October November, followed by manuring with organic matter (25kg) and the recommended input of fertilizers [30].

Ecotype and Cultivars available for *Moringa* for commercial cultivation

Tamil Nadu Agricultural University have succeeded in developing two promising, high yielding, and annual seed-propagated *Moringa* types PKM-1 (Selection) and PKM- 2 (MP 31 X MP 28), Dhanraj (dwarf type) which has

revolutionised the *Moringa* industry in the country. KAU released one drumstick variety named Anupama. Besides that, some high-yielding land races are also cultivated in Tamil Nadu and Andhra Pradesh namely Jaffna Melanor, Saragva, Chavakacheri, Chemmurungai, Pal Murungai, Puna Murungai, Kodaikal Murungai and Saragvi etc. but whether these varieties are suitable in Odisha condition or not need to be further studied. Some varieties namely, KM 1, GKVK 1,2,3, KDM 1, Konkan Ruchira, Rohit 1 are known to be developed by the public sector, In India, more than 60,000 farmers are engaged in commercial cultivation of *Moringa* as it is a highly remunerative crop. The small farmers get a handsome amount of benefit from *Moringa* cultivation. Though several varieties are present in India but cultivation, improvement and outstanding new varietal production found in Odisha is inadequate. In Odisha only PKM 1 and PKM 2 is cultivated predominantly [30].









Source: <https://phys.org/news/2019-05-genomics-uncovers-mystery-magic-drumstick.html>

Fig 2: Mystery of the magic drumstick tree *Moringa oleifera*

Table 1: Nutrient content and Pharmacological properties of different plant parts of *Moringa oleifera* (Adopted from Saha *et al.*, 2012)

Plant Parts	Nutrient content	Pharmacological properties
Leaves	Rich in protein (arginine: 0.38 g; histidine: 0.14; lysine: 0.32; tyrosine: 0.10g; phenylalanine: 0.29g; methionine: 0.11; cysteine: 0.13; threonine: 0.25; leucine: 0.46; isoleucine: 0.28 and valine: 0.35.), carotene, iron and ascorbic acid. contain magnesium: 24 mg; potassium: 259 mg;	Anti-ulcer, hyperthyroidism, anti-diabetic, hypolipidemic, anti-helminthic, anti-oxidant, hypo-cholesterolemic, hepatoprotective, antifungal, antibacterial, nutritional, supplement etc.
Flower	Copper: 0.62mg; sulphur: 137 mg; chlorine: 423 mg; oxalic acid: 101 mg; and phytin P:44mg, lysine is found in the flowers	Anti-arthritic, Lactation enhancer
Pods and seeds	Rich in amino acid (alanine, arginine, glycine, serine, threonine, valine, glutamic acid and aspartic acid) and lysine. Sucrose also occurs in the fruit, benzylisothiocyanate derivative and benzoisothiocyanate	Hypotensive, Analgesic, anti-spasmodic, diuretic, anti-allergic, anti- bacterial, larvicidal, anti-viral, Anti - asthmatic, anti - inflammatory
Stem and Stem Bark	hydroxymellein, vanillin, octacosanoic acid, beta-sitosterol and betasitostenone reported for the first time from a plant species, white crystalline alkaloid, two resins, an inorganic acid and mucilage (gum)	Anti-urolithiatic, Anti-ulcer, hyperthyroidism, anti-diabetic
Root and Root bark	Anthomine and pterygospermine (an antibiotic). The root yields a very pungent essential oil, which is offensive in odour, moringinine and spirochine along with benzylamine and glucotropaoline	Analgesic, anti-convulsive, anti- nociceptive

Table 2: Some beneficial *Moringa* based commercial health care product available in market

Company Brand	Product Name	Product (Online Photo)	Use of the product	Product Details
Earth Expo Company	India Moringa Powder		Adding moringa powder by grind and processed, leaving a completely vegetarian, powder packed and pure supplement to boost your health regime.	Minimum Order Quantity - 10 Kilogram, Pack Size - 10Kg Pack Type - Box
The Man Company	Anti-sweat lotion, Moringa & Vitamin E		79.15% Natural, Gentle formulation for sensitive skin, Controls perspiration and fungal activity, Moisturises skin while keeping it dry, Sulphate Free, Paraben Free	Available in 90ml bottles Contains Shea Butter, Moringa, Vitamin E Contains other natural ingredients
Kama Ayurveda	Organic moringa oil		The high content of oleic acid makes it a deeply hydrating oil, protecting the skin from pollution and other environmental aggressors. Repairs skin damage due to pollution, Rich in Antioxidants, Encourages renewal of skin cells, Dermatologically Tested	Available in 100 ml bottles
Maharishi Ayurveda India	Organic Moringa		Acts as an antioxidant & boosts immunity, Promotes energy & overall well-being, Promotes heart, skin & eye health, Promotes healthy weight balance, Supports healthy cholesterol & blood sugar levels	Pack of 2 (60 Tablets Each)
Bixa Botanical	Moringa / Shigru extract		Useful For Joint pain & General Nutrition, Supports removal of blockages in blood and normal heart circulation, Contains Anti-oxidants, essential nutrients & is useful for blood circulation.	60 veg capsules (450mg) 1% alkaloids
ALPS Goodness	Alps Goodness Powder - Green Tea		Give your skin and hair a powdery twist with Alps Goodness Powder. Sourced from natural ingredients, it makes sure to benefit your skin and hair in the most beautiful way possible	50g Pack Available

Conclusion

The *Moringa oleifera* Lam. is not only providing very good nutrition but also the cure and prevention of a lot of diseases in human being. Due to its multipurpose unlimited benefits for humanity, supports the fact that it is often referred to as both “miracle tree” and “gift of nature”. India could easily fight against the problems of malnutrition and diseases through plantation in unutilized areas to build up socio-economic importance. The study revealed that almost various parts of this plant have immense nutritional and medicinal importance. In order to discover and utilize full uses of this miracle tree, market development strategies, Strong policies, and research were required. Given its multiple uses and wide range of adaptability, *Moringa* is an ideal crop for sustainable food production that thrives as the climate changes. Generally, *Moringa oleifera* offers very interesting opportunities for small holder farmers as food supplement, medicine, nutrition, water treatment, livestock feed, vegetable, oil, foliar spray, green manure, natural fertilizer, cosmetic, fooder, care products, soil and water conservation and reduce greenhouse gas emission. *Moringa* should be promoted for further consumption to improve nutrition and medicinal functions and as well as for climate change mitigation.

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